

## BR-2

## Brake System

## General Information

## GENERAL

## SPECIFICATION (ABS)

Part	Item	Standard value	Remark	
HECU(Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor (Solenoid)	·ABS system:ABS & EBD control	
	Type	Motor, valve relay integrated type		
	Operating voltage	8 V ~ 16 V(DC)		
	Operating temperature	-40 ~ 120 °C (-40 ~ 248 °F)		
Warning lamp	Operating voltage	12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, brake oil, EBD failure	
	Current consumption	80 mA		
Active wheel speed sensor	Supply voltage	DC 4.5 ~ 2.0 V		
	Operating temperature	-40 ~ 150 °C		
	Output current low	5.9 ~ 8.4 mA	Typ.7 mA	
	Output current High	11.8 ~ 16.8 mA	Typ.14 mA	
	Frequency range	1 ~ 2500 HZ		
	Air gap	Front	0.15 ~ 1.5 mm	Typ.0.7 mm
		Rear	0.2 ~ 1.2 mm	Typ.0.7 mm
	Tone wheel		48 teeth	
Output duty		30~70 %		

## General Information

## BR-3

## SPECIFICATION(VDC)

Part	Item	Standard Value	Remark
HECU(Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor(Solenoid)	·Total control(ABS, E-BD, TCS, ESP)
	Type	Motor, valve relay integrated type	
	Operating voltage	8 V ~ 16 V(DC)	
	Operating temperature	-40 ~ 120 °C(-40 ~ 248 °F)	
Warning lamp	Operating voltage	12 V	·ESP Operating Lamp ·ESP Warning Lamp
	Current consumption	80 mA	
Active wheel speed sensor	Supply voltage	DC 4.5 ~ 20V	
	Operating temperature	-40 ~ 150 °C	
	Output current low	5.9 ~ 8.4 mA	
	Output current high	11.8 ~ 16.8 mA	
	Tone wheel	48 teeth	
	Frequency range	1 ~ 2500 HZ	
	Airgap	Front	0.15 ~ 1.5 mm
Rear		0.2 ~ 1.2 mm	Typ. 0.7 mm
Steering Wheel Angle Sensor	Operating Voltage	8V ~ 16 V	
	Current Consumption	Max 150 mA	
	Operating Angular velocity	Max ± 780 °/sec	
Yaw-rate & Lateral G sensor	Operating Voltage	8 V ~ 16 V	
	Current Consumption	Max. 120 mA	
	Output Voltage high	4.35 V~ 4.65 V	Typ. 4.5 V
	Output Voltage low	0.35 ~ 0.65 V	Typ. 0.5 V
	Yaw Sensor Operating Range	±100 ° /s	
	G Sensor Operating Range	±1.8 G	
	Reference voltage output	2.464 ~ 2.536 V	Typ. 2.5 V

## BR-4

## Brake System

## SPECIFICATIONS

ITEMS	SPECIFICATIONS
<b>Master cylinder</b> Type I.D. Fluid level sensor	Tandem type 26.99 mm (1.06 in.) Provided
<b>Brake booster</b> Type Effective dia. Boosting ratio	Vacuum type with tandem booster 8 + 9 in. 7.5 : 1
<b>Front brake</b> Type Disc O.D. Disc thickness Pad thickness Cylinder type Cylinder I.D.	Floating with ventilated disc 302 mm (11.89 in.) 28 mm (1.10 in.) 10.5 mm (0.413 in.) Double piston 46 mm (1.81 in.) (x2)
<b>Rear disk brake</b> Type Disc O.D. Disc thickness Pad thickness Cylinder type Cylinder I.D.	Floating with ventilated disc 315 mm (12.4 in.) 20 mm (0.787 in.) 10 mm (0.39 in.) Single piston 42.9 mm (1.69 in.)
<b>Parking brake</b> Type Brake type Drum I.D. Lining thickness	DIH (Drum In Hat) type Hand brake lever type 190 mm (7.48 in.) 4 mm (0.157 in.)

O.D. = Outer diameter

I.D. = Inner diameter

# General Information

# BR-5

## SERVICE STANDARD

ITEMS	SPECIFICATIONS
<b>Standard value</b> Brake pedal height Clearance between stop lamp switch outer case and pedal arm Brake pedal free play Parking brake lever stroke	200 mm (7.87 in.) 1.5 ~ 2.0mm(0.06 ~ 0.08in.) 4-7 mm (0.157 - 0.275 in.) 4~6 clicks (When lever assembly is pulled with 10kgf)
<b>Service limit</b> Front disc brake pad thickness Front disc thickness (minimum) Front disc runout Front disc thickness variation Rear disc brake pad thickness Rear disc thickness Parking brake drum I.D. Parking brake lining thickness	2.0 mm (0.0787 in.) 26 mm (1.02 in.) 0.03 mm ( 0.0012 in.) 0.005 mm (0.0002 in.) 2.0 mm (0.079 in.) 18.4 mm (0.724 in.) 191 mm (7.52 in.) 1.5 mm (0.059 in.)

## TIGHTENING TORQUE

Item		Nm	kg·cm	lb·ft
Sensor mounting bolt on the brake plate	Front	7-10	70-100	5-7
	Rear	7-10	70-100	5-7
Hydraulic & electronic control unit mounting nut		8-12	80-120	6-9
Hydraulic & electronic control unit mounting bracket bolt		19-26	190-260	14-19
Six brake tubes on the Hydraulic Unit		13-22	130-220	9-16

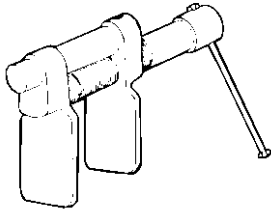
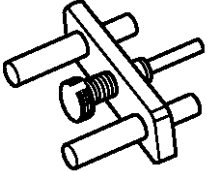
## LUBRICANTS

Items	Recommended lubricant	Quantity
Brake fluid	DOT 3 or equivalent	As required
Brake pedal bushing and brake pedal bolt	Chassis grease SAE J310, NLGI No.0	As required
Joint pin	Wheel bearing grease SAE J310, NLGI No.2	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease, NLGI No.0-1	As required

## BR-6

## Brake System

## SPECIAL SERVICE TOOLS

Tool (Number and Name)	Illustration	Use
09581 - 11000 Piston expander		Pushing back of the front disc and rear disc brake piston
OK993 430 032 Adjustment gauge		Used to adjust push rod gap

## TROUBLESHOOTING

Trouble symptom	Possible cause	Remedy
Noise or vibration when brakes are applied	Caliper improperly mounted Loose caliper mounting bolts Unevenly worn or cracked brake drum or brake disc Foreign material in brake drum Seized pad or lining contact surface Excessive clearance between pad assembly and caliper Uneven pad contact Lack of lubrication in sliding parts Loose suspension parts Excessive of disc runout Excessive variation of disc thickness	Correct Retighten Replace Clean Replace Correct Correct Lubricate Retighten Correct the runout Replace disc
Vehicle pulls to one side when brakes are applied	Difference in left and right tire inflation pressure Inadequate contact of pad Grease or oil on pad surface Incorrect wheel cylinder installation	Adjust Correct Replace Correct
Insufficient braking power	Low or deteriorated brake fluid Air in the brake system Brake booster malfunction Inadequate contact of pad Grease or oil on pad surface Overheated brake rotor due to dragging of pad Clogged brake line Proportioning valve malfunction	Refill or change Bleed the system Correct Correct Replace Correct Replace Replace

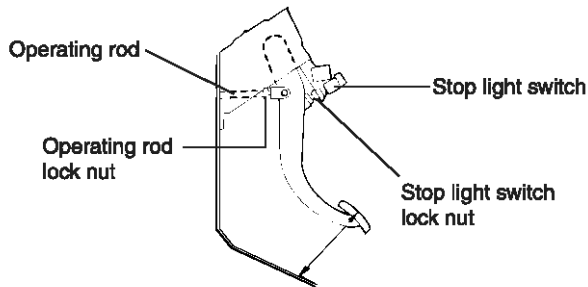
# General Information

# BR-7

## SERVICE ADJUSTMENT PROCEDURES INSPECTION AND ADJUSTMENT

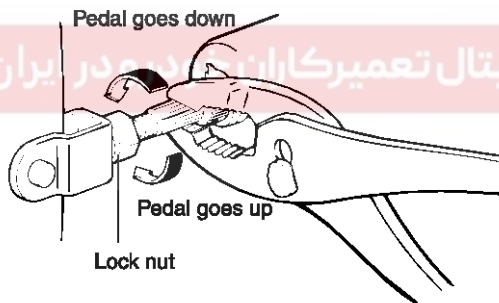
1. Measure the brake pedal height. If the brake pedal height is not within the standard value, adjust as follows.

Standard value : 200 mm (7.87 in.)



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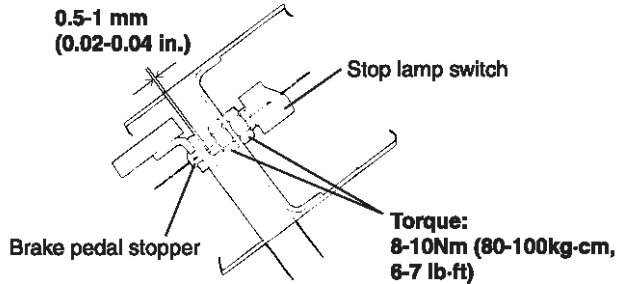
- 1) Disconnect the stop lamp switch connector, loosen the lock nut, and move the stop lamp switch to a position where it does not contact the brake pedal arm.
- 2) Adjust the brake pedal height by turning the operating rod with pliers (with the operating rod lock nut loosened), until the correct brake pedal height is obtained.



LJAC006B

- 3) After turning the stop lamp switch until it contacts the brake pedal stopper (just before the brake pedal is caused to move), return the stop lamp switch 1/2 to 1 turn and secure by tightening the lock nut.
- 4) Connect the connector of the stop lamp switch.

- 5) Check that the stop lamp is not illuminated with the brake pedal unpressed.



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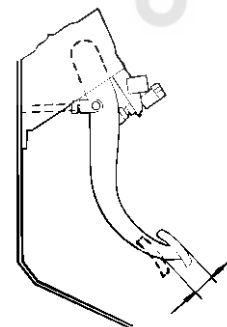
2. With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal down by hand, and confirm that the amount of movement before resistance is met (the free play) is within the standard value.

Standard value : 4 - 7 mm (0.157 - 0.275 in.)

If free play does not reach the standard value, check that clearance between the outer case of stop light switch and brake pedal is within the standard value.

If free play exceeds the standard value, it is probably due to excessive clearance between the clevis pin and brake pedal arm.

Check for excessive clearance and replace faulty parts as required.



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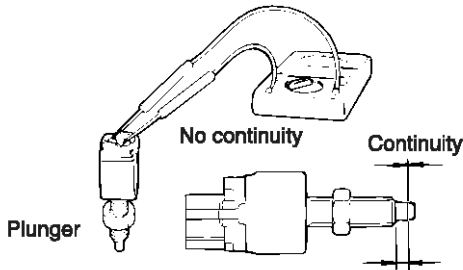
3. Start the engine, depress the brake pedal with approximately 120kgf of force, and check for oil leakage in the master cylinder, brake line and each connecting part.

Repair the faulty parts as required.

# BR-8

# Brake System

## STOP LAMP SWITCH INSPECTION

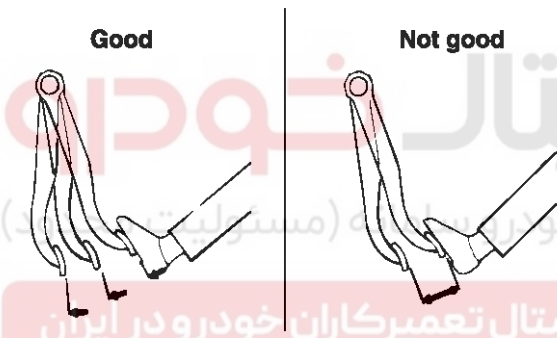


LJAC006E

## BRAKE BOOSTER OPERATING TEST

1. Run the engine for one or two minutes, and then stop it.

If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is defective.

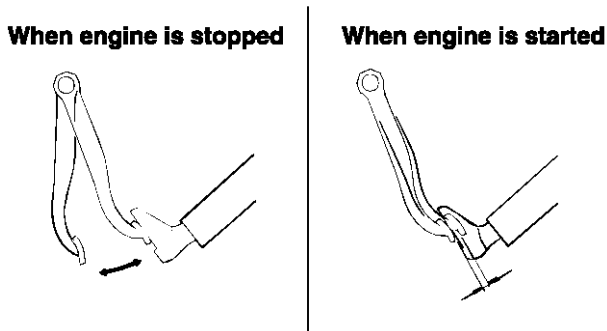


LJAC006F

2. With the engine stopped, step on the brake pedal several times.

Then step on the brake pedal and start the engine.

If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.



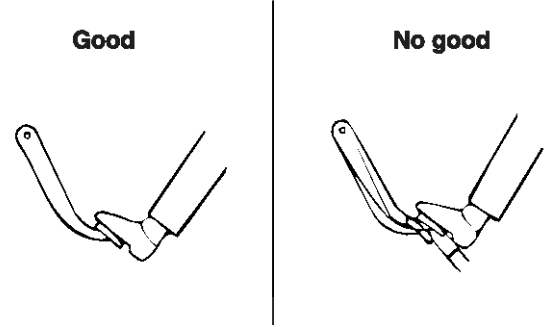
LJAC006G

3. With the engine running, step on the brake pedal and then stop the engine.

Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective.

If the above three tests are okay, the booster performance can be determined as good.

Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for defect.



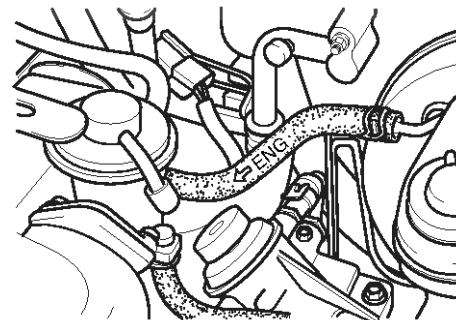
LJAC006H

## CHECK VALVE INSPECTION

1. Disconnect the vacuum hose.
2. Check to be sure that air passes to the engine and not from the engine when air is taken in from the power-brake unit side of the vacuum hose.

### NOTICE

The check valve is pressed into the vacuum hose, and there is an arrow on the hose surface to indicate the installation direction.



LJAC006I

## General Information

## BR-9

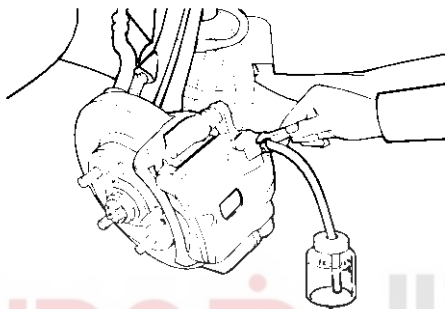
### BLEEDING THE BRAKE SYSTEM

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

#### ⚠ CAUTION

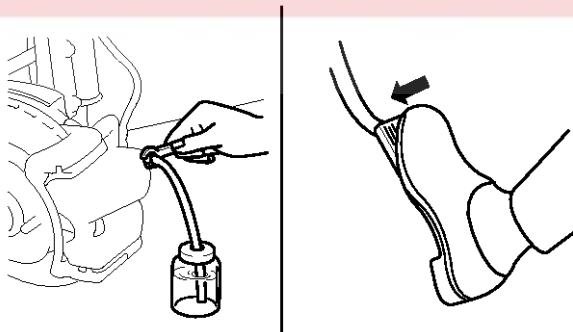
- Do not allow brake fluid to remain on a painted surface. Wash it off immediately.
- Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

2. Connect a vinyl tube to the wheel cylinder bleeder screw and insert the other end of the tube in a container of brake fluid which is half full.



LJAC007A

3. Start the engine.
4. Slowly depress the brake pedal several times.
5. While depressing the brake pedal fully, loosen the bleeder screw until fluid runs out. Then close the bleeder screw and release the brake pedal.



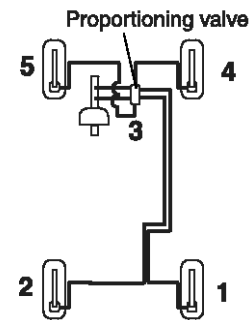
LJCD007B

6. Repeat steps 4 and 5 until there are no more bubbles in the fluid.
7. Tighten the bleeder screw.

Tighten torque:

7 - 9 N·m (70-90 kg·cm, 5-6.6 lb·ft)

8. Repeat the above procedure for each wheel in the sequence shown in the illustration.



LJAC007C





## BR-10

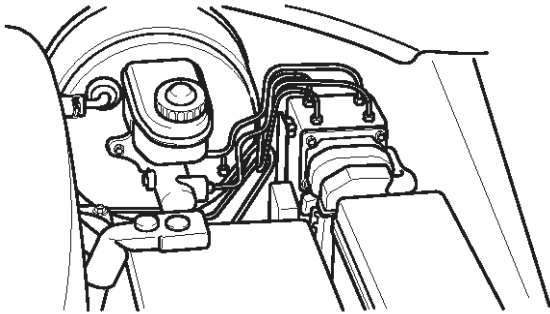
## Brake System

## Brake System

## Brake Booster

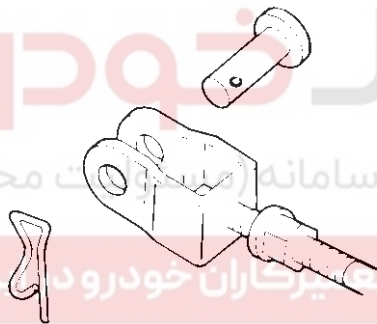
## REMOVAL

1. Remove master cylinder and gasket.
2. Disconnect vacuum hose from the booster.



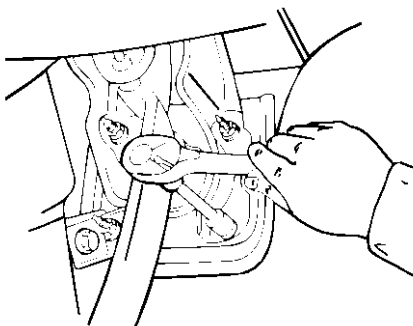
LJAC008A

3. Remove the shift knob cable (A/T) and then remove joint pin and snap pin.



LJAC008B

4. Remove the lock nut and then remove brake booster.



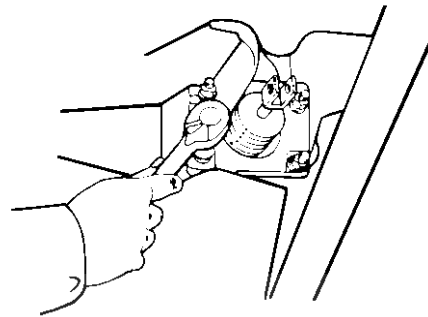
LJAC008C

## INSTALLATION

1. When installing the booster assembly, replace the packing of each end of booster installation holder.
2. Insert the booster and tighten the nut.

Tightening torque :

19 - 26 N·m (1.9 - 2.6 kg·m, 13 - 18 lb·ft)

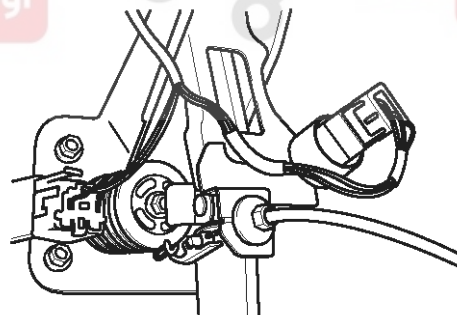


LJAC009A

3. Connect the booster push rod and brake pedal with a joint pin and install a snap pin to the joint pin and then install the shift knob cable (A/T).

**CAUTION**

When installing the snap pin, A new one must be used.



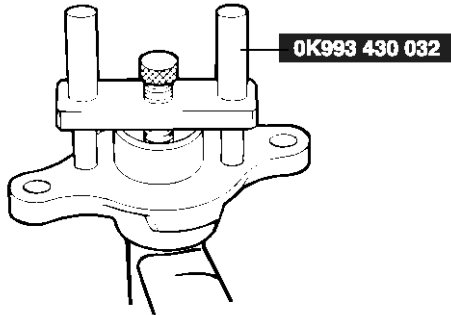
LJAC008D

# Brake System

## BR-11

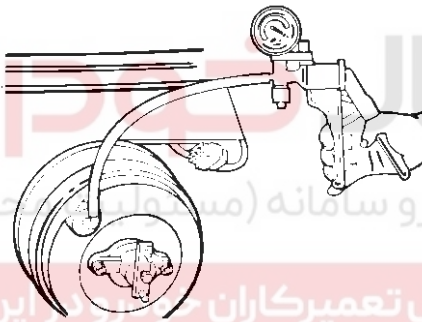
### 4. Adjust push rod length

- 1) Insert the gasket onto the master cylinder.
- 2) Put the SST onto the gasket and tighten the adjusting bolt until the bolt touches the bottom of the push rod hole.



LJAC009C

- 3) Apply 500 mmHg vacuum with a vacuum pump.
- 4) Invert the SST used in step 2 and place it on the booster.



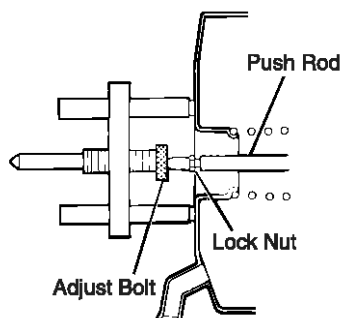
LJAC009D

- 5) Check whether the clearance between the edge of the adjust bolt and the push rod of the booster is 1.2 - 1.7 mm (0.047 - 0.067 in.)

If it is not 1.2 - 1.7 mm (0.047 - 0.067 in.), loosen the lock nut of the push rod, and turn the push rod to make the adjustment.

Permissible play :

1.2 - 1.7 mm (0.047 - 0.067 in.)



LJAC009E

### 5. Install the master cylinder.

Tightening torque :

10-16 Nm (1.0-1.6 kg-m, 7-11 lb-ft)

6. Connect the vacuum hose to the brake booster.
7. After filling the brake reservoir with brake fluid, bleed the system.
8. Check for fluid leakage.
9. Check and adjust the brake pedal for proper operation.
10. After installing, apply grease to the contact parts of the joint pin and brake pedal.



## BR-12

## Brake System

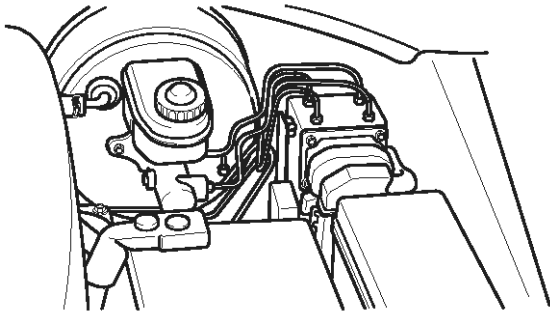
## Master Cylinder

## REMOVAL

1. Detach the brake tubes from the master cylinder, and then install the plug.

**CAUTION**

Do not allow brake fluid to remain on a painted surface. Wash it off immediately.



LJAC008A

2. Remove the master cylinder mounting nuts and then remove the master cylinder.

## INSTALLATION

1. Install the master cylinder on the brake booster with 2 nuts.

## Tightening torque

Master cylinder installation nut :

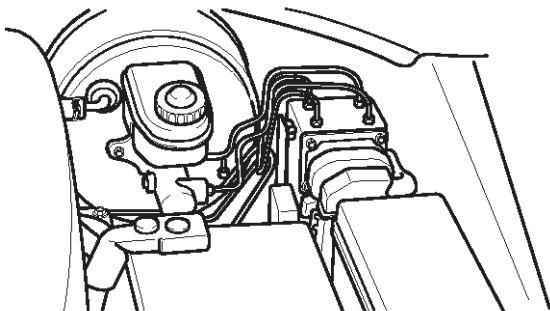
100-16 Nm (100-160 kg·cm, 7-11 lb·ft)

2. Connect 2 brake tubes and the brake fluid level warning connector.

## Tightening torque

Brake tube flare nut :

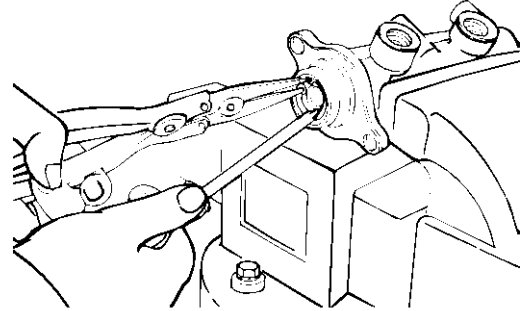
13-22 (130-220 kg·cm, 9.5-15 in.)



LJAC008A

## DISASSEMBLY

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the reservoir from the master cylinder.
3. Using a snap ring pliers, remove the retainer ring.

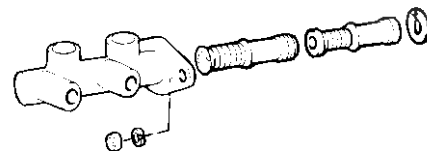


LJAC026B

4. Remove the bolt with the primary piston pushed completely using a screwdriver. Remove the primary piston assembly.
5. Remove the bolt with the secondary piston pushed completely using a screwdriver. Remove the secondary piston assembly.

**NOTICE**

Do not disassemble the primary and secondary piston assembly.



LJAC026C

## INSPECTION

1. Check the master cylinder bore for rust or scratch.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

**CAUTION**

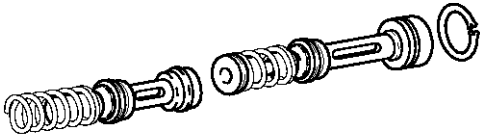
- If the cylinder bore is damaged, replace the master cylinder assembly.
- Wash the contaminated parts in alcohol.

# Brake System

## BR-13

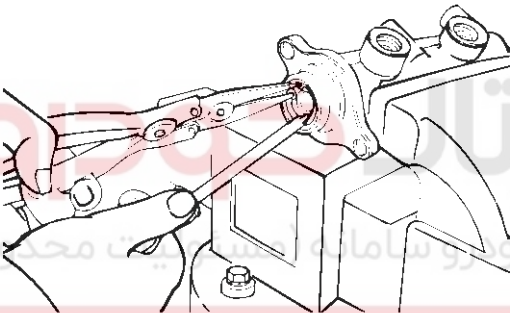
### REASSEMBLY

1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.



LJAC028A

2. Carefully insert the springs and pistons in the proper direction.
3. Press the piston with a screwdriver and install the retainer ring.



LJAC026B

4. With the piston pushed completely by a screwdriver, install the bolt.

Tightening torque :

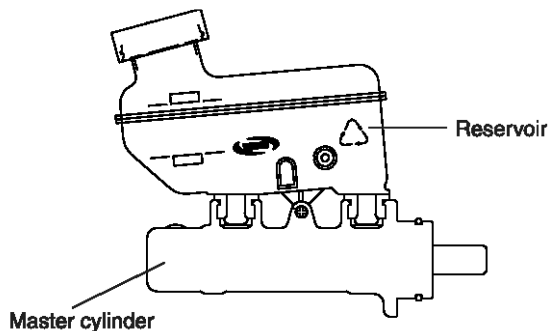
7-10 N·m (0.7-1.0 kg-m, 5-7 lb-ft)

5. Mount two grommets.

6. Install the reservoir on the cylinder.

Tightening torque :

1-1.5 N·m (0.1-0.15 kg-m, 0.7-1.0 lb-ft)



LJAC028B



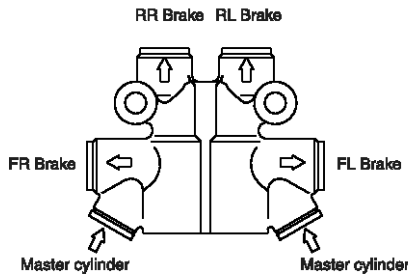
# BR-14

# Brake System

## Proportioning Valve

### INSPECTION

1. to the inlet valve and outlet valve of rear wheel.

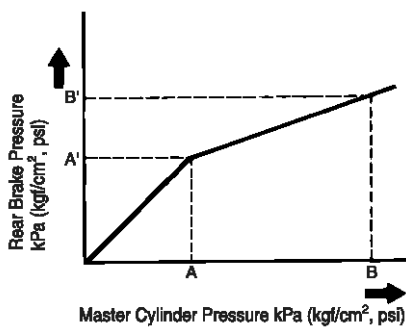


LJAC030A

2. Bleed the air from the brake system.
3. Depress the brake pedal until the master cylinder pressure equal to A; then record rear brake pressure A'.
4. Depress the brake pedal again, and apply additional pressure until the pressure equal to B; then record pressure B'.

### SPECIFICATIONS (DYNAMIC CONDITION)

Slope (tan θ)	Split point
11.3	35 bar
Master cylinder output pressure	Rear brake pressure
A:35(497.8)	A':35(497.8)
B:50(711.1)	B':38(540.4)



LJAC030B

5. If the test value exceeds standard value, replace the proportioning valve.

Tightening torque

7-10 N·m (0.7-1.0 kg-m, 5-7.2 lb-ft)

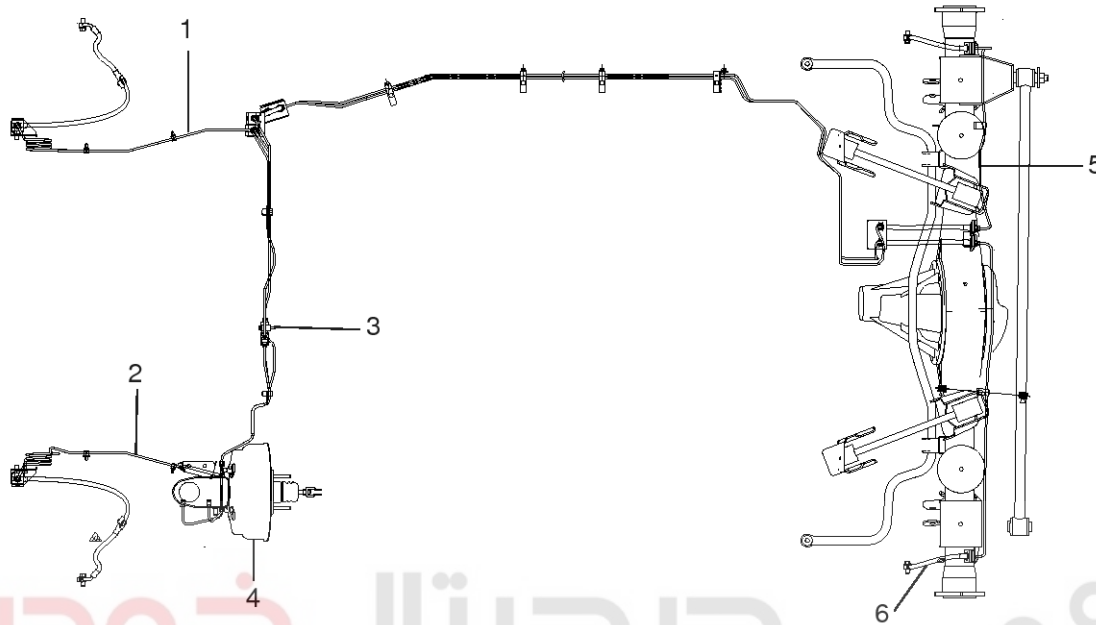
# Brake System

# BR-15

## Brake Line

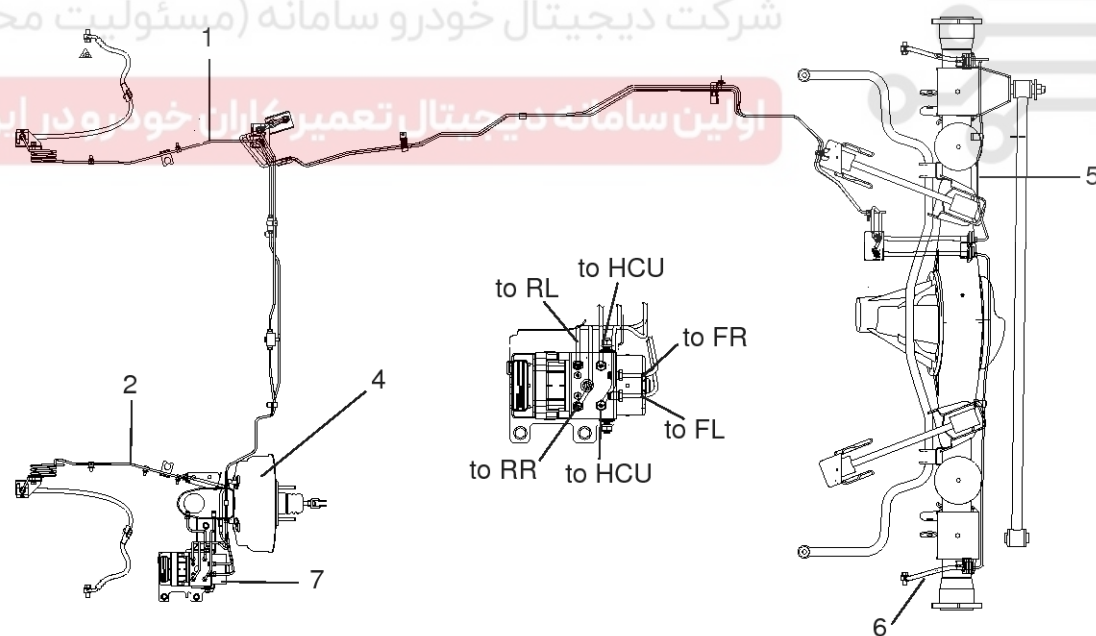
### COMPONENTS

<CBS>



<ABS>

شرکت دیجیتال خودرو (مسئولیت محدود)  
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



- 1. Brake hose & pipe (FR)
- 2. Brake hose & pipe (FL)
- 3. Proportioning valve
- 4. Booster & master cylinder assembly
- 5. Brake hose & pipe (RR)
- 6. Brake hose & pipe (RL)
- 7. Hydraulic control unit

LJAC010A

## BR-16

## Brake System

### REMOVAL

Holding the nut at the brake hose side, loosen the flare nut of the brake tube.

### INSTALLATION

1. Install the brake hoses without twisting them.

#### **⚠ CAUTION**

**When installing, be sure the brake hose does not contact edges, welding or moving parts.**

2. Tighten to the specified torque as follows.

Items	Torque N·m (kg-m, lb-ft)
Brake flare nut and brake hose	13 - 22 (1.3-2.2, 9-15)
Brake hose and caliper	17 - 20 (1.7-2.0, 12-14)
Air bleed screw	7 - 9 (0.7-0.9, 5-7)

### INSPECTION

- Check the brake tubes for cracks, crimps and corrosion.
- Check the brake hoses for cracks, damaged and oil leakage.
- Check the brake tube flare nuts for damage and oil leakage.

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

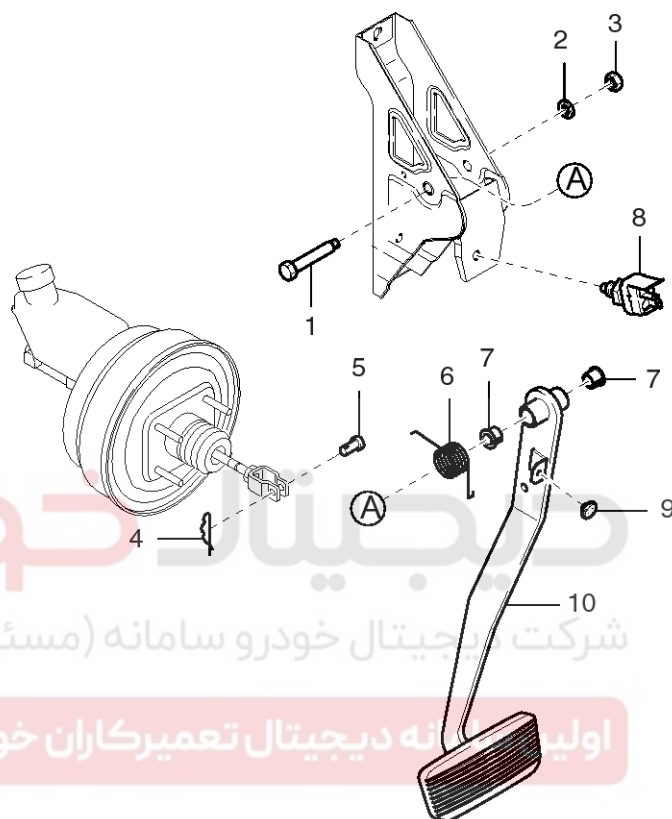


# Brake System

## BR-17

### Brake Pedal

#### COMPONENTS



- |                  |                     |
|------------------|---------------------|
| 1. Bolt          | 6. Return spring    |
| 2. Spring washer | 7. Bushing          |
| 3. Nut           | 8. Stop lamp switch |
| 4. Snap pin      | 9. Rubber stopper   |
| 5. Joint pin     | 10. Brake pedal     |

LJAC014A

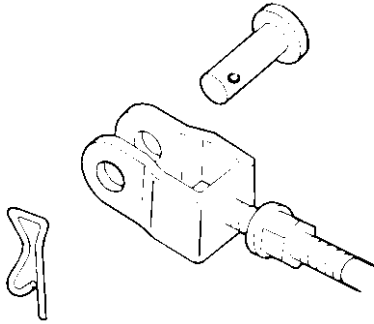


## BR-18

## Brake System

### REMOVAL

1. Remove the stop lamp switch connector.
2. Remove the joint pin and snap pin.



LJAC008B

3. Remove the nut and then remove the brake pedal.

### INSTALLATION

1. Installation is the reverse of removal.

Nut tightening torque :

20-35 N·m (2.0-3.5 kg·m, 14-25 lb·ft)

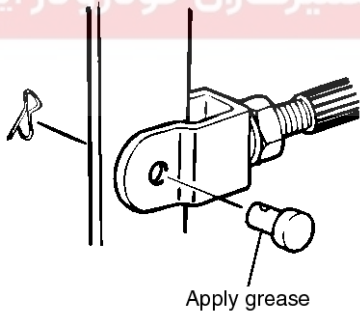
#### ⚠ CAUTION

Coat the inner surface of the bushings with the specified grease.

Specified grease :

Chassis grease LiG-2

2. Before inserting the joint pin, apply the specified grease to the joint pin.



LJAC009B

### INSPECTION

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.
4. Check all parts for crack and wear.



# Brake System

# BR-19

## Front Disc Brake

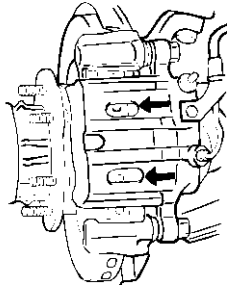
### INSPECTION AND REPLACEMENT OF FRONT DISC BRAKE PAD

1. Check the brake pad thickness through the caliper body inspection hole.

Pad lining thickness

Standard value : 10.5 mm (0.413 in.)

Service limit : 2.0 mm (0.0787 in.)



LJAC018A

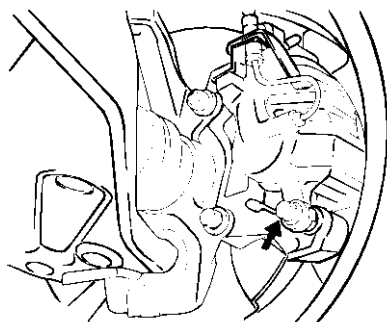
**CAUTION**

- If the pad lining thickness is out of specification, left and right pads must be replaced as a complete set.
- When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston, the lock pin and the guide pin.

2. Remove the guide pin, lift the caliper assembly up and suspend it with a wire.

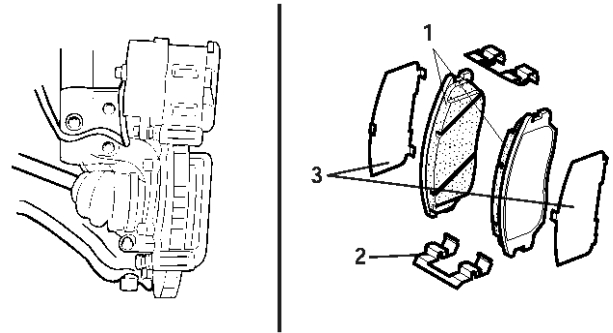
**CAUTION**

Be careful not to contaminate the lock pin and guide pin with grease.

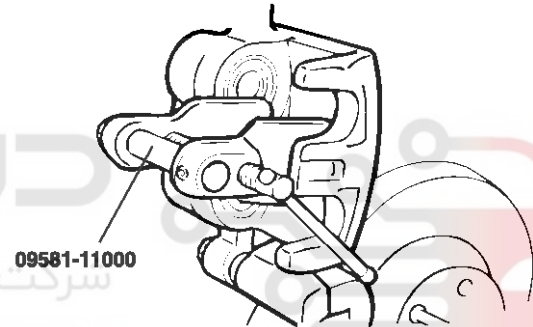


LJAC018B

3. Remove the following parts from the caliper support.
  1. Pad and wear sensor assembly
  2. Pad spring
  3. Outer shim



LJAE018C

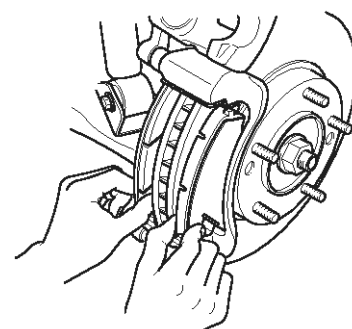


09581-11000

LJAC018D

### INSTALLATION

1. Install the pad clips.
2. Install the pads on each pad clip.



LJAC020A

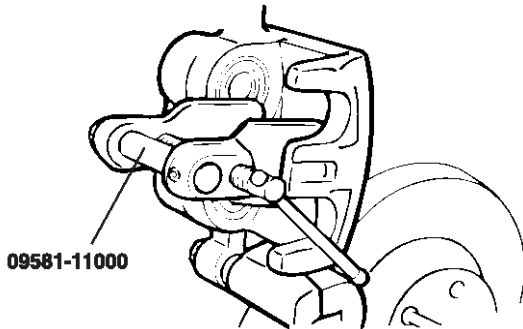
**CAUTION**

- All four pads must be replaced as a complete set.
- When replacing the brake pads, check for deformation. When replacing the guide spring, use a new one or thoroughly clean the used one.

## BR-20

## Brake System

3. Press-fit the piston with a hammer handle or the special tool (09581-11000).



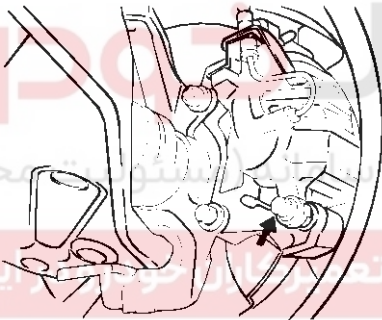
LJAC018D

4. Lower and insert the brake cylinder carefully so as not to damage the boot.  
5. Tighten the two guide rod bolts to the specified torque.

Tightening torque

Guide rod bolt :

22 - 32 Nm (220 - 320 kg-cm, 16 - 24 lb-ft)



LJAC018B

## DISASSEMBLY

Front disc brakes should be disassembled separately into the left and right as a set.

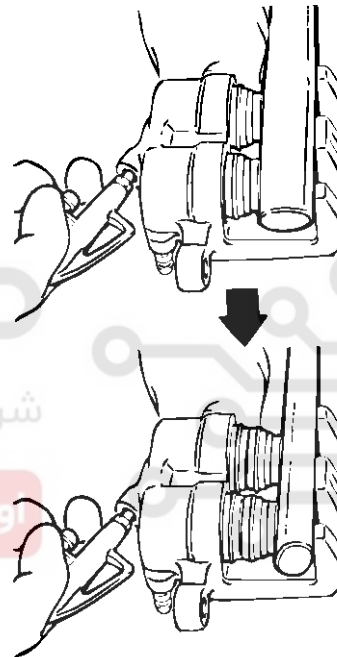
1. Remove the piston boot/piston.

Blow compressed air into the brake hose seating hole so as to remove the piston and the piston boot.

**NOTICE**

*When removing the piston, blow air slowly, adjusting the heights of the two pistons to push them out equally.*

*The secondary piston should not be removed before the primary piston is removed completely. Otherwise the secondary piston can't be removed.*



LJAC021A

# Brake System

## BR-21

2. Remove the piston seal.

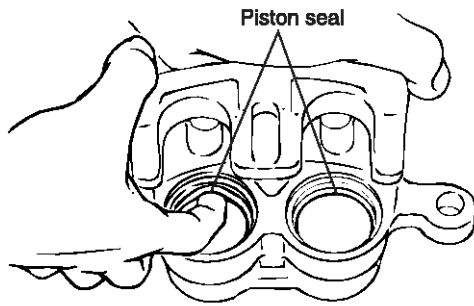
1) Remove the piston seal with your finger.

### ⚠ CAUTION

**Do not use a screwdriver or another tool because it may damage the cylinder.**

2) Clean the piston surface and inner cylinder using alcohol or the specified brake fluid.

Brake fluid : DOT 3 or DOT 4



LJAC021B

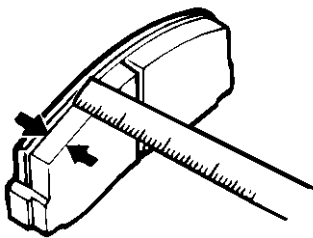
### INSPECTION

1. Check the cylinder for wear, damage and rust.
2. Check the piston surface for wear, damage and rust.
3. Check the caliper body and sleeve for wear.
4. Check that grease is applied, and the pad and backing metal are not damaged.
5. Check the pad wear. Measure the pad thickness and replace it if it is less than the specified value.

Pad thickness

Specification : 10.5 mm (0.413 in.)

Service limit : 2.5 mm (0.098 in.)



LJAC022A

### INSPECTION

#### FRONT BRAKE THICKNESS CHECK

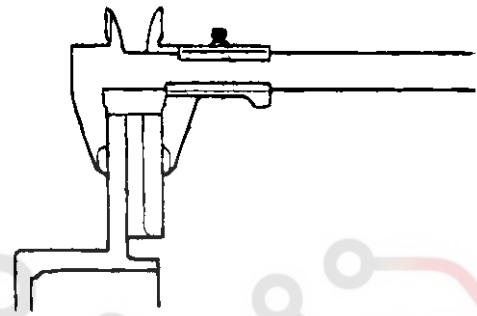
1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 4 positions at least.

Front brake disc thickness

Standard value : 28mm (1.10 in.)

Limit : 26mm (1.02 in.)

2. Thickness variation should not exceed 0.005mm (circumference) and 0.05mm (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly for left and right of the vehicle.



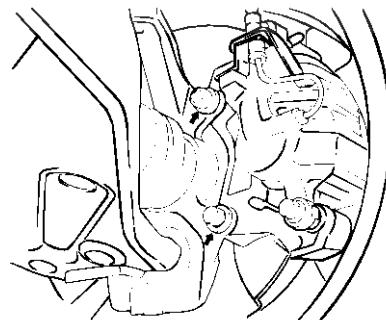
LJAC019A

#### FRONT BRAKE DISC RUNOUT CHECK

1. Remove the caliper support, then raise the caliper assembly upward and suspend with a wire.

Tightening torque :

65-75 N·m (6.5-7.5 kg·m, 47-54 lb·ft)



LJAC019D

## BR-22

## Brake System

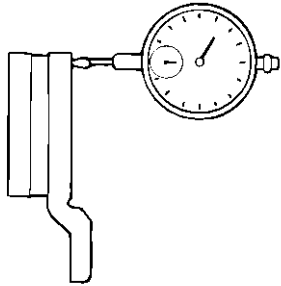
- Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout

Limit : 0.03mm (0.0012 in.) or less

### NOTICE

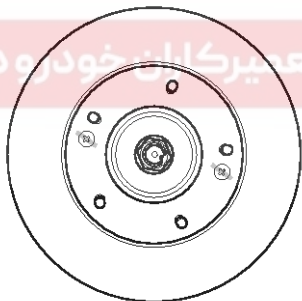
Fix the disc to the hub by tightening the nut.



LJAC019B

### FRONT BRAKE DISC RUN OUT CORRECTION

- If the runout of the brake disc is equivalent to or exceeds the limit specification, replace the disc and hub, and then measure the runout again.
  - Before removing the brake disc, chalk both sides of the screw on the side at which the runout is greatest.

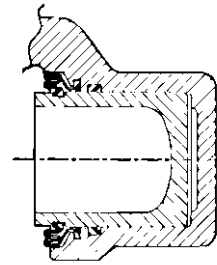


LJAC019C

- If it exceeds the limit, disassemble the hub knuckle and check each part.
  - If the runout does not exceed the limit specification, install the brake disc after turning it 180° from the chalk mark, and then check the runout of the brake disc again.
- If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

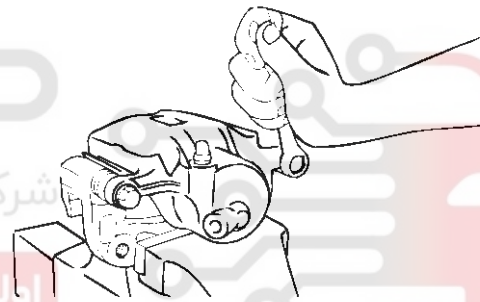
### REASSEMBLY

- Clean all components with isopropyl alcohol except for the pad and shim.
- Install the piston seal.
- After applying the specified brake fluid to the piston outer surface, install the piston into the cylinder.
- Install the piston boot.



LJAC023A

- Install the guide pin boots and guide pin.



LJAC023B

# Brake System

## BR-23

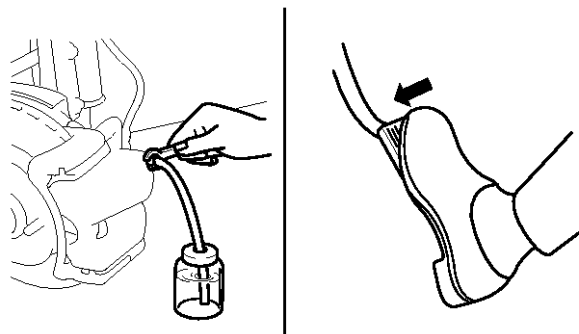
### Adjustment

1. Install the pads and brake cylinder.
2. Install the brake hose to the caliper.

Tightening torque

17-20 Nm (170-200 kg·cm, 12-14 lb·ft)

3. Fill the brake reservoir with brake fluid.
4. Bleed the system.



LJCD007B

# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



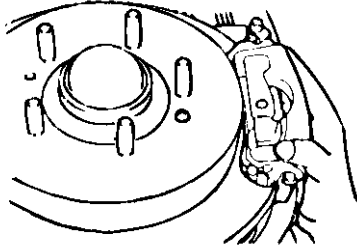
## BR-24

## Brake System

## Rear Disc Brake

## REMOVAL

1. Remove the wheel.
2. Remove the guide bolt, lift up the caliper assembly, and remove the pad assembly.



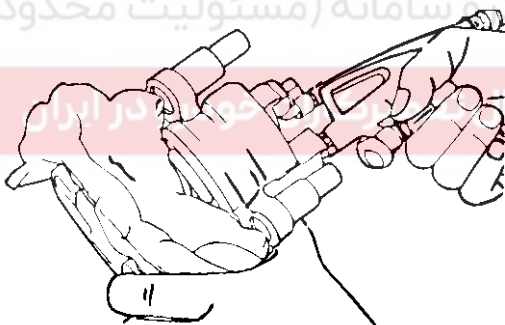
LJAC031A

## DISASSEMBLY SERVICE POINT

1. Remove the piston boot/piston.

Wrap the caliper body with a rag. Blow compressed air into the brake hose, and remove the piston and the piston boot.

**CAUTION**  
Blow air slowly.



LJAC035B

2. Remove the piston seal.

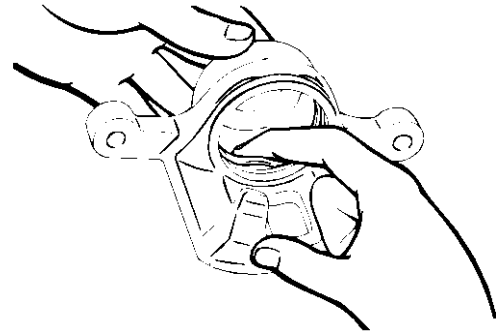
- 1) Remove the piston seal with your finger.

**CAUTION**

Do not use a screwdriver or another tool in order to avoid damage the inside of the cylinder.

- 2) Clean the piston surface and the inside of the cylinder using trichloro-ethylene, alcohol or the specified brake fluid.

Brake fluid : DOT 3 or DOT 4



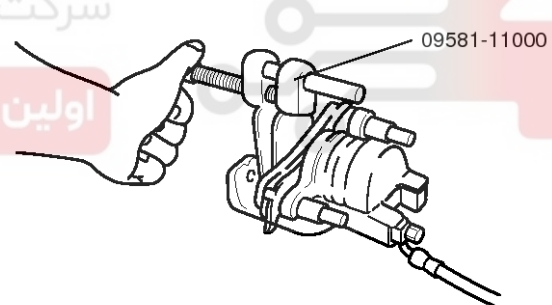
LJAC031C

## REMOVAL (CALIPER)

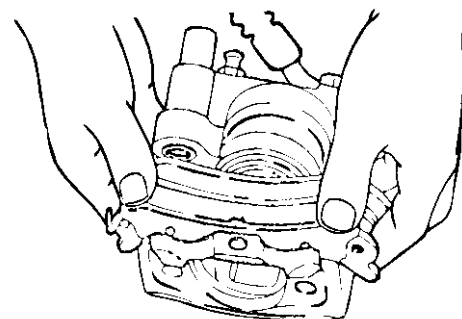
1. Remove the rear wheel.
2. Remove the caliper assembly.
3. Remove the brake hose from the caliper.

## INSTALLATION

1. Before replacing the brake pads, drain brake fluid from the master cylinder reservoir until it remains half full.
2. Remove the brake pad by turning the piston in the housing assembly. Using the special tool (09581-11000), remove the piston.



LJAE033A



LJAC033B

# Brake System

# BR-25

3. Install two caliper guide rods and tighten to a torque of 22-32 Nm (220-320 kg-cm, 16-23 lb-ft)
4. After filling the master cylinder reservoir with the fluid, bleed the brake line.

Recommended brake fluid : DOT 3 or DOT 4

## INSTALLATION (CALIPER)

1. Install the caliper mounting bolts.

Tightening torque :

65-75 N-m (6.5-7.5 kg-m, 47-54 lb-ft)

2. Refer to "Brake pad installation" for detail.
3. Install the brake hose connector

Tightening torque :

17-20 N-m (1.7-2.0 kg-m, 12-14 lb-ft)

4. Install the caliper guide bolt.

Tightening torque :

22-32 N-m (2.2-3.2 kg-m, 16-23 lb-ft)

5. Bleed the system.

### CAUTION

When replacing the piston seal, check the pedal stroke.

If the pedal stroke is too excessive, the piston may not retain the piston seal.

Adjust as follows :

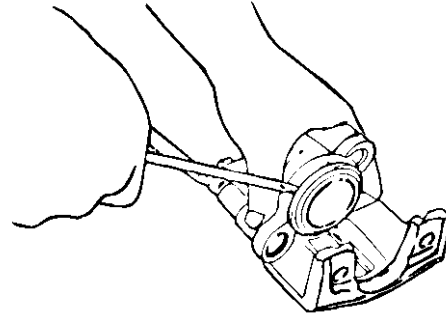
- After removing the pad from the piston, push the piston into the cylinder 3-5mm. Put a lever or steel plate (1mm x 0.3m) between the piston and disc, being careful not to damage the contact surface of the disc or the piston end.
- Install the pad. To restore the brake pedal to the original position, step on it 2-3 times.
- Repeat the above procedure more than 5 times and move the piston outward and inward to assure that the piston seal is properly installed.
- Before driving a vehicle, step on the brake pedal and release it several times.
- Perform the road test.

## DISASSEMBLY (CALIPER)

1. Remove the pad.
2. Remove the piston boot from the housing, and then remove the piston.

### NOTICE

Using a wire hanger or equivalent, remove the caliper so as not to damage the brake hose.

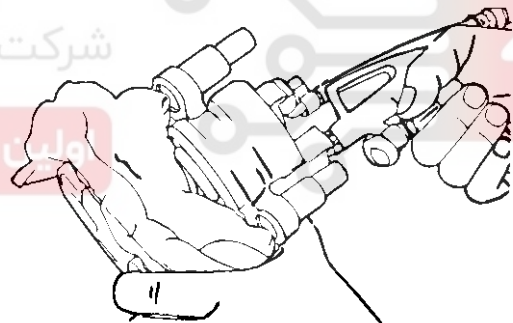


LJAC035A

3. Remove the piston by applying compressed air through the brake hose fitting.

### NOTICE

Do not place your fingers in front of the piston when using compressed air.



LJAC035B

4. Remove the piston seal carefully so as not to damage the cylinder wall.
5. Clean all removed parts with the specified fluid.

Item	Specified fluid
Metal section	Trichloroethylene, alcohol or brake fluid
Piston seal	If the oil level is low, add fluid (about 70cc).
Piston boot and other rubber parts	Alcohol

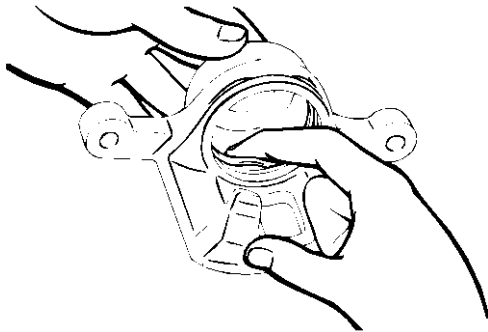


# BR-26

# Brake System

### CAUTION

Rubber parts should be replaced with new ones but if you want to reuse them, don't put them in alcohol for more than thirty minutes.



LJAC031C

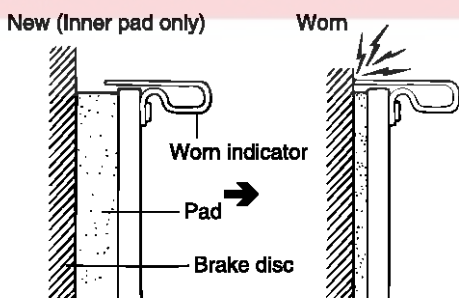
### INSPECTION

1. Check the cylinder for wear, damage and rust.
2. Check the piston surface for wear, damage and rust.
3. Check the caliper body and sleeve for wear.
4. Check that grease is adhesive, and the pad and backing metal are damaged.
5. Check the pads for wear or oil contamination and replace if necessary.

### NOTICE

The pads for the right and left wheels should be replaced at the same time.

Pad thickness wear limit : 2.0mm (0.08 in.)

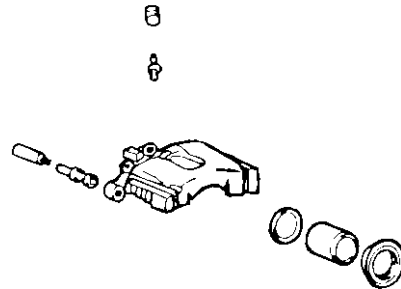


LJAC032A

6. Check for worn or damaged dust boots. If dust or mud had entered the caliper assembly through the seal, the caliper assembly must be replaced or repaired.

### INSPECTION (CALIPER)

1. Check the piston and its inside for wear, damage and rust.  
Replace the damaged parts if necessary.
2. Check the piston seal, boot, and pin insulators for wear and damage.



LJAC036A

### REASSEMBLY (CALIPER)

1. When disassembling the caliper assembly, use a new piston seal and boot.
2. Apply the recommended fluid to the bearing part of the piston seal and piston. Insert the piston seal into grooves inside the caliper, being careful not to twist the seal.

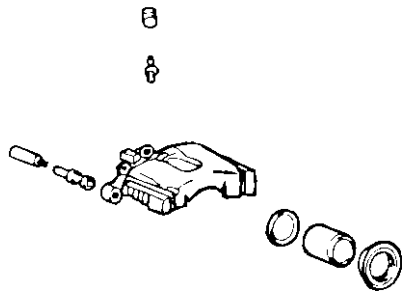
Item	Recommended fluid	Quantity
Piston seal	Brake fluid (DOT 3, DOT4)	As required
Inside of piston cylinder	Brake fluid (DOT 3, DOT4)	As required
Piston boot	Brake fluid (DOT 3, DOT4)	As required
Locating pin insulator	White silicone grease	As required

## Brake System

## BR-27

3. Install the piston boot to the piston.

Confirm that the concave part of the piston is placed outward and the boot is seated in grooves of the piston completely.



LJAC036A

4. Install the piston and boot in the caliper housing. Insert the boot flange in the caliper housing and check that the boot fits in grooves around the piston.
5. Apply the recommended oil to the inside of the locating pin insulator.

# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



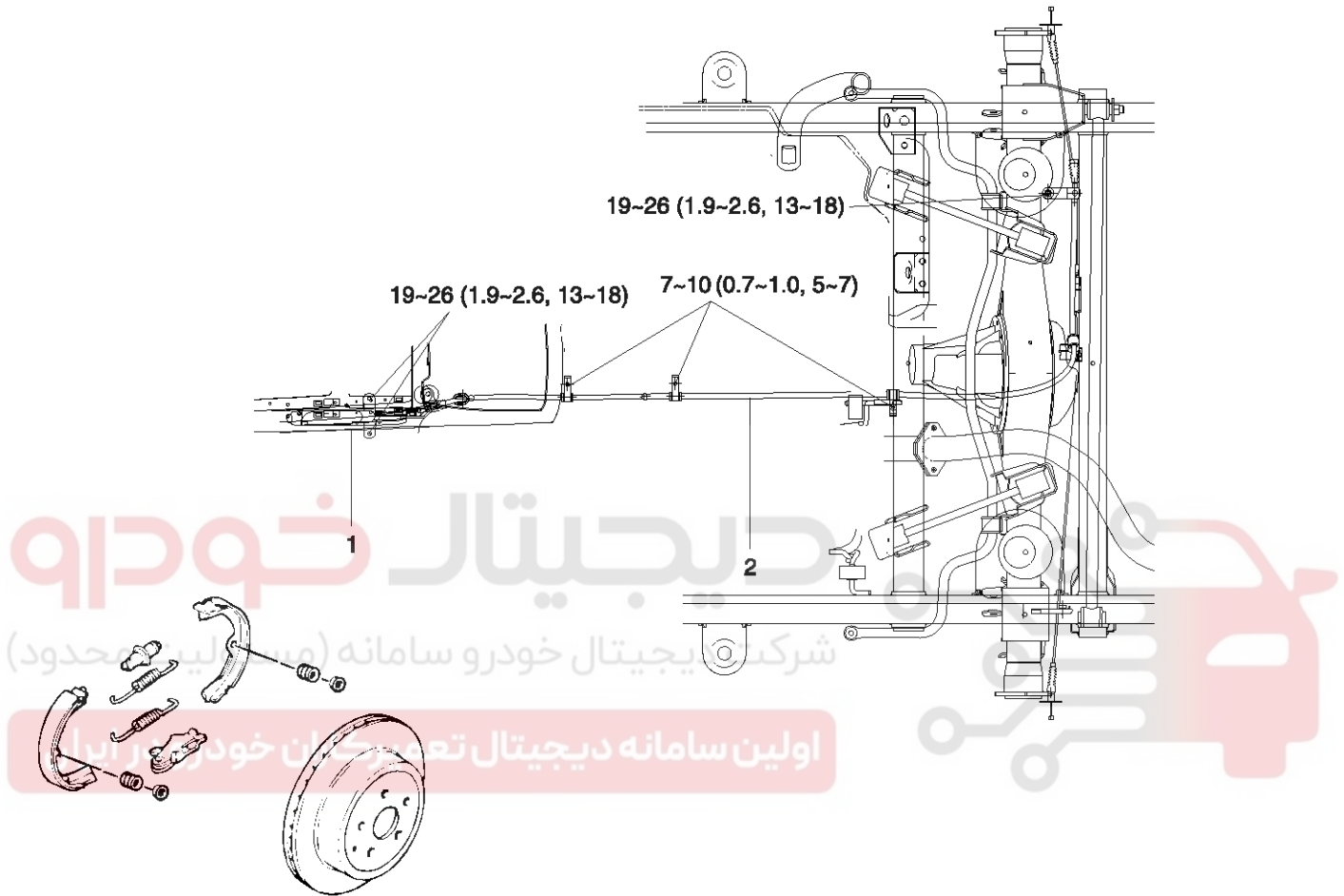
# BR-28

# Brake System

## Parking Brake System

### Parking Brake Assembly

#### COMPONENT



TORQUE : N·m (kg·m, lb·ft)

1. Parking brake lever
2. Parking brake cable

LJAC042A

# Parking Brake System

BR-29

## REMOVAL (LEVER)

1. Remove the console
2. Loosen the lever adjusting nut
3. Detach the cable from the lever
4. Remove the lever mounting bolts and nuts
5. Disconnect the parking brake switch connector

## REMOVAL (CABLE)

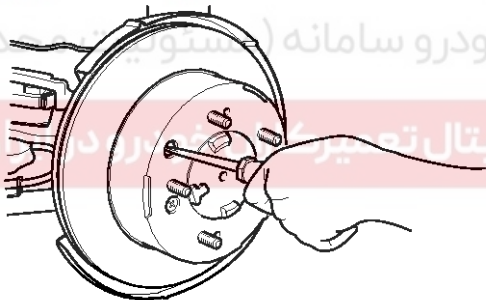
1. Remove the console
2. Loosen the lever adjusting nut
3. Detach the cable from the lever
4. Remove the cable clip which connect the cable to the body and install the axle housing
5. Remove the parking cable from the operating lever

## REMOVAL (BRAKE SHOE)

1. Remove rear disk caliper assembly.(Refer to "Rear disk brake")
2. Before removing the brake disk, chalk both sides of the screw.

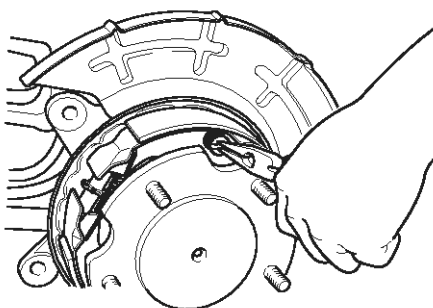
### NOTICE

Reduce the shoe gap by turning the adjuster with appropriate tool.



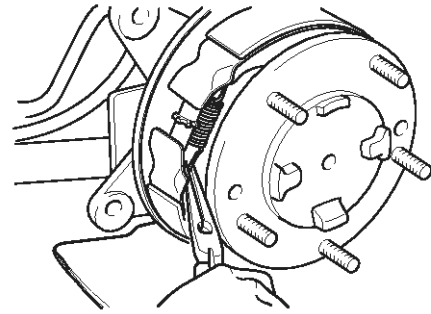
LJAC043E

3. After turning the pin to coincide with hole of spring cap, remove the shoe hold spring.



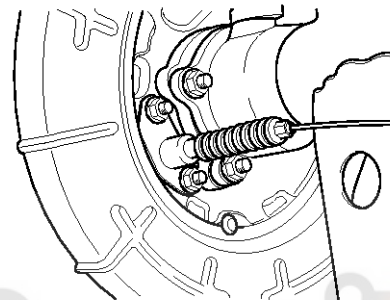
LJAC043B

4. Remove the lower return spring.



LJAC043C

5. Remove the parking brake cable mounting nuts.

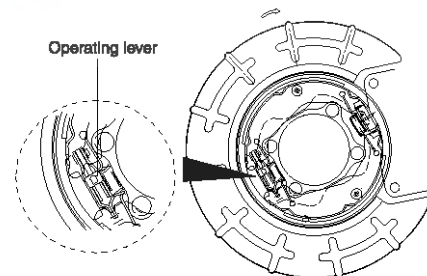


LJAC043D

6. Remove the parking brake shoes.

## ASSEMBLY (BRAKE SHOE)

1. Install the parking brake cable to the operating lever and then install the operating lever as shown in the figure.



LJAC044A

2. Tighten the parking brake cable mounting nuts.

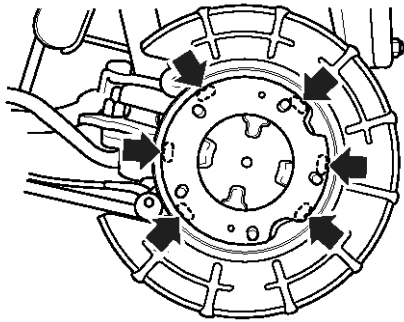
Tightening torque

47-54 N·m (4.7-5.4 kg·m, 34-39 lb·ft)

# BR-30

# Brake System

3. Apply the grease to the area in the figure.



LJAC044B

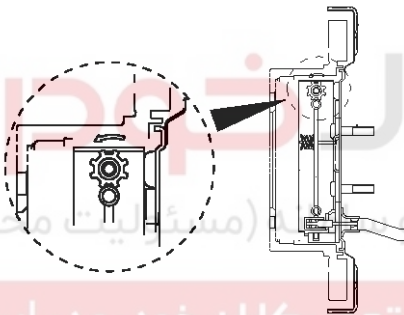
- 4. Install the upper return spring and brake shoes
- 5. Turn the adjuster in clockwise direction and install.

**NOTICE**

*Direction of adjuster turn*

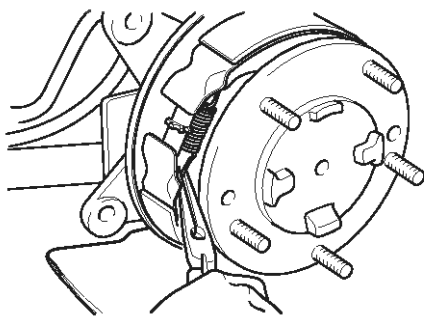
*Clockwise : narrowing the shoe gap.*

*Counterclockwise : widen the shoe gap.*



LJAC044C

6. Install the lower return spring.



LJAC043C

- 7. Install the shoe hold spring with a plier.
- 8. Install the disk brake and then align the mark while tightening the screw.

## INSPECTION

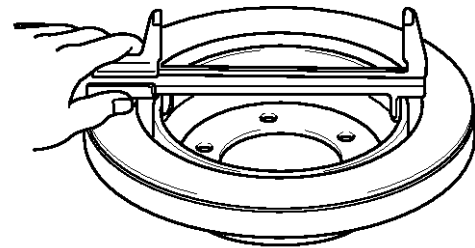
1. Measure the drum inside diameter.

Standard value : 190mm (7.48 in.)

Service limit : 191mm (7.52 in.)

**CAUTION**

**If the brake drum inner diameter is greater than the service limit, replace the brake drum.**

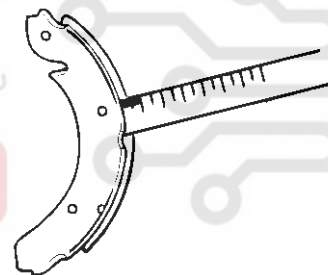


KGX8067A

2. Measure the brake lining thickness.

Standard value : 4mm (0.157 in.)

Service limit : 1.5mm (0.059 in.)

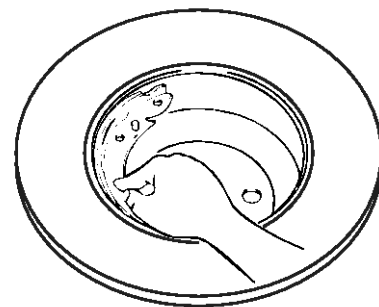


LJAC040B

**CAUTION**

**If the brake lining thickness is less than the service limit, replace the brake lining.**

3. Inspect the brake lining and drum for proper contact.



LJAC040C

# Parking Brake System

## BR-31

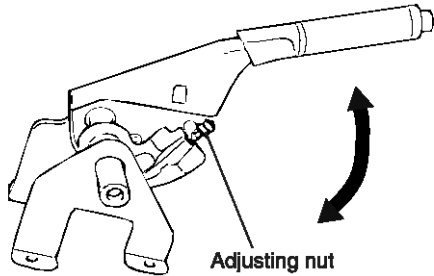
### ADJUSTMENT PROCEDURE

#### Parking brake stroke adjustment

1. Pull the brake lever with force of 100N (10kg, 22lbs) and count the number of notches.

Parking brake stroke

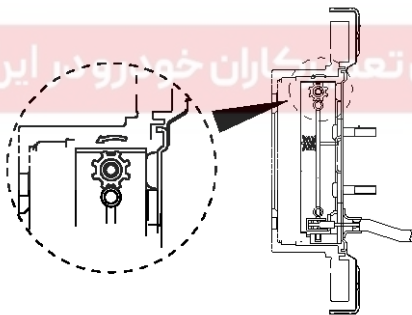
Standard value : 4 ~ 6 clicks



LJAC043A

2. If the parking brake stroke is out of the standard value, adjust it as follows :

- 1) Loosen the adjusting nut to release the parking brake cable.
- 2) Remove the adjusting hole plug, and then turn the adjuster in the direction of the arrow. To prevent the disc from rotating, use a screwdriver (flat tip (-)).



LJAC044C

- 3) Turn the adjuster 5 notches in the opposite direction of arrow.
- 4) Turn the adjuster nut to adjust the parking brake stroke to the specification.

#### ⚠ CAUTION

If the number of parking brake notches is less than the specification, loosen the adjusting nut and readjust.

- 5) After adjusting the parking brake stroke, raise the rear of vehicle with a jack.

- 6) Check that the rear brakes do not drag by turning the rear wheel when the parking brake lever is released.

#### PARKING BRAKE BED-IN (DIH)

1. When the parking brake lever is pulled with force of 15 kg(f), drive the vehicle 500m at 60 kph, or accelerate to 60 kph on a roll device.
2. Repeat step 1 more than 2 times.
3. Parking should be possible on a hill of 30% with gross vehicle weight.

#### 📌 NOTICE

- *BED-IN* : Procedure of operating the vehicle with parking brakes active for the purpose of setting the position of the brake pads.
- *DIH (Drum in hat)* : Disk brake type parking system.

## BR-32

## Brake System

## ABS(Anti-Lock Brake System)

## COMPONENTS



1. Front left wheel speed sensor
2. ABS control module(HECU)
3. Front right wheel speed sensor

4. Hydraulic line
5. Rear right wheel speed sensor
6. Rear left wheel speed sensor

SBLBR6500L

# ABS(Anti-Lock Brake System)

BR-33

## DESCRIPTION

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)

This specification is for the wiring design and installation of ABS/TCS/ESC ECU.

This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.
- Control of braking force / traction force/ yaw moment.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

### Installation position : engine compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

## OPERATION

The ECU shall be put into operation by switching on the operating voltage (IGN).

On completion of the initialization phase, the ECU shall be ready for operation.

In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

### Wheel Sensor signal processing

The ECU shall receive wheel speed signal from the four active wheel sensors.

The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the MCU.

### Solenoid Valve Control

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.

The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

## Voltage limits

- Overvoltage

When overvoltage is detected(above 16.8 V), the ECU switches off the valve relay and shuts down the system.

When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.

- Undervoltage

In the event of undervoltage(below 9.3 V), ABS control shall be inhibited and the warning lamp shall be turned on.

When voltage is returned to operating range, the warning lamp is switched off and ECU returns to normal operating mode.

## Pump Motor Checking

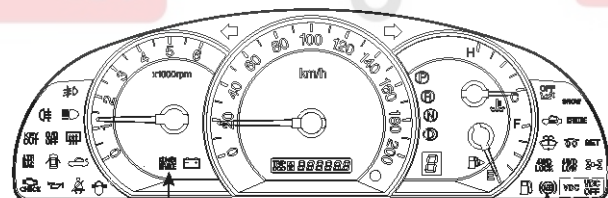
The ECU performs a pump motor test at a speed of 30km/h once after IGN is switched on.

## Diagnostic Interface

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.

The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU (Air-bleeding line or Roll and Brake Test line).

## Warning Lamp module



Parking/EBD Warning lamp

ABS Warning lamp

SBLBR6501L



## BR-34

## Brake System

### 1. ABS WARNING LAMP MODULE

The active ABS warning lamp module indicates the selftest and failure status of the ABS. The ABS warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is separated from ECU.

### 2. PARKING/EBD WARNING LAMP MODULE

The active EBD warning lamp module indicates the selftest and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order.
- During diagnostic mode.
- When the ECU Connector is separated from ECU.

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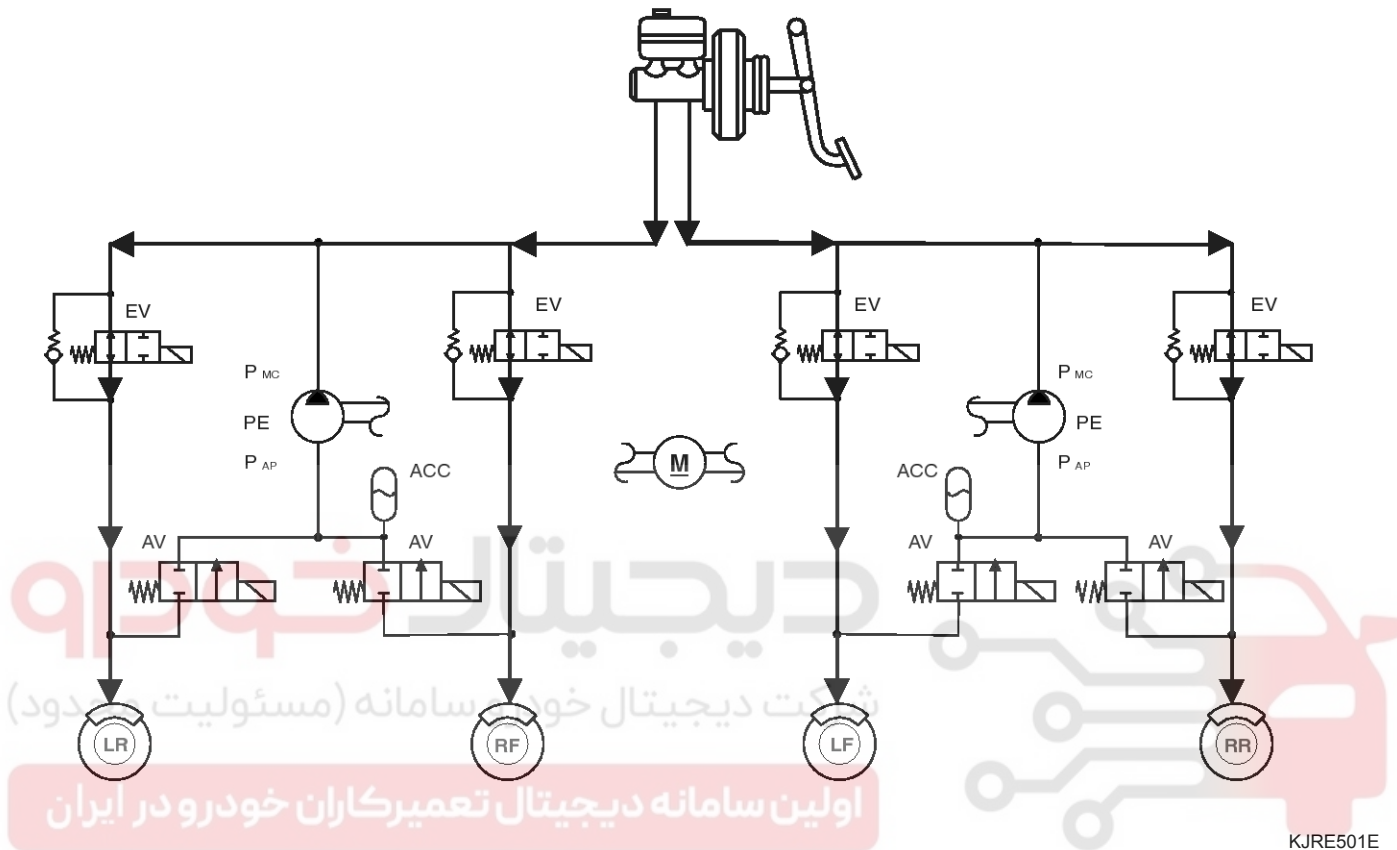
# ABS(Anti-Lock Brake System)

## BR-35

### ABS CONTROL

#### 1. NORMAL BRAKING without ABS

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF



KJRE501E

#### NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

LF : Front left wheel

RR : Rear right wheel

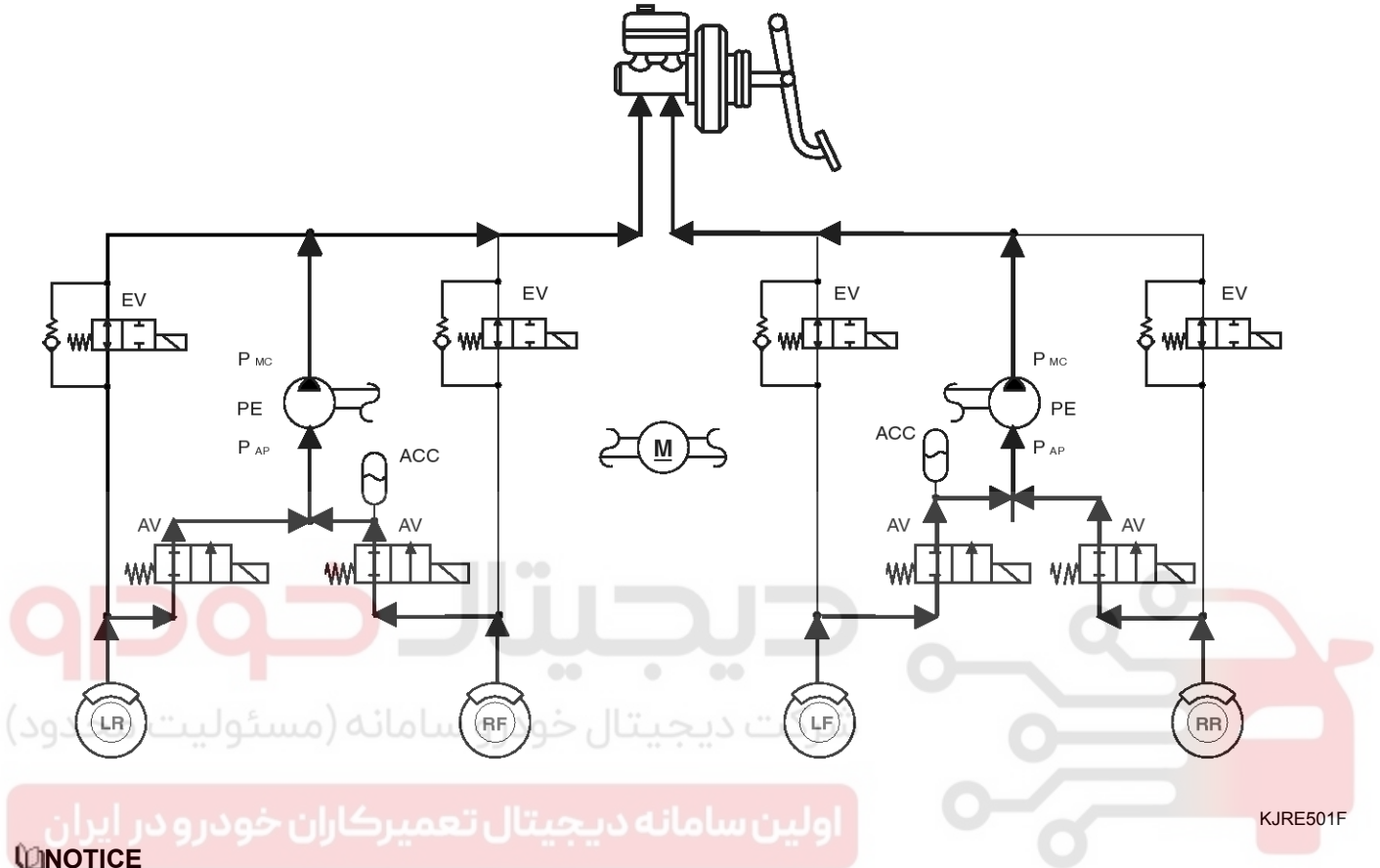
PE : Pump motor

# BR-36

# Brake System

## 2. DECREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Open	ON(Motor speed control)



KJRE501F

**NOTICE**

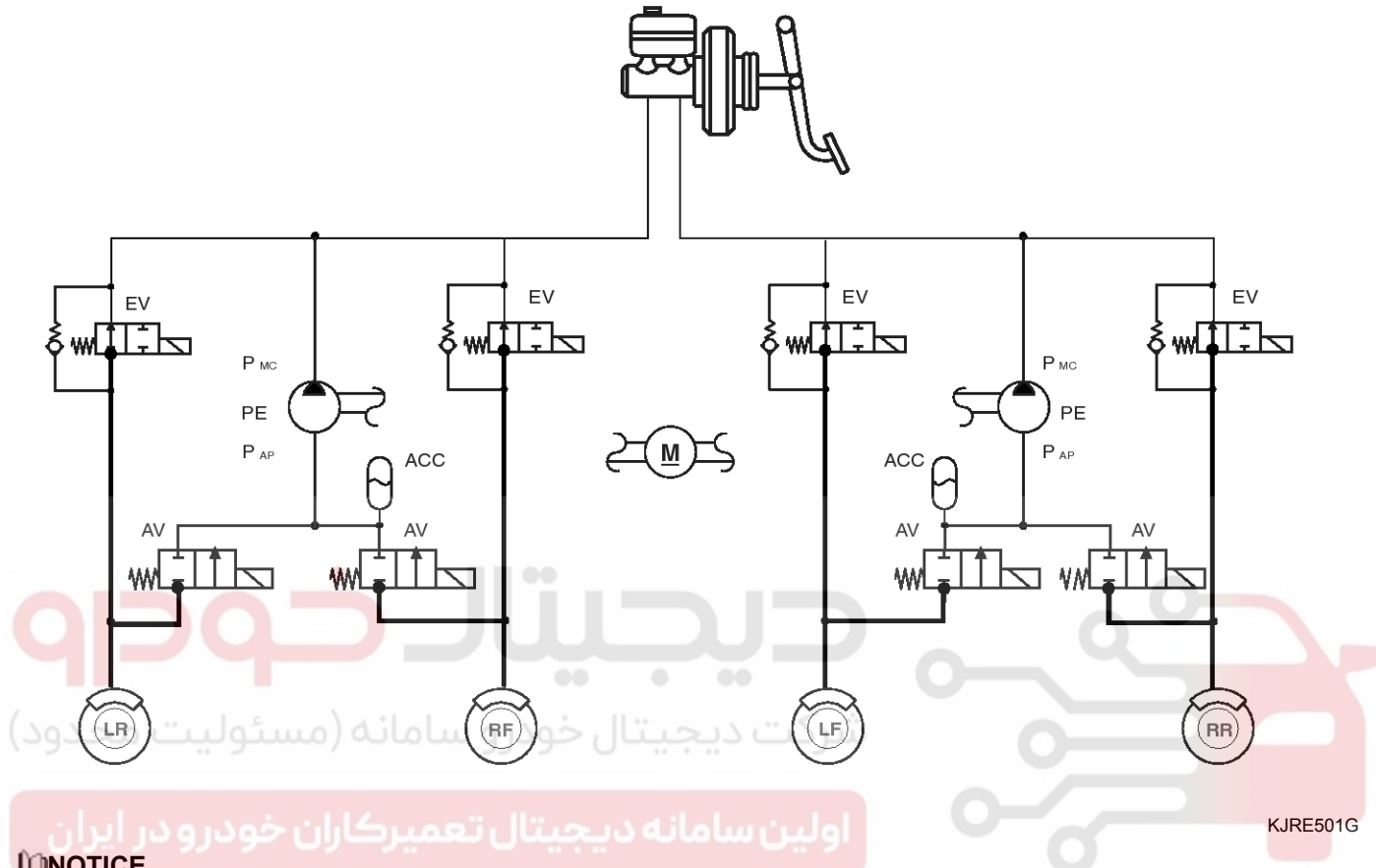
- EV : Inlet Valve
- AV : Outlet Valve
- LR : Rear left wheel
- RF : Front right wheel
- LF : Front left wheel
- RR : Rear right wheel
- PE : Pump motor

# ABS(Anti-Lock Brake System)

# BR-37

### 3. HOLD MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Close	ON(Motor speed control)



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KJRE501G

**NOTICE**

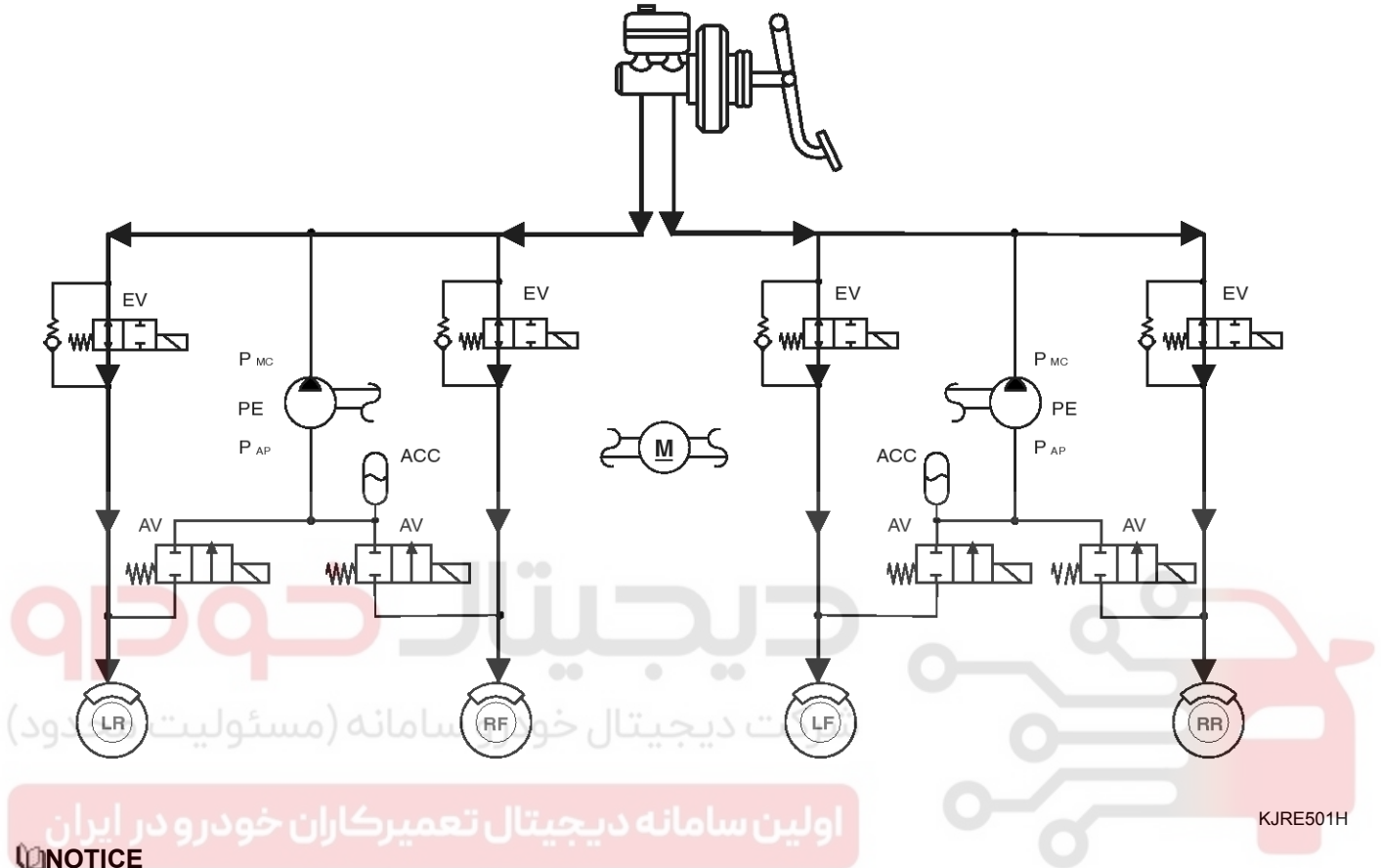
- EV : Inlet Valve
- AV : Outlet Valve
- LR : Rear left wheel
- RF : Front right wheel
- LF : Front left wheel
- RR : Rear right wheel
- PE : Pump motor

# BR-38

# Brake System

## 4. INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	ON(Motor speed control)



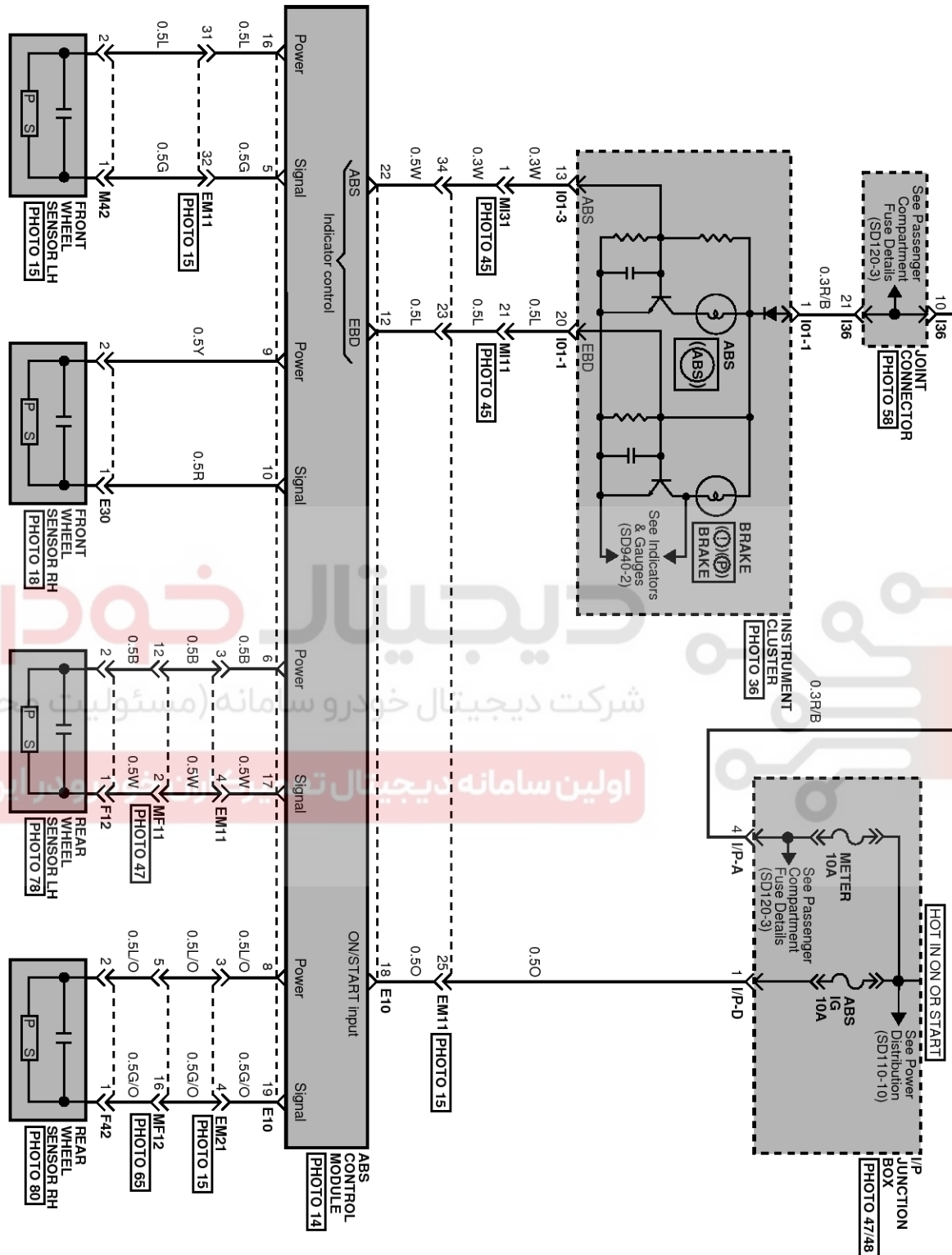
**NOTICE**

- EV : Inlet Valve
- AV : Outlet Valve
- LR : Rear left wheel
- RF : Front right wheel
- LF : Front left wheel
- RR : Rear right wheel
- PE : Pump motor

# ABS(Anti-Lock Brake System)

## BR-39

### ABS CIRCUIT DIAGRAM(1)

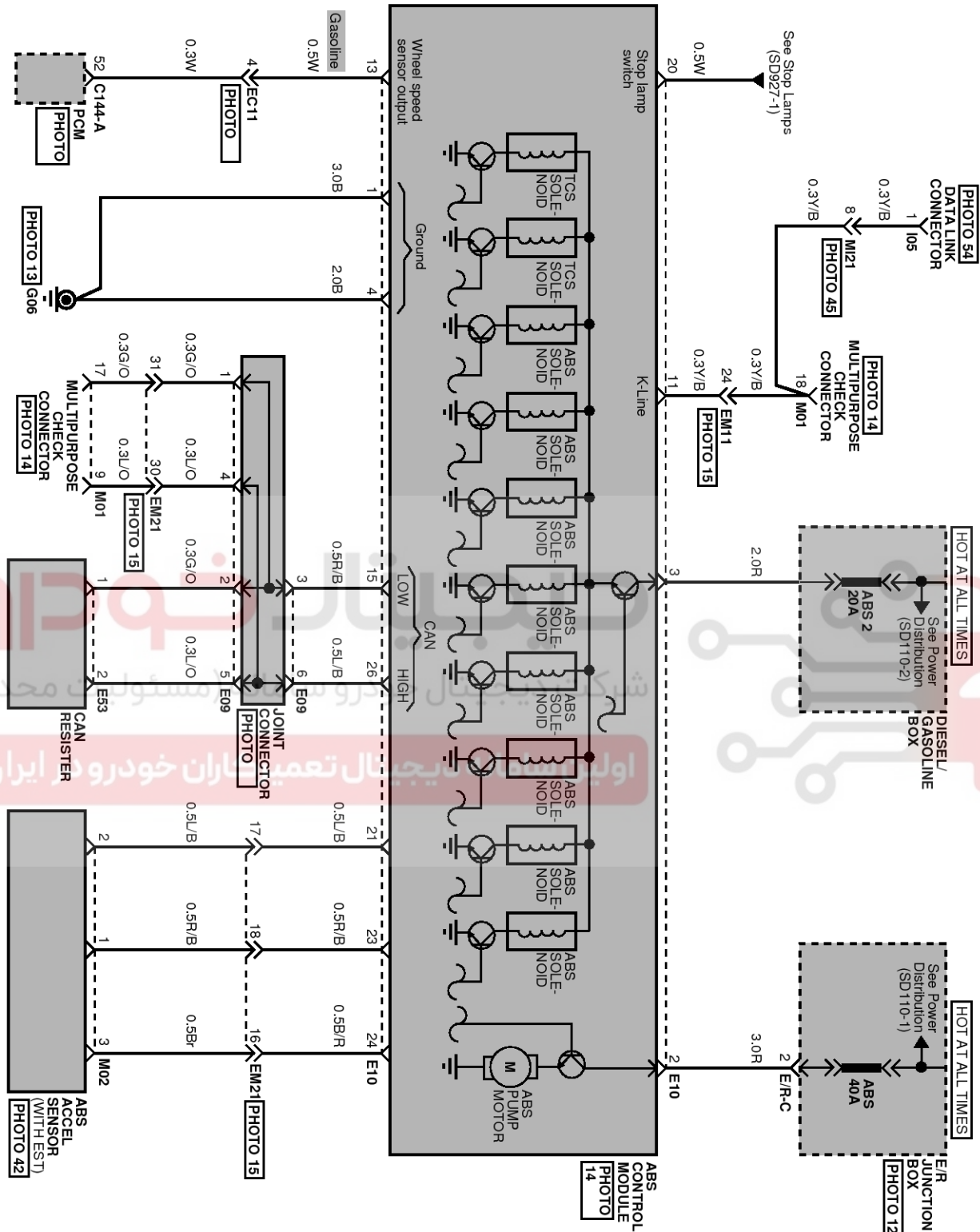


SBLBR6502L

# BR-40

# Brake System

## ABS CIRCUIT DIAGRAM(2)

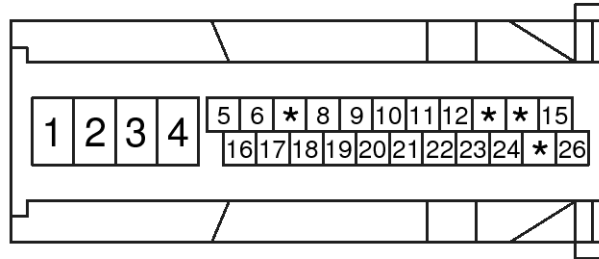


SBLBR6503L

# ABS(Anti-Lock Brake System)

# BR-41

## ECU CONNECTOR INPUT/OUTPUT(ABS)



SBLBR6504D

Wire No.	Designation	Current		max.permissible wire resistance R_L (mΩ)	min.leakage resistance R_P (kΩ)
		max	min		
1	Ground for recirculation pump	20~39 A	10 A	10	
4	Ground for solenoid valves and ECU	5~15 A	2.5 A	10	
2	Voltage supply for pump motor	20~39 A	10 A	10	200
3	Voltage supply for solenoid valves	5~15 A	2 A	10	200
18	Voltage for hybrid ECU	1 A	500 mA	60	200
5,10,17,19	signal wheel speed sensor FL, FR, RL,RR	16 mA	6 mA	250	200 to ground 1. 5M to bat
16,9,6,8	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	10 mA	6 mA	250	200 to ground 1. 5M to bat
11	Diagnostic wire K	6 mA	3 mA	250	200
22	ABS-warning lamp actuation	30 mA	5 mA	250	200
12	EBD-warning lamp actuation	30 mA	5 mA	250	200
20	brake light switch	10 mA	5 mA	250	200
15	CAN Low	30 mA	20 mA	250	200
26	CAN High	30 mA	20 mA	250	200



## BR-42

## Brake System

## ABS HECU CONNECTOR

Connector terminal		Specification	Condition
Number	Description		
1	Ground for recirculation pump	Current range: Min.10A Max.20~39A	Always
4	Ground for solenoid valves and ECU	Current range: Min.2.5A Max.5~15A	Always
2	Voltage supply for pump motor	Battery voltage	Always
3	Voltage supply for solenoid valves		
16	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG ON
9			
6			
8			
5	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.89~1.26 V Voltage (Low) : 0.44~0.63 V	On driving
10			
17			
19			
11	Diagnostic wire K	Voltage (High) $\geq 0.8$ * IG ON Voltage (Low) $\leq 0.2$ * IG ON	On SCAN TOOL communication
18	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
20	Brake light switch	Voltage (High) $\geq 4.5$ * IG ON Voltage (Low) $\leq 2.0$ * IG ON	BRAKE ON/OFF

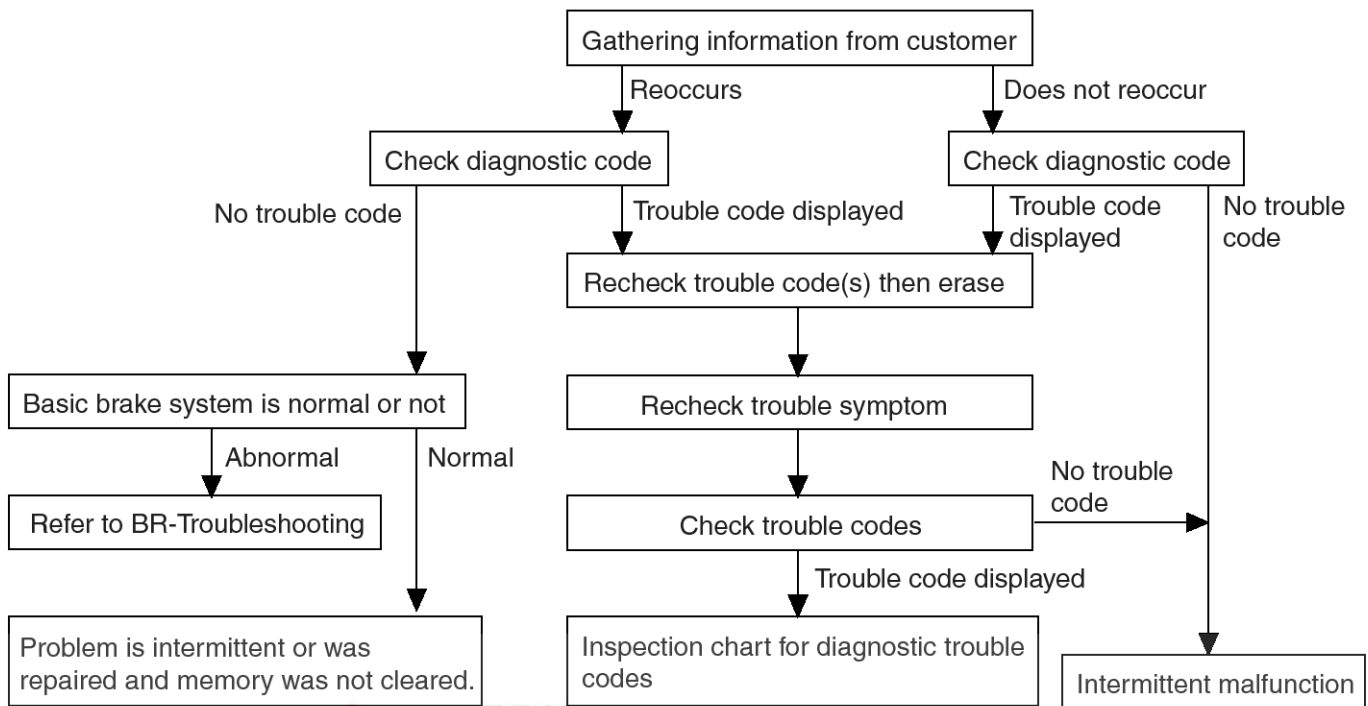
**ABS(Anti-Lock Brake System)****BR-43****SENSOR OUTPUT ON SCAN TOOL(ABS)**

	Description	Abbreviation	Unit	Remarks
1	Vehicle speed sensor	VEH. SPD	Km/h	
2	Battery voltage	BATT. VOL	V	
3	FL Wheel speed sensor	FL WHEEL	Km/h	
4	FR Wheel speed sensor	FR WHEEL	Km/h	
5	RL Wheel speed sensor	RL WHEEL	Km/h	
6	RR Wheel speed sensor	RR WHEEL	Km/h	
7	ABS Warning lamp	ABS LAMP	-	
8	EBD Warning lamp	EBD LAMP	-	
9	Brake Lamp	B/LAMP	-	
10	Pump relay state	PUMP RLY	-	
11	Valve relay state	VALVE RLY	-	
12	Motor	MOTOR	-	
13	Front Left valve(IN)	FL INLET	-	
14	Front Right valve (IN)	FR INLET	-	
15	Rear Left valve (IN)	RL INLET	-	
16	Rear Right valve (IN)	RR INLET	-	
17	Front Left valve (OUT)	FL OUTLET	-	
18	Front Right valve (OUT)	FR OUTLET	-	
19	Rear Left valve(OUT)	RL OUTLET	-	
20	Rear Right valve (OUT)	RR OUTLET	-	

BR-44

Brake System

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



\* Using the customer problem analysis check sheet for reference, ask the customer as much detail as possible about the problem.

NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	<ol style="list-style-type: none"> <li>1. Sound of the motor inside the ABS hydraulic unit operation (whine).</li> <li>2. Sound is generated along with vibration of the brake pedal (scraping).</li> <li>3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)</li> </ol>
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.

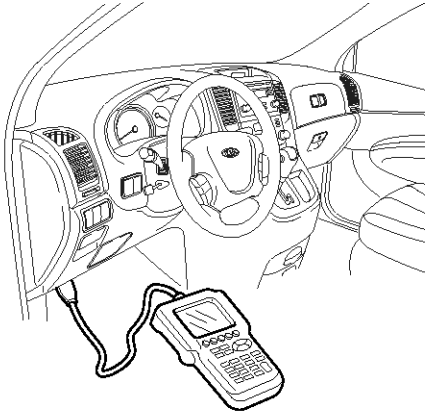
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.

# ABS(Anti-Lock Brake System)

## BR-45

### SCAN TOOL CHECK

1. Turn the ignition switch OFF.
2. Connector the Scan tool to the 16P data link connector located the driver's side kick panel.



SBLBR6542L

3. Turn the ignition switch ON.
4. Check for DTC using the Scan tool
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes using the scan tool.
6. Disconnect the Scan tool from the 16P data link connector.



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## BR-46

## Brake System

## ABS CHECK SHEET

## ABS Check Sheet

Inspector's  
Name \_\_\_\_\_

Customer's Name		Registration No.	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	Odometer	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurrence of Problem	<input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent (    times a day)

Symptoms	<input type="checkbox"/> ABS does not operate.	
	<input type="checkbox"/> ABS does not operate efficiently.	<input type="checkbox"/> Intermittent (    times a day)
	ABS Warning Light Abnormal	<input type="checkbox"/> Remains ON <input type="checkbox"/> Does not light up

Diagnostic Trouble Code Check	1st Time	<input type="checkbox"/> Normal Code	<input type="checkbox"/> Malfunction Code (Code    )
	2nd Time	<input type="checkbox"/> Normal Code	<input type="checkbox"/> Malfunction Code (Code    )

EJDA017A

# ABS(Anti-Lock Brake System)

## BR-47

### PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area
ABS does not operate.	Only when 1. -4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.
ABS does not operate intermittently.	Only when 1. -4. are all normal and the problem is still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the system is operating to specifications. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.
Communication with Scan tool is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line
Communication with Scan tool is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU

### ⚠ CAUTION اولین سامانه دیجیتال تعمیرکاران خودرو در

During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

# BR-48

# Brake System

## ABS Does Not Operate.

EJBF505T

### DETECTING CONDITION

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	<ul style="list-style-type: none"> <li>- Inoperative power source circuit</li> <li>- Inoperative wheel speed sensor circuit</li> <li>- Inoperative hydraulic circuit for leakage</li> <li>- Inoperative HECU</li> </ul>

### INSPECTION PROCEDURES

#### DTC INSPECTION

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Verify that the system is operating to specifications.

Is the system operating to specifications?

**NO**

- ▶ Check the power source circuit.

**YES**

- ▶ Erase the DTC and recheck using Scan Tool.

#### CHECK THE POWER SOURCE CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

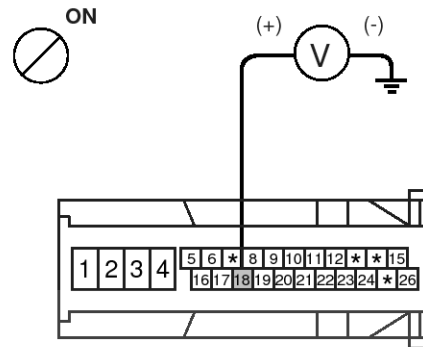
Is the voltage within specification?

**YES**

- ▶ Check the ground circuit.

**NO**

- ▶ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



SBLBR6506D

#### CHECK THE GROUND CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 1,4 of the ABS control module harness side connector and ground point.

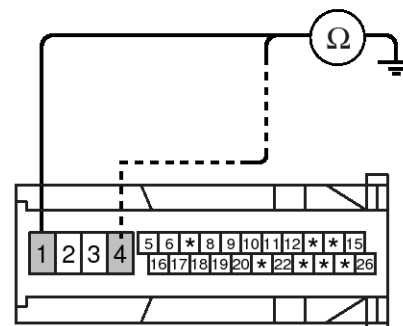
Is there continuity?

**YES**

- ▶ Check the wheel speed sensor circuit.

**NO**

- ▶ Repair an open in the wire and ground point.



SCMBR6588D

# ABS(Anti-Lock Brake System)

**BR-49**

## CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.

Is the system operating to specifications?

**YES**

▶ Check the hydraulic circuit for leakage.

**NO**

▶ Repair or replace the wheel speed sensor.

## CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.

Is the system operating to specifications?

**YES**

▶ The problem is still occurring, replace the ABS control module.

**NO**

▶ Replace the leaking hydraulic lines.



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## BR-50

## Brake System

## ABS Does Not Operate (Intermittently).

BJKG500R

## DETECTING CONDITION

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ABS control module.	<ul style="list-style-type: none"> <li>- Inoperative power source circuit</li> <li>- Inoperative wheel speed sensor circuit</li> <li>- Inoperative hydraulic circuit for leakage</li> <li>- Inoperative HECU</li> </ul>

## INSPECTION PROCEDURES

## DTC INSPECTION

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Verify that the system is operating to specifications.  
Is the system operating to specifications?

**NO**

- ▶ Check the wheel speed sensor circuit.

**YES**

- ▶ Erase the DTC and recheck using Scan Tool.

## CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.

Is the system operating to specifications?

**YES**

- ▶ Check the stop lamp switch circuit.

**NO**

- ▶ Repair or replace the wheel speed sensor.

## CHECK THE STOP LAMP SWITCH CIRCUIT.

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 20 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification: approximately B+

Is the voltage within specification?

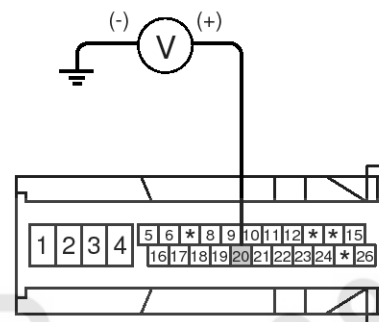
**YES**

- ▶ Check the hydraulic circuit for leakage.

**NO**

- ▶ Repair the stop lamp switch. Repair an open in the

wire between the ABS control module and the stop lamp switch.



SBLBR6507D

## CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.

Is the system operating to specifications?

**YES**

- ▶ The problem is still occurring, replace the ABS control module.

**NO**

- ▶ Replace the leaking hydraulic lines.

# ABS(Anti-Lock Brake System)

# BR-51

Communication with Scan-Tool is not possible.  
(Communication with any system is not possible)

BJKG500S

## DETECTING CONDITION

Trouble Symptoms	Possible Cause
Possible malfunction in the power supply system (including ground) for the diagnosis line.	<ul style="list-style-type: none"> <li>- An open in the wire</li> <li>- Poor ground</li> <li>- Inoperative power source circuit</li> </ul>

## INSPECTION PROCEDURES

### CHECK THE POWER SUPPLY CIRCUIT FOR THE DIAGNOSIS

Measure the voltage between terminal 9 of the data link connector and body ground.

Specification: approximately B+

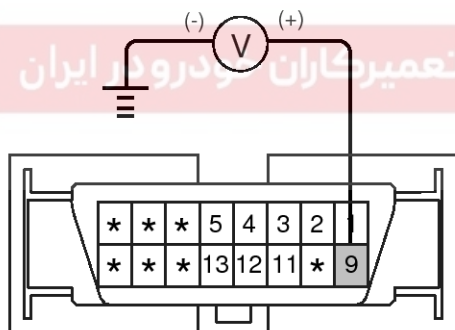
Is voltage within specification?

**YES**

► Check the ground circuit for the diagnosis.

**NO**

► Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.



SBLBR6508D

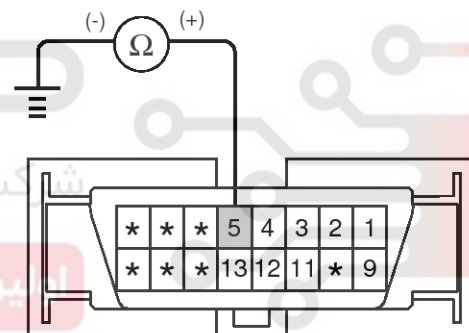
### CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

Check for continuity between terminal 5 of the data link connector and body ground.

Is there continuity?

**NO**

► Repair an open in the wire between terminal 5 of the data link connector and ground point.



SBLBR6509D

# BR-52

# Brake System

Communication with Scan Tool is not possible.  
(Communication with ABS only is not possible)

BJKG500T

### DETECTING CONDITION

Trouble Symptoms	Possible Cause
When communication with Scan Tool is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	<ul style="list-style-type: none"> <li>- An open in the wire</li> <li>- Inoperative HECU</li> <li>- Inoperative power source circuit</li> </ul>

### INSPECTION PROCEDURES

#### CHECK FOR CONTINUITY IN THE DIAGNOSIS LINE

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 11 of the ABS control module connector and 1 of the data link connector.

Is there continuity?

**YES**

- ▶ Check the power source of ABS control module.

**NO**

- ▶ Repair an open in the wire.

#### CHECK THE POWER SOURCE OF ABS CONTROL MODULE

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

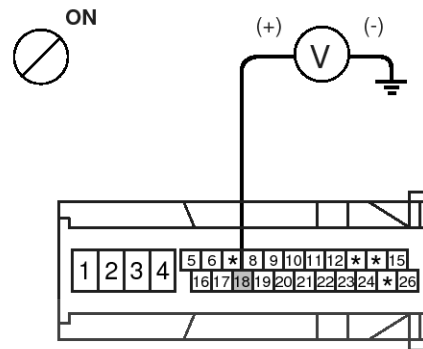
Is voltage within specification?

**YES**

- ▶ Check for poor ground.

**NO**

- ▶ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS control module. Repair if necessary.



SBLBR6510D

#### CHECK FOR POOR GROUND

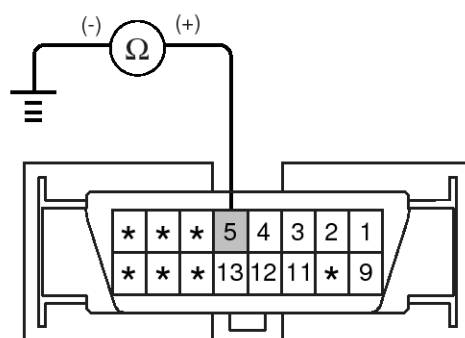
Check for continuity between terminal 5 of the data link connector and ground point.

**YES**

- ▶ Replace the ABS control module and recheck.

**NO**

- ▶ Repair an open in the wire or poor ground.



SBLBR6511D

# ABS(Anti-Lock Brake System)

# BR-53

When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

EJBF505X

## DETECTING CONDITION

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the H-ECU, and the inoperative HECU.	<ul style="list-style-type: none"> <li>- Inoperative ABS warning lamp bulb</li> <li>- Blown No.2 fuse (10A) in the engine compartment junction block</li> <li>- Inoperative ABS warning lamp module</li> <li>- Inoperative HECU</li> </ul>

## INSPECTION PROCEDURES

### PROBLEM VERIFICATION

Disconnect the connector from the ABS control module and turn the ignition switch ON.

Does the ABS warning lamp light up?

**YES**

▶ It is normal. Recheck the ABS control module.

**NO**

▶ Check the power source for the ABS warning lamp.

### CHECK THE POWER SOURCE FOR THE ABS WARNING LAMP

1. Disconnect the instrument cluster connector and turn the ignition switch ON.
2. Measure the voltage between terminal 13 of the cluster harness side connector and body ground.

Specification: approximately B+

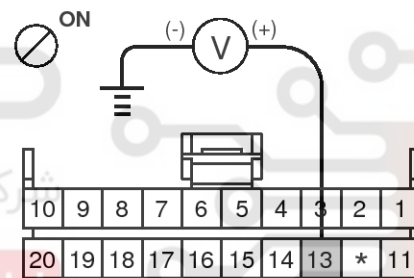
Is voltage within specification?

**YES**

▶ Repair bulb or instrument cluster assembly.

**NO**

▶ Check for blown fuse.



SBLBR6512D

### CHECK FOR BLOWN FUSE

Check continuity of fuse (10A) from the engine compartment junction block.

Is there continuity?

**YES**

▶ Repair an open in the wire between ABS fuse and 13 of cluster connector.

**NO**

▶ Replace the blown fuse.

**BR-54****Brake System**

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

EJBF505Y

**DETECTING CONDITION**

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	<ul style="list-style-type: none"> <li>- An open in the wire</li> <li>- Inoperative instrument cluster assembly</li> <li>- Inoperative ABS warning lamp module</li> <li>- Inoperative HECU</li> </ul>

**INSPECTION PROCEDURES****CHECK DTC OUTPUT.**

1. Connect the Scan Tool to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using Scan Tool.

Is DTC output?

**YES**

- ▶ Repair circuit indicated by code output.

**NO**

- ▶ Check instrument cluster.

**CHECK INSTRUMENT CLUSTER**

Disconnect the cluster connector and turn the ignition switch ON.

Does the ABS warning lamp remains ON?

**YES**

- ▶ Replace the instrument cluster.

**NO**

- ▶ Check for open the wire.

**CHECK FOR OPEN IN THE WIRE**

Check for continuity in the wire between cluster and ABS control module.

Is there continuity?

**YES**

- ▶ Replace the ABS control module and recheck.

**NO**

- ▶ Repair an open in the wire between cluster and ABS control module.

# ABS(Anti-Lock Brake System)

# BR-55

## BLEEDING OF BRAKE SYSTEM

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

**⚠ CAUTION**

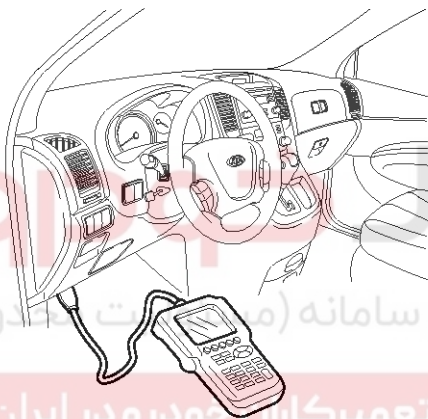
If there is any brake fluid on any painted surface, wash it off immediately.

**📄 NOTICE**

When pressure bleeding, do not depress the brake pedal.

Recommended fluid..... DOT3 or DOT4

2. Connect a clear plastic tube to the brake caliper bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the scan tool to the data link connector located underneath the dash panel.



ARKF500A

4. Select and operate according to the instructions on the scan tool screen.

**⚠ CAUTION**

You must obey the maximum operating time of the ABS motor with the scan tool to prevent the motor pump from burning.

- 1) Select Kia vehicle diagnosis.
- 2) Select vehicle name.
- 3) Select Anti-Lock Brake system.
- 4) Select air bleeding mode.
- 5) Press "YES" to operate motor pump and solenoid valve.

1.6 AIR BLEEDING MODE	
ABS AIR BLEEDING STATUS	
01. SOLENOID VALVE STATUS	CLOSE
02. MOTOR PUMP STATUS	OFF
DO YOU WANT TO START ? (PRESS [YES] KEY)	

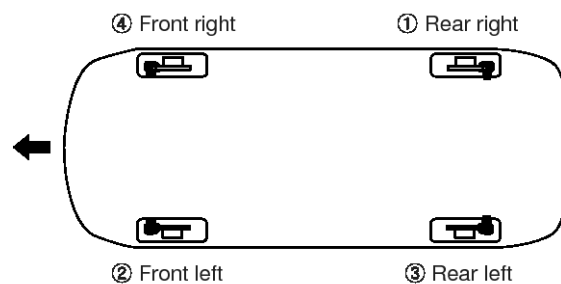
EJDA014F

- 6) Wait 60 sec. before operating the air bleeding again. (If not, you may damage the motor.)

1.6 AIR BLEEDING MODE	
ABS AIR BLEEDING STATUS	
01. SOLENOID VALVE STATUS	OPEN
02. MOTOR PUMP STATUS	ON
TIME : AUTOMATIC COUNT (1-60 SEC.)	

EJDA014G

5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.
6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



SBLBR6504L

7. Tighten the bleeder screw.

Bleed screw tightening torque:  
7~13 Nm (0.7 ~1.3 kgf·m, 5.1 ~ 9.4 lb-ft)

## BR-56

## Brake System

## DIAGNOSTIC TROUBLE CODE CHART(DTC)

● : MIL ON ○ : MIL OFF

DTC CODE	Trouble description	Warning lamp condition			Etc.
		EBD	ABS	ESP	
C1101	Battery voltage high	●	●	●	
C1102	Battery voltage low	○/●	●	●	
C1200	Wheel speed sensor front-LH open/short	○/●	●	●	
C1201	Wheel speed sensor front-LH range / performance / intermittent	○/●	●	●	
C1202	Wheel speed sensor front-LH invalid/no signal	○/●	●	●	
C1203	Wheel speed sensor front-RH open/short	○/●	●	●	
C1204	Wheel speed sensor front-RH range / performance / intermittent	○/●	●	●	
C1205	Wheel speed sensor front-RH invalid/no signal	○/●	●	●	
C1206	Wheel speed sensor rear-LH open/short	○/●	●	●	
C1207	Wheel speed sensor rear-LH range / performance / intermittent	○/●	●	●	
C1208	Wheel speed sensor rear-LH invalid/no signal	○/●	●	●	
C1209	Wheel speed sensor rear-RH open/short	○/●	●	●	
C1210	Wheel speed sensor rear-RH range / performance / intermittent	○/●	●	●	
C1211	Wheel speed sensor rear-RH invalid/no signal	○/●	●	●	
C1213	Wheel speed frequency error	○/●	●	●	
C1235	Primary pressure sensor - electrical	○	●	●	ESP only
C1237	Pressure sensor - other	○	●	●	ESP only
C1260	Steering angle sensor - signal	○	○	●	ESP only
C1261	Steering angle sensor not calibrated	○	○	●	ESP only
C1274	Longitudinal G sensor error	○	●	-	ABS 4WD(EST)
C1275	Longitudinal G sensor Range/Performance error	○	●	-	ABS 4WD(EST)
C1282	Yaw rate & lateral G sensor - electrical	○	○	●	ESP only
C1283	Yaw rate & lateral G sensor - signal	○	○	●	ESP only
C1503	ESP switch error	○	○	●	ESP only
C1513	Brake switch error	○	●	●	ESP only
C1604	ECU hardware error	●	●	●	
C1605	CAN hardware error	○	○	●	ESP only
C1611	CAN time-out EMS	○	○	●	ESP only
C1612	ECU(brake system) hardware error	○	○	●	ESP only
C1616	CAN bus off ESP	○	○	●	ESP only
C1623	CAN time-out SAS	○	○	●	ESP only
C1625	CAN time-out ESP	○	○	●	ESP only

# ABS(Anti-Lock Brake System)

## BR-57

DTC CO-DE	Trouble description	Warning lamp condition			Etc.
		EBD	ABS	ESP	
C1626	Implausible Control	○	●	●	ESP only
C1627	CAN time-out 4WD	○	○	●	4WD
C1702	Variant Coding	●	●	●	ABS TOD, ESP only
C2112	Valve relay error	○/●	●	●	
C2308	Front-LH Valve error (Inlet valve)	●	●	●	
C2312	Front-LH Valve error (Outlet valve)	●	●	●	
C2316	Front-RH Valve error (Inlet valve)	●	●	●	
C2320	Front-RH Valve error (Outlet valve)	●	●	●	
C2324	Rear-LH Valve error (Inlet valve)	●	●	●	
C2328	Rear-LH Valve error (Outlet valve)	●	●	●	
C2332	Rear-RH Valve error (Inlet valve)	●	●	●	
C2336	Rear-RH Valve error (Outlet valve)	●	●	●	
C2366	USV1 error	●	●	●	ESP only
C2370	USV2 error	●	●	●	ESP only
C2372	HSV1 error	●	●	●	ESP only
C2374	HSV2 error	●	●	●	ESP only
C2402	Motor electrical	●	●	●	

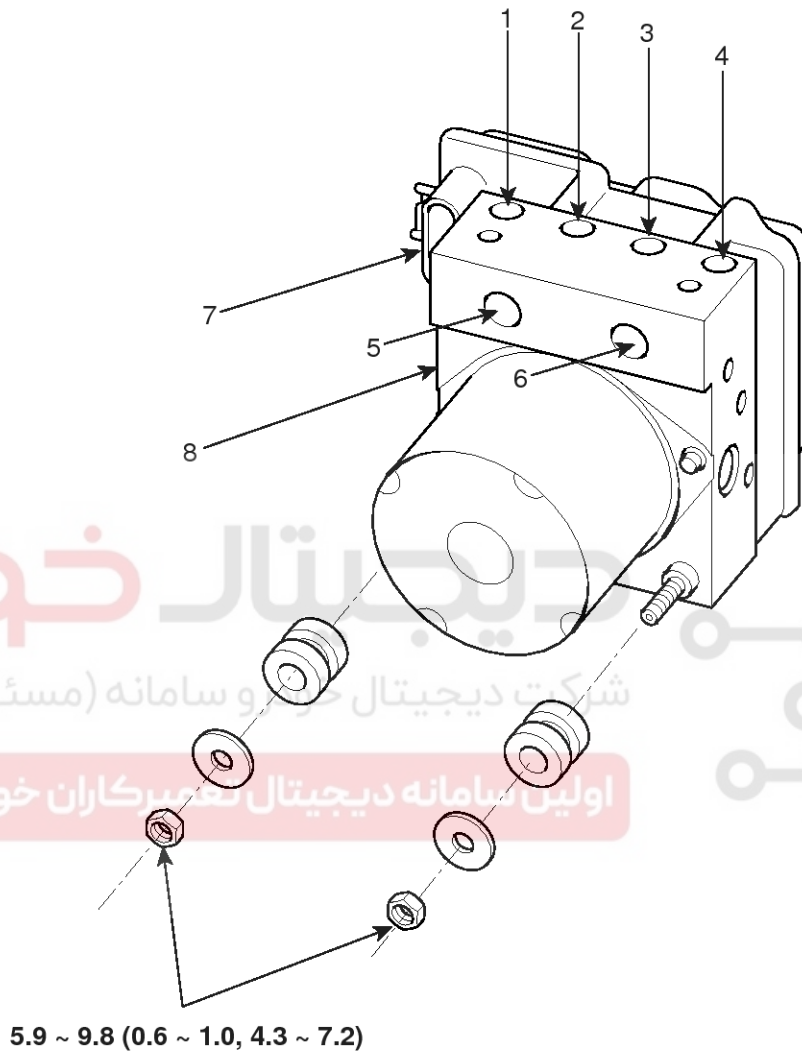


# BR-58

# Brake System

## ABS Control Unit

### COMPONENTS



### TORQUE : Nm (Kgf.m, lb-ft)

- |                       |                                       |
|-----------------------|---------------------------------------|
| 1. Front - right tube | 5. Master cylinder tube2              |
| 2. Rear - left tube   | 6. Master culinder tube1              |
| 3. Rear - right tube  | 7. ABS control module connector (26P) |
| 4. Front - left tube  | 8. ABS control module (HECU)          |

SBLBR6532L

# ABS(Anti-Lock Brake System)

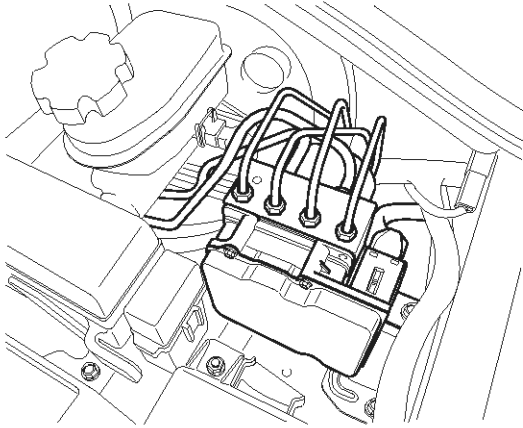
**BR-59**

## REMOVAL

1. Disconnect the battery(-) terminal.
2. Disconnect the brake tubes from the HECU.

**Tightening torque Nm (kgf.m, lb-ft):**

5.9 ~ 9.8 (0.6 ~ 1.0, 4.3 ~ 7.2)



SBLBR6541D

3. Disconnect the HECU connector.
4. Remove the HECU by loosening the bracket mounting bolts.

**Tightening torque Nm (kgf.m, lb-ft):**

16.7 ~ 25.5 (1.7 ~ 2.6, 12.3 ~ 18.8)

### ⚠ CAUTION

- Never attempt to disassemble the HECU.
- The HECU must be protected during storage and transport, and must not be subjected to excessive shock.

## INSTALLATION

1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to ABS bleeding)

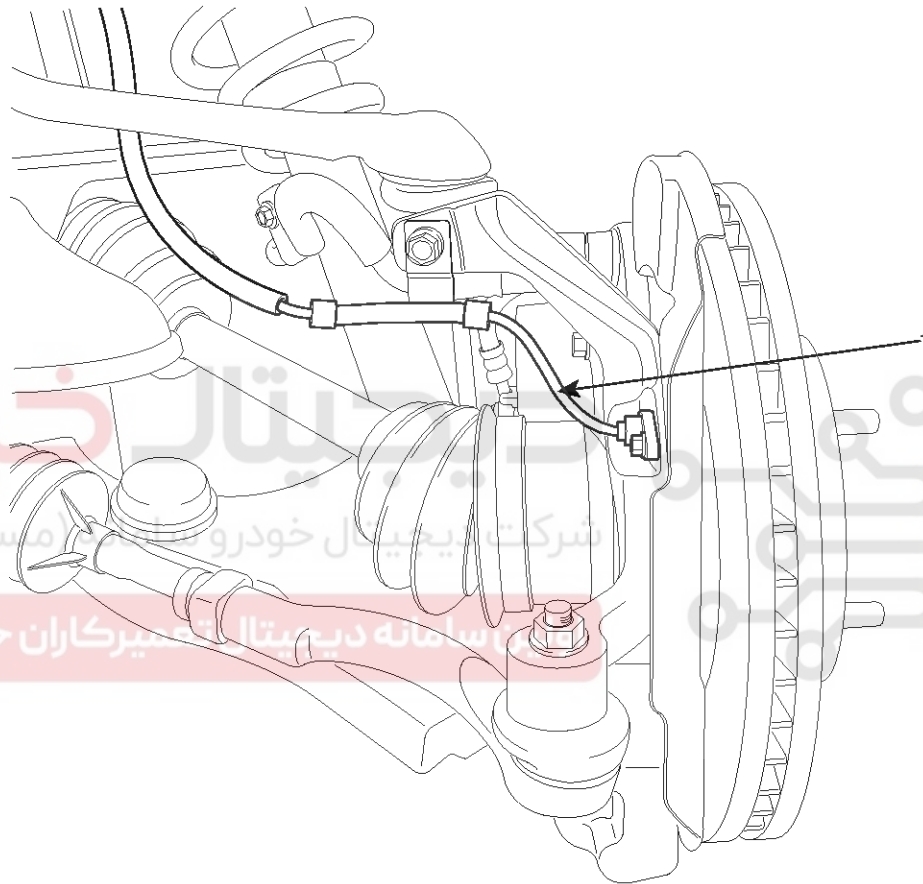


## BR-60

## Brake System

### Front Wheel Speed Sensor

#### COMPONENTS



1. Front wheel speed sensor

SBLBR6533L

# ABS(Anti-Lock Brake System)

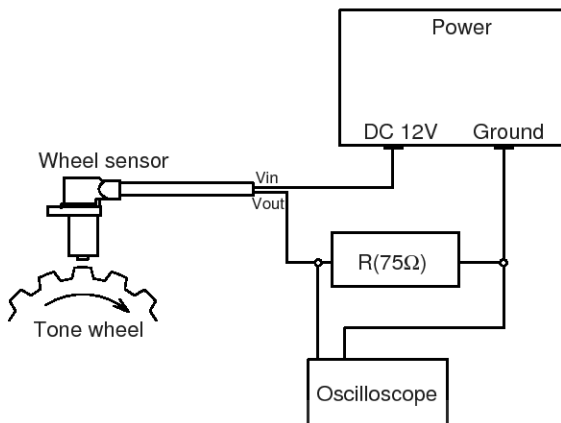
BR-61

## INSPECTION

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

### ⚠ CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a  $75\Omega$  resistor must be used as shown.

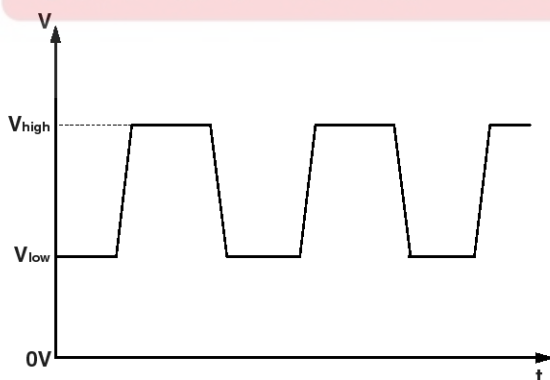


EJRF501Z

2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



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KJQE260B

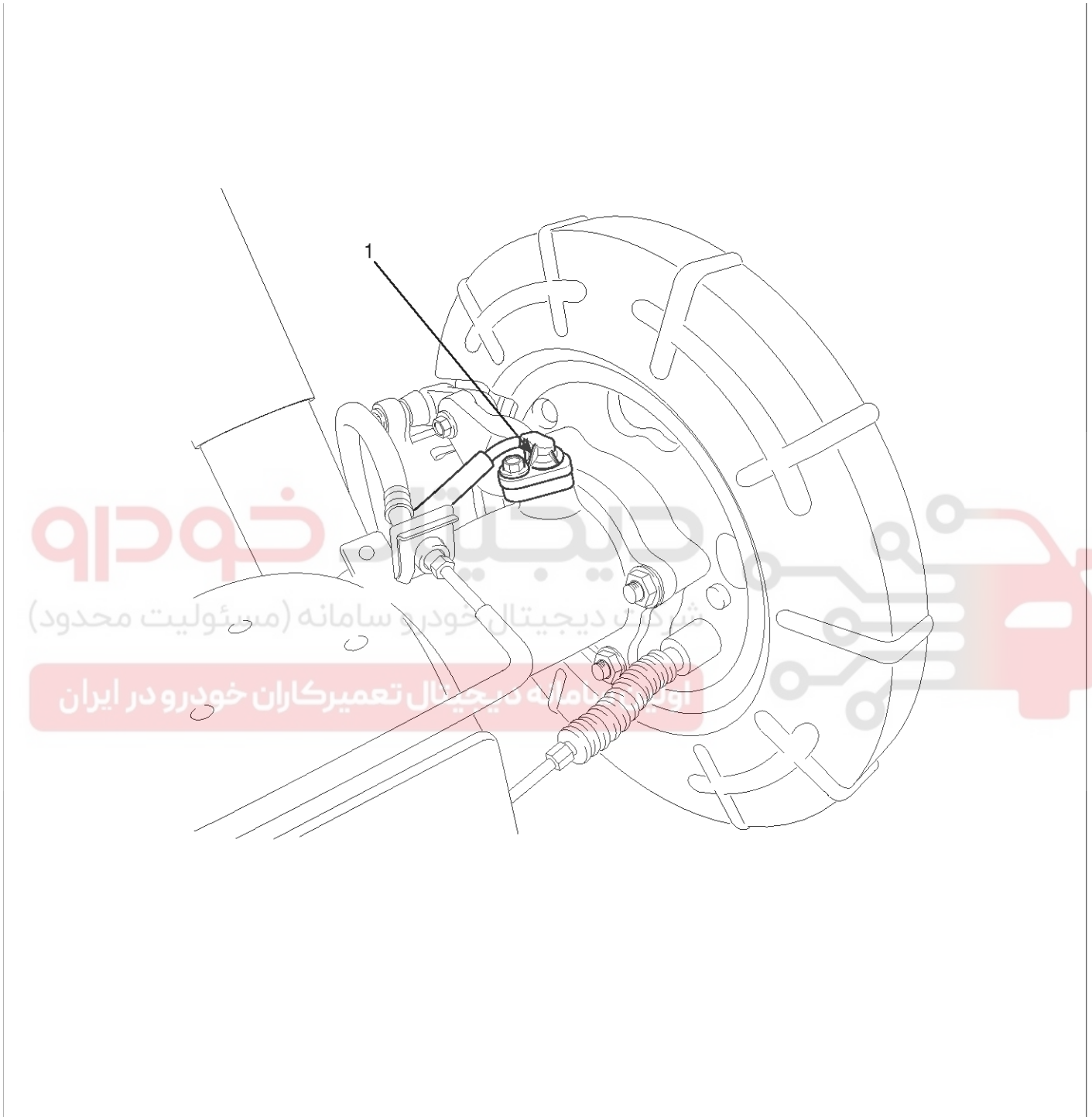
- $V_{low}$  : 0.44 V ~ 0.63 V
- $V_{high}$  : 0.885 V ~ 1.26 V
- Frequency range : 1~2,500 Hz

# BR-62

# Brake System

## Rear Wheel Speed Sensor

### COMPONENTS



1. Rear wheel speed sensor

SBLBR6534L

# ABS(Anti-Lock Brake System)

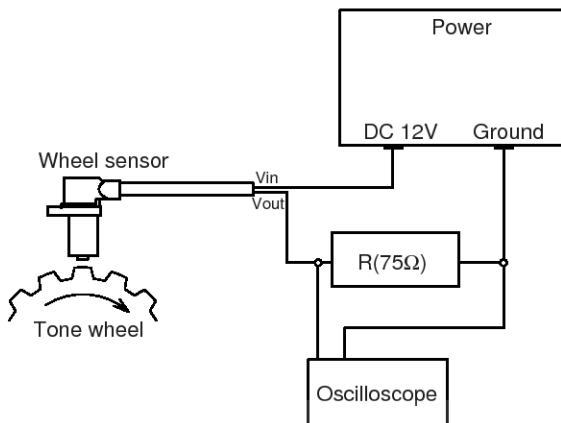
BR-63

## INSPECTION

1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

### ⚠ CAUTION

In order to protect the wheel speed sensor, when measuring output voltage, a  $75\Omega$  resistor must be used as shown.

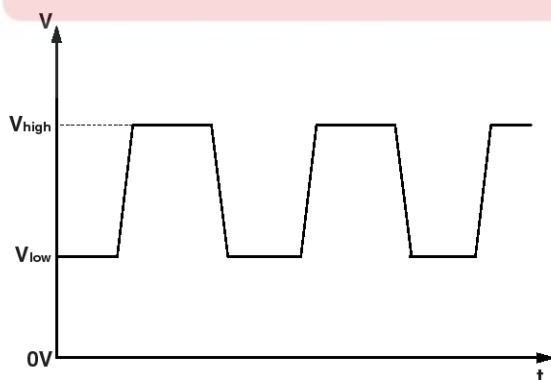


EJRF501Z

2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



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KJQE260B

- $V_{low}$  : 0.44 V ~ 0.63 V
- $V_{high}$  : 0.885 V ~ 1.26 V
- Frequency range : 1~2,500 Hz

## BR-64

## Brake System

## EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION)

## DESCRIPTION

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.

It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.

The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.

The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution to the rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.

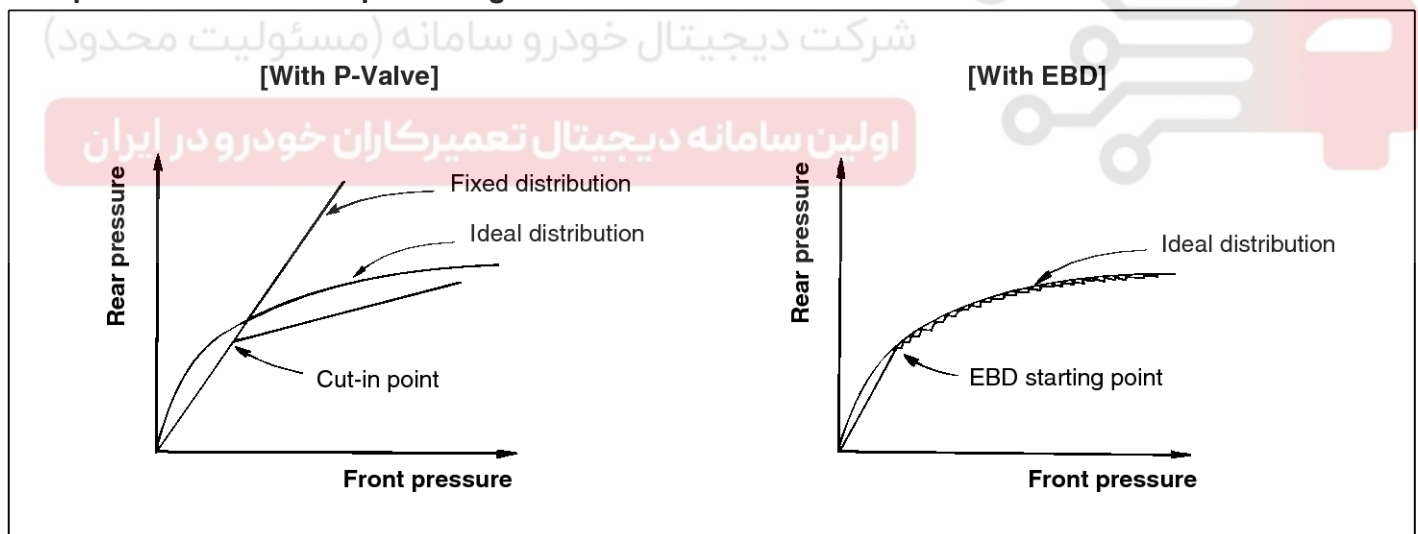
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

## ADVANTAGES

- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.
- Failure recognition by the warning lamp.

## Comparison between Proportioning valve and EBD



EJA0032A

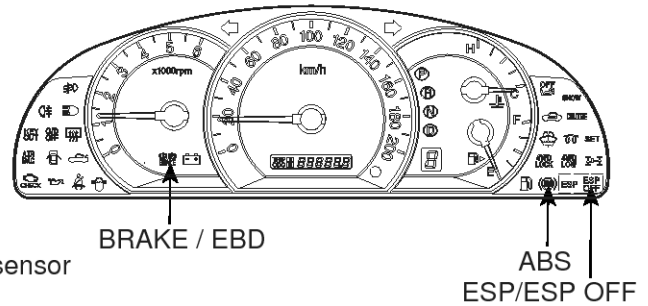
# ESP(Electronic Stability Program) System

# BR-65

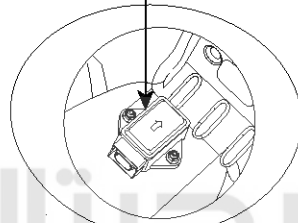
## ESP(Electronic Stability Program) System

### Components and Components Location

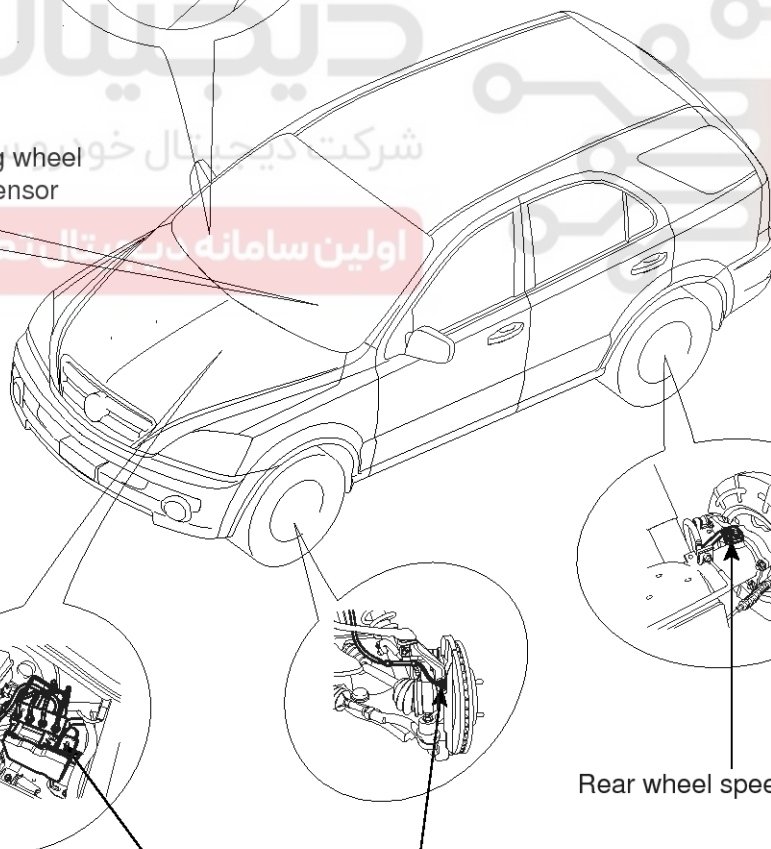
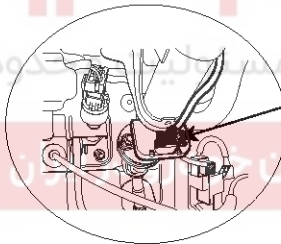
#### COMPONENTS



Yaw-late & lateral G sensor



Steering wheel angle sensor



Rear wheel speed sensor

ESP Control module(HECU)

Front wheel speed sensor



BR-66

Brake System

SBLBR6537L

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



# ESP(Electronic Stability Program) System

BR-67

## Description and Operation

### description of ESP

Optimum driving safety now has a name : ESP, the Electronic Stability Control.

ESP recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no need for actuating the brake or the gas pedal.

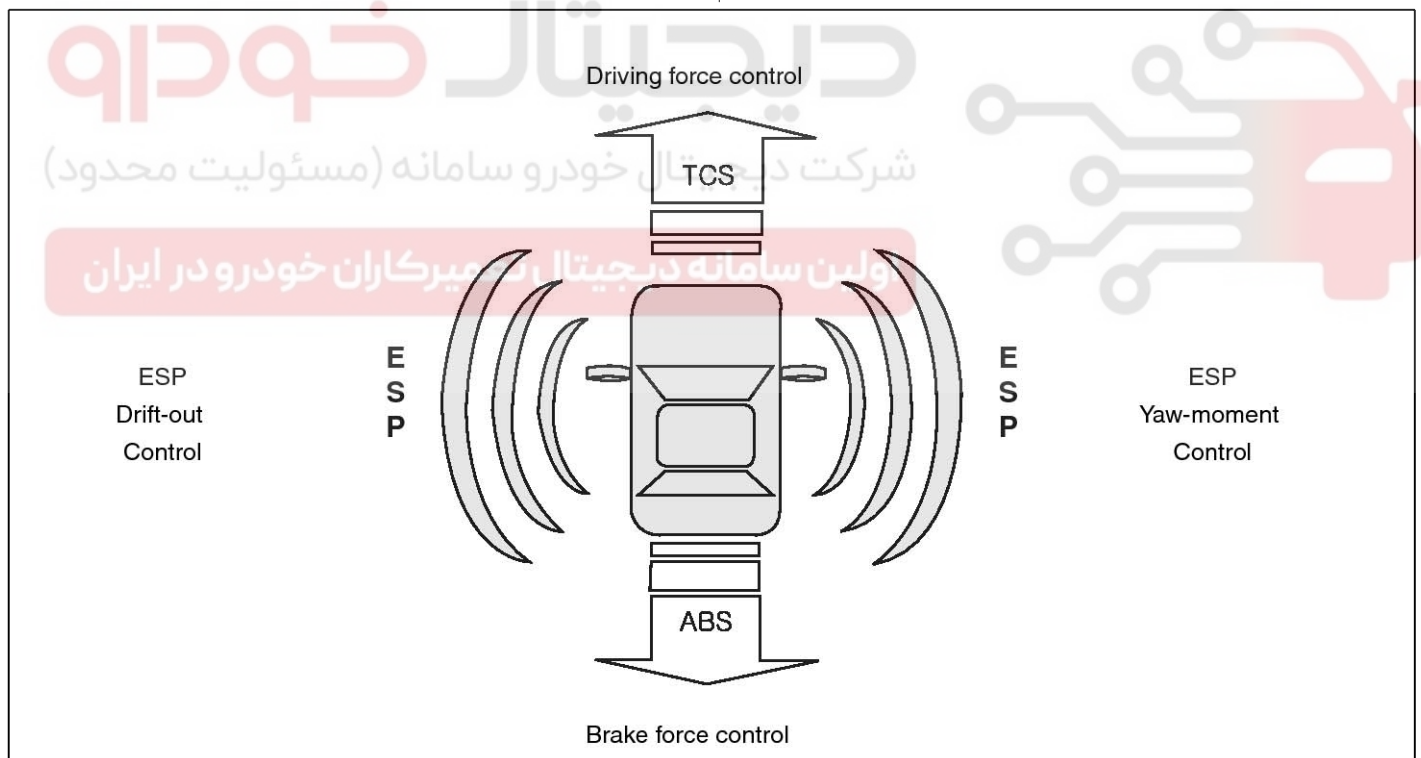
ESP adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESP functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.

This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.

ESP essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.

Of course, the stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESP function in response to a command by the driver.

In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



LJCD201A

# BR-68

# Brake System

## DESCRIPTION OF ESP CONTROL

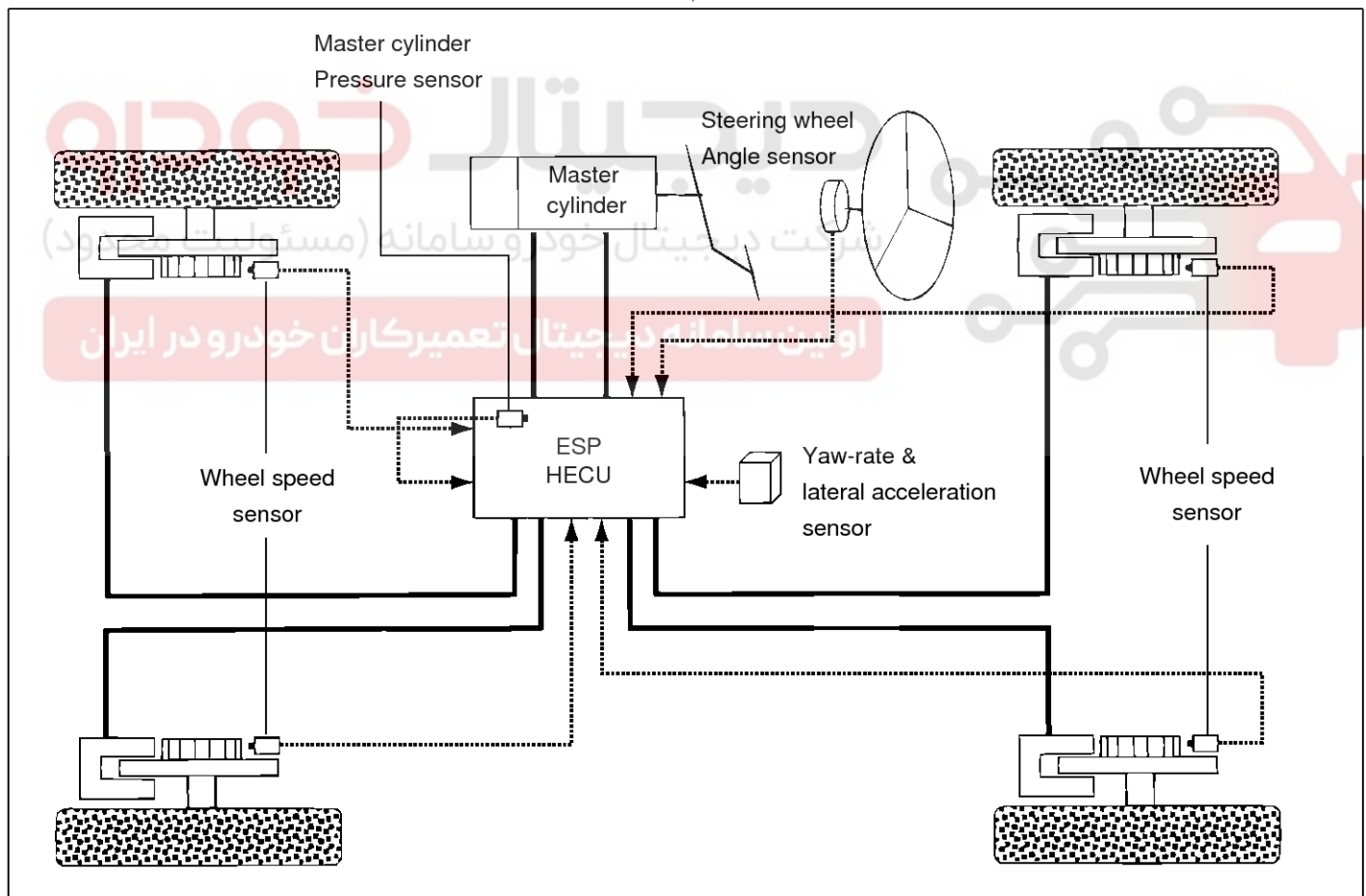
ESP system includes ABS/EBD, TCS and AYC (Active yaw control) function.

ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square waveform.By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels.And, the ECU judges whether the ABS/EBD should be actuated or not.

TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication.TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.

AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.

After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis)If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESP warning lamp. (fail-safe warning)



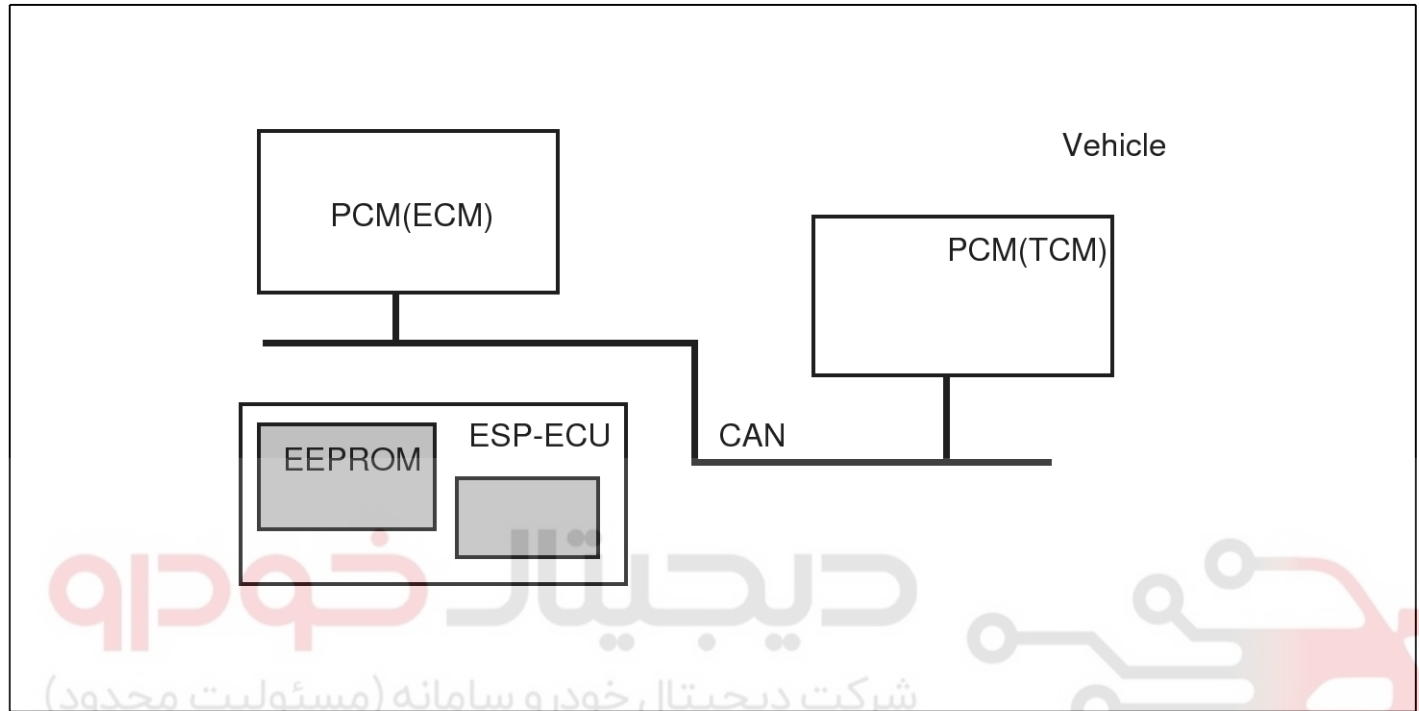
EJRF502K

# ESP(Electronic Stability Program) System

BR-69

## VARIANT CODING

The HECU is programmed with a variant code based on the vehicle powertrain configuration. This variant code is used to determine the appropriate ESP calculations. Variant code programming should be performed whenever an HECU is replaced.



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شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

LJKG500Y

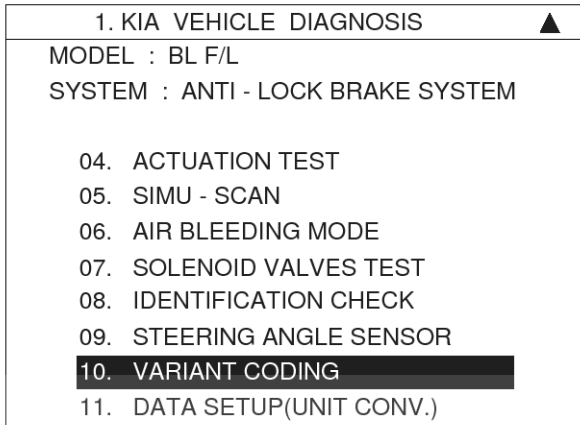
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

# BR-70

# Brake System

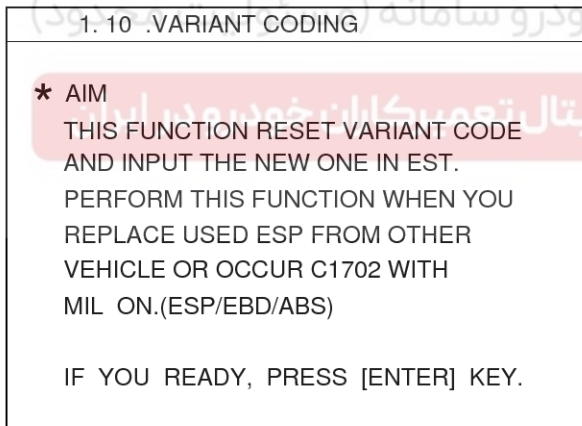
## PROCEDURE OF VARIANT CODING

1. Install a PCM(ECM & TCM)/ESP normally.
2. Connect the scan tool to the data link connector located underneath the dash panel.
3. Select vehicle name.
4. Select ANTI-LOCK BRAKE SYSTEM.
5. Select the variant coding.



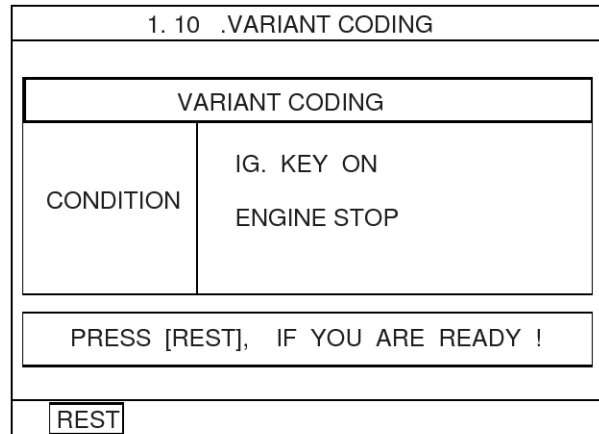
SBLBR6535L

6. Follow the next procedure according to the comment



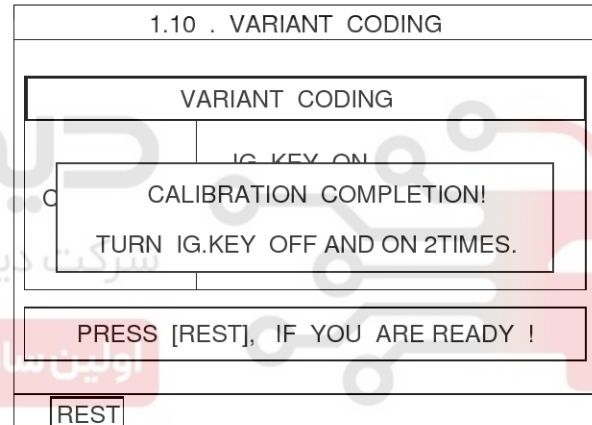
EJBF505O

7. Confirm the condition , and then push the "REST".



EJRF703J

8. If the procedure is finished, the screen is displayed as shown below.



EJRF703K

9. IGN off.
- 10.IGN on.
- 11.The variant coding is completed.

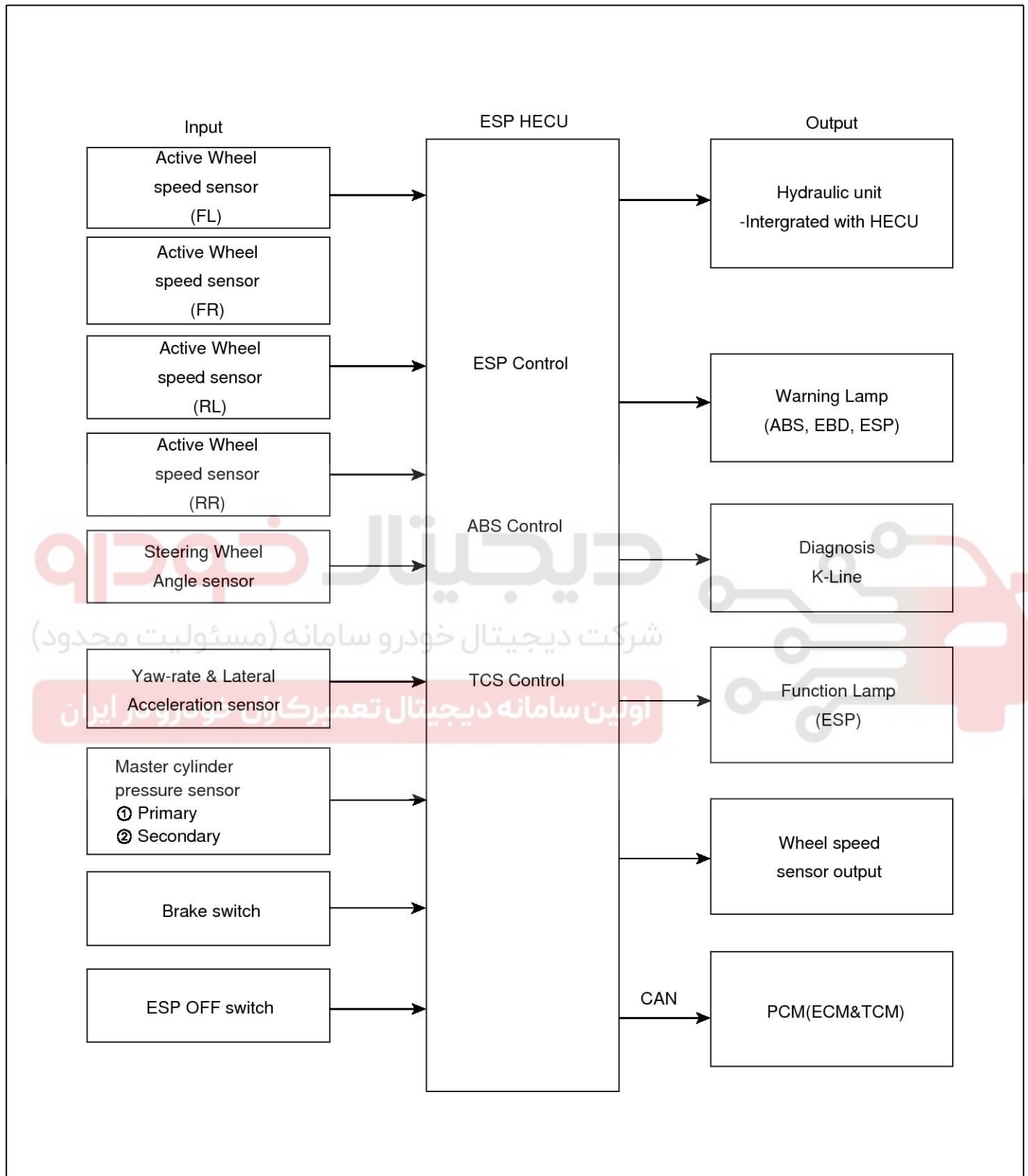
### ⚠CAUTION

- If the warning lamp(ESP, EBD, ABS) is illuminated, follow the "Variant coding" again.
- For the vehicle equipped 4WD, delete the DTC(s) memorized in 4WD ECU when variant coding is completed.

# ESP(Electronic Stability Program) System

BR-71

## INPUT AND OUTPUT DIAGRAM



LJKG500X

## BR-72

## Brake System

## ESP OPERATION MODE

## 1. STEP 1

The ESP analyzes the intention of the driver.

Position of steering wheel  
+ Vehicle speed  
+ Acceleration pedal



ECU decides the intention of the driver.

EJRF502B

## 2. STEP 2

It analyzes the movement of the ESP vehicle.

Vehicle rotation speed  
+ Operated power to the side



ECU decides movement of the ESP vehicle.

EJRF502C

## 3. STEP 3

The HECU calculates the required strategy, then actuates the appropriate valves and sends torque control requests via CAN to maintain vehicle stability.



دیجیتال خودرو  
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

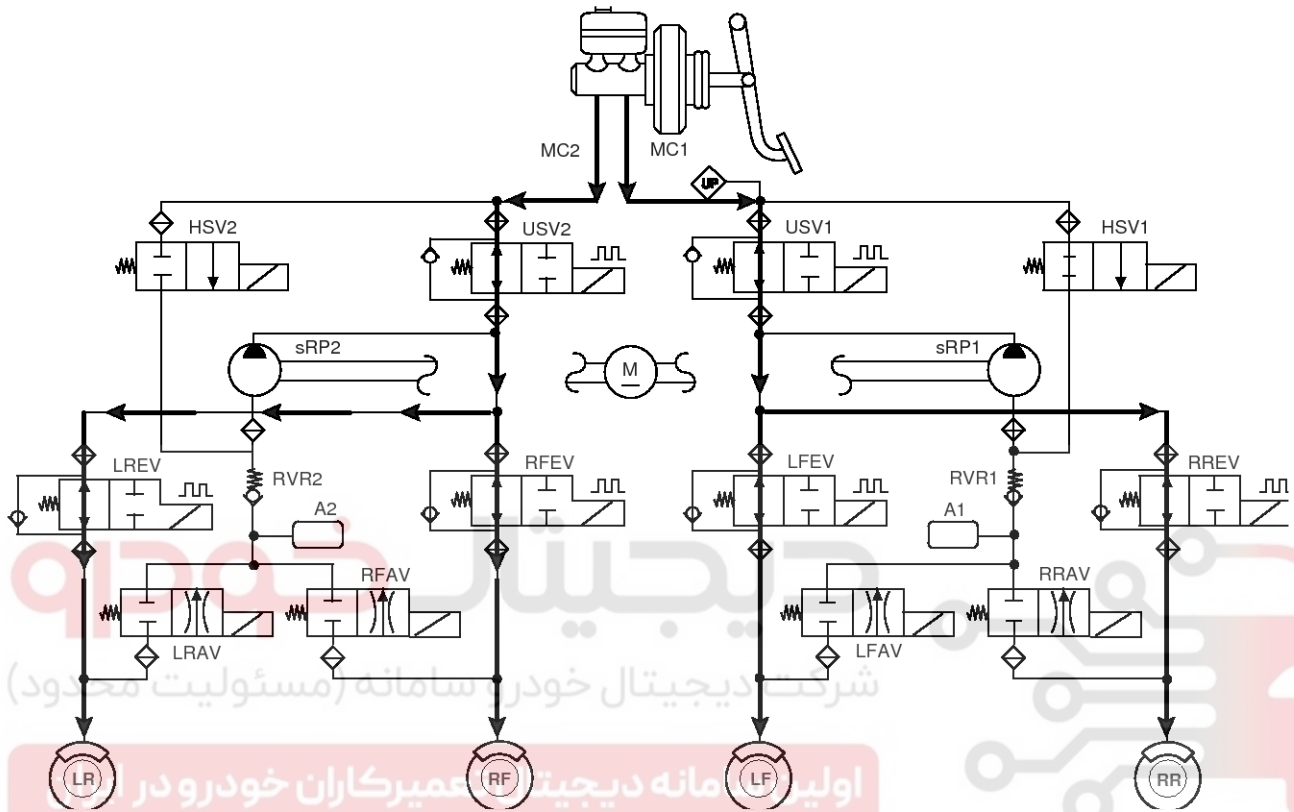
# ESP(Electronic Stability Program) System

# BR-73

## ESP OPERATION MODE

1. ESP Non-operation-Normal braking.

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Open	Close	OFF



EJRF703R

### NOTICE

- EV : Inlet Valve
- AV : Outlet Valve
- LR : Rear left wheel
- RF : Front right wheel
- LF : Front left wheel
- RR : Rear right wheel
- PE : Pump motor
- USV : Pilot Valve
- HSV : High pressure Switch Valve

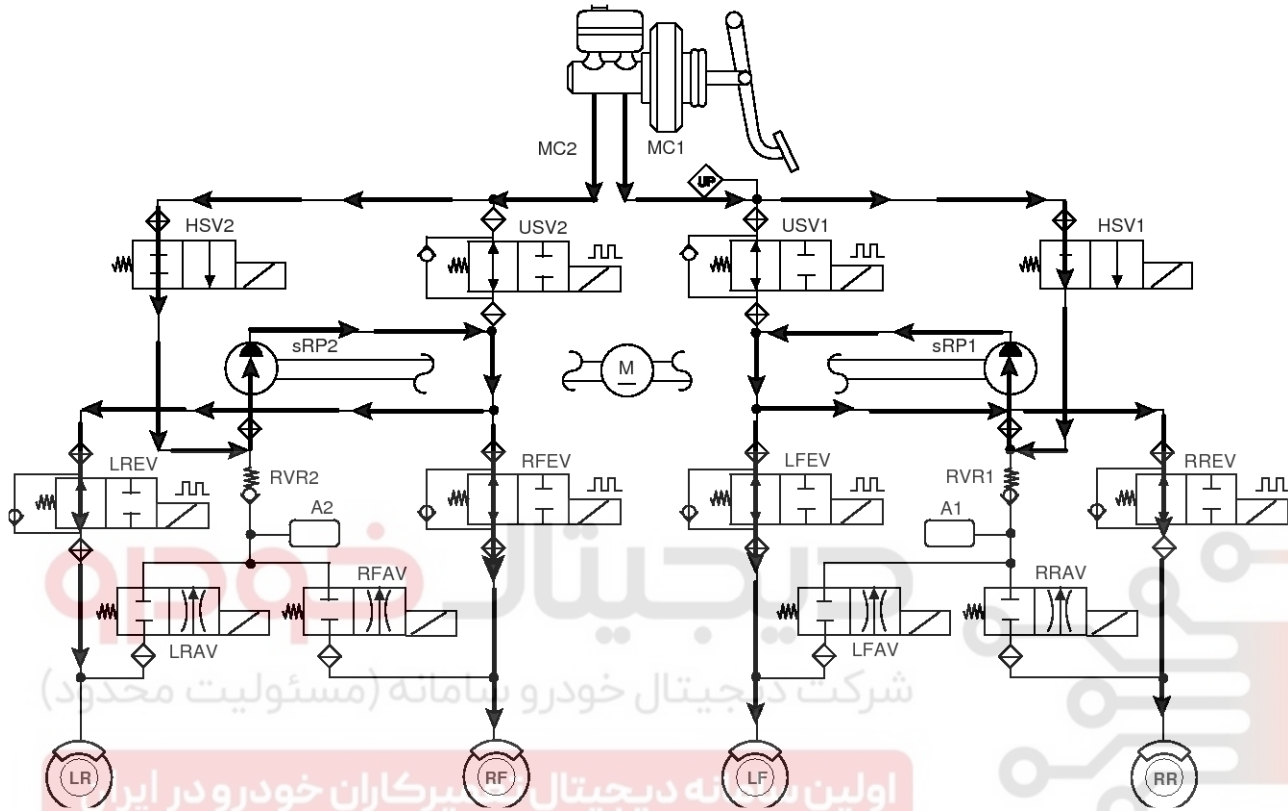


# BR-74

# Brake System

## 2. ESP INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Open	Close	Close(Partial)	Open	ON(Motor speed control)



EJRF703S

### NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

LF : Front left wheel

RR : Rear right wheel

PE : Pump motor

USV : Pilot Valve

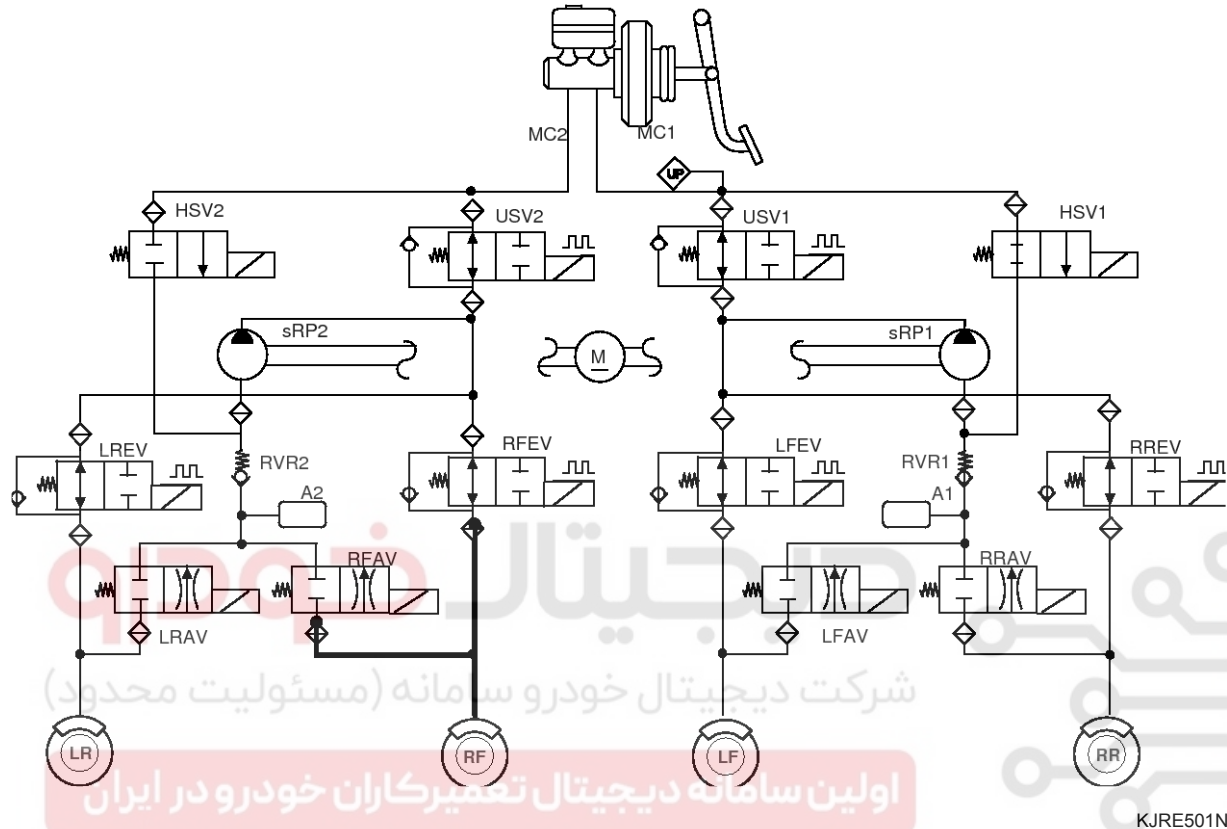
HSV : High pressure Switch Valve

# ESP(Electronic Stability Program) System

# BR-75

### 3. ESP HOLD MODE ( FR is only controlled.)

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Close	Close(Partial)	Open	ON(Motor speed low control)



KJRE501N

#### NOTICE

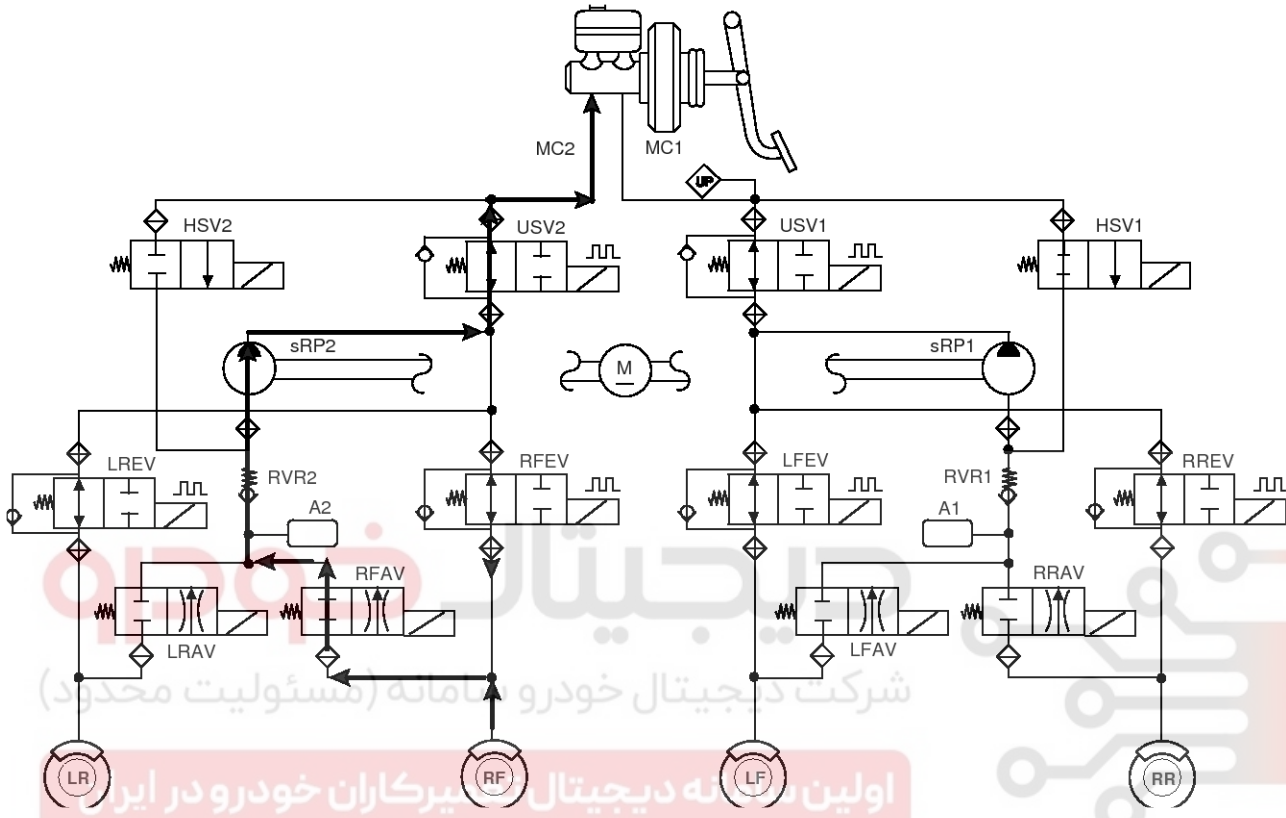
- EV : Inlet Valve
- AV : Outlet Valve
- LR : Rear left wheel
- RF : Front right wheel
- LF : Front left wheel
- RR : Rear right wheel
- PE : Pump motor
- USV : Pilot Valve
- HSV : High pressure Switch Valve

# BR-76

# Brake System

### 4. ESP DECREASE MODE (FR is only controlled)

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Open	Close(Partial)	Open	ON(Motor speed low control)



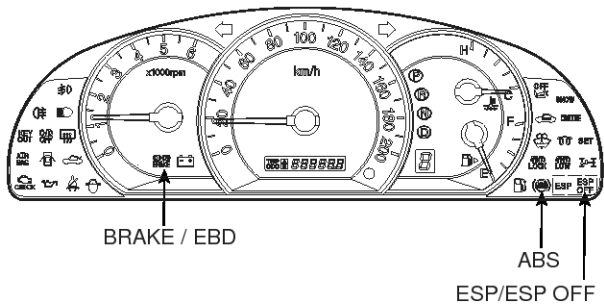
EJRF703T

**NOTICE**

- EV : Inlet Valve
- AV : Outlet Valve
- LR : Rear left wheel
- RF : Front right wheel
- LF : Front left wheel
- RR : Rear right wheel
- PE : Pump motor
- USV : Pilot Valve
- HSV : High pressure Switch Valve

# ESP(Electronic Stability Program) System

BR-77



SBLBR6536L

## ABS Warning Lamp module

The active ABS warning lamp module indicates the self-test and failure status of the ABS. The ABS warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is separated from ECU.

## EBD/PARKING BRAKE WARNING LAMP MODULE

The active EBD warning lamp module indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order.
- During diagnostic mode.
- When the ECU Connector is separated from ECU.

## ESP Warning Lamp (ESP system)

The ESP warning lamp indicates the self-test and failure status of the ESP.

The ESP warning lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESP functions by failure.
- When driver turn off the ESP function by on/off switch.
- During diagnostic mode.

## ESP Function Lamp (ESC system)

The ESP function lamp indicates the self-test and operating status of the ESP.

The ESP Function lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESP control is operating. (Blinking - 2Hz)

## ESP On/Off Switch (ESP system)

The ESP On/Off Switch shall be used to toggle the ESP function between On/Off states based upon driver input.

The On/Off switch shall be a normally open, momentary contact switch.

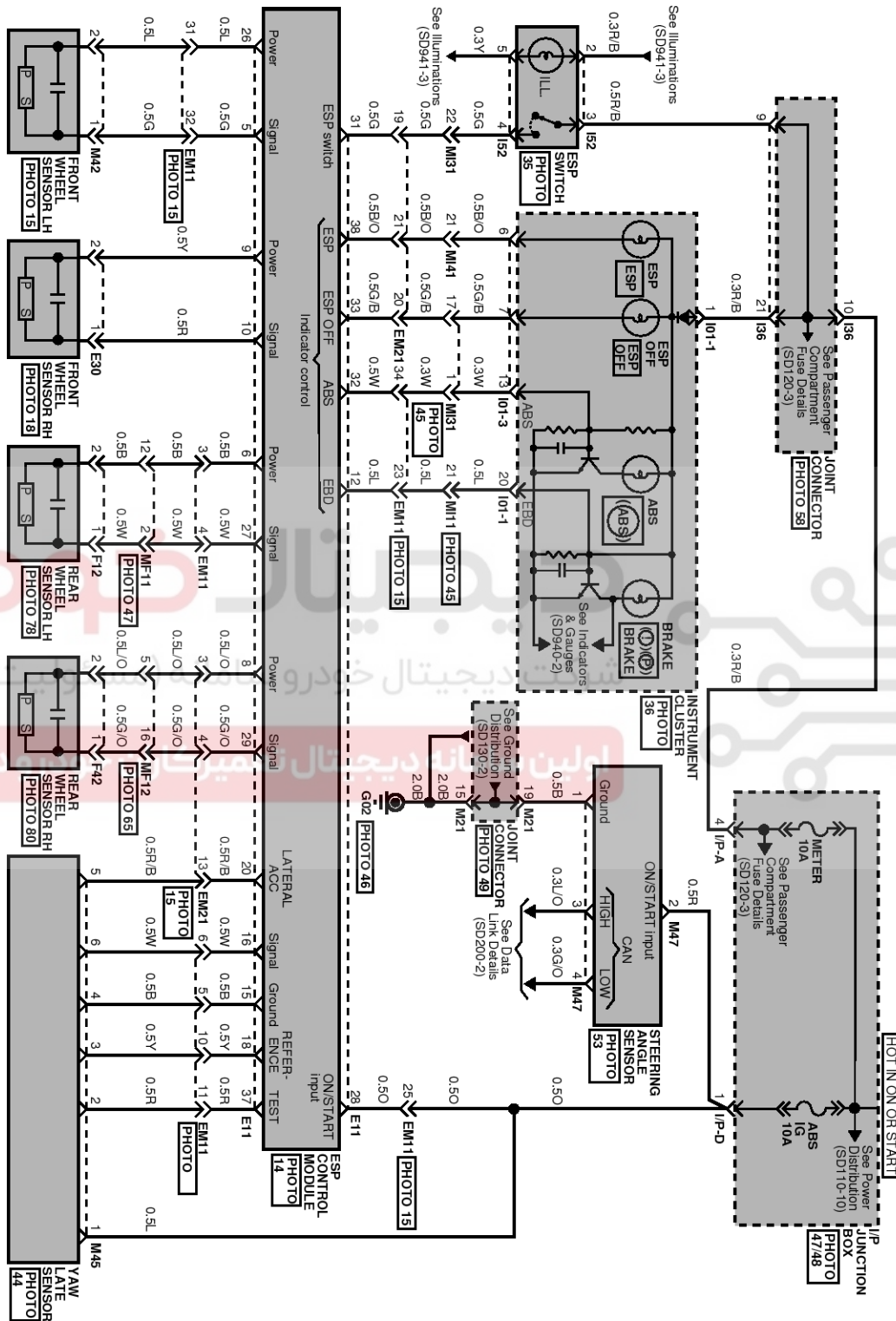
Initial status of the ESP function is on and the switch is used to request an ESC status change.

# BR-78

# Brake System

## Schematic Diagrams

### ESP circuit DIAGRAM(1)

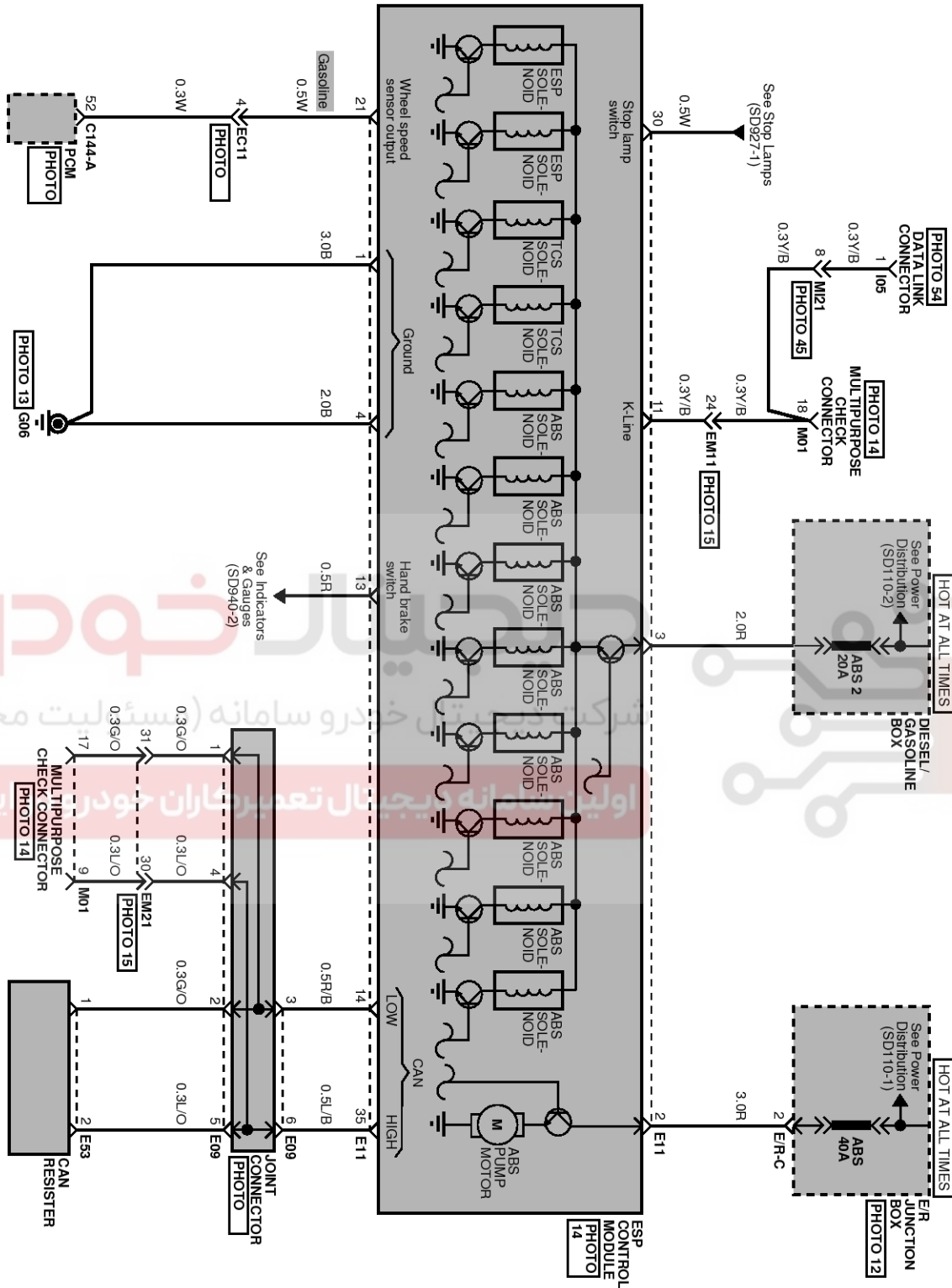


SBLBR6538L

# ESP(Electronic Stability Program) System

# BR-79

### ESP circuit DIAGRAM(2)

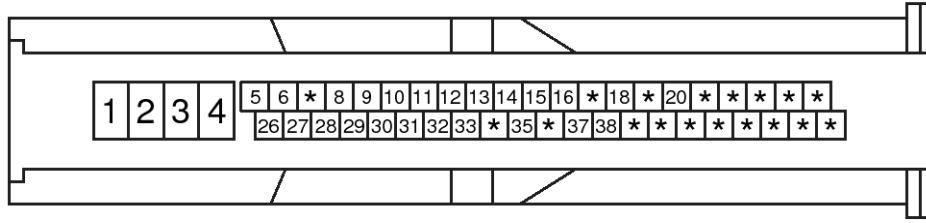


SBLBR6539L

# BR-80

# Brake System

## ESP HECU CONNECTOR INPUT / OUTPUT

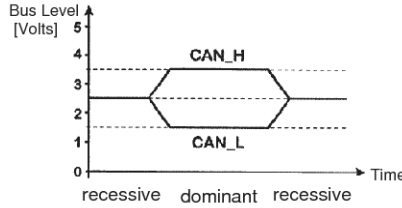


SCMBR6595D

Connector Terminal		Specifications	Conditions
No	Description		
1	Ground(Pump)	Current range : Min-10 A Max-20 ~ 39 A	Always
4	Ground(Valve,ECU)	Current range : Min-2.5 A Max-5 ~ 15 A	Always
2	Supply voltage(Pump)	Battery voltage	Always
3	Supply voltage(Valve)		
26	Wheel sensor voltage(FL)	Battery voltage	IG ON
9	Wheel sensor voltage(FR)		
6	Wheel sensor voltage(RL)		
8	Wheel sensor voltage(RR)		
5	Wheel sensor signal(FL)	Voltage(High) : 0.89~1.26 V Voltage(Low) : 0.44~0.63 V	RUNNING
10	Wheel sensor signal(FR)		
27	Wheel sensor signal(RL)		
29	Wheel sensor signal(RR)		
11	Diagnosis Input/oupput	Voltage(High) : 0.8 * IG ON more Voltage(Low) : 0.2 * IG ON lower	SCAN TOOL Communication
28	Ignition	Battery voltage	KEY ON/OFF
31	ESP Passive switch	Voltage(High) : 0.6 * IG ON more Voltage(Low) : 0.4 * IG ON lower	Switch ON/OFF
37	Yaw Rate Sensor Test	Voltage(High) : 4.1 V more Voltage(Low) : 1 V lower	IG ON
18	Yaw Rate Sensor Reference	2.464 V ~ 2.536 V	IG ON
16	Yaw Rate Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V(-100 ~ 100 °/s)	IG ON
20	Acceleration Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V(-1.8 g ~ 1.8 g)	IG ON
15	Yaw Rate Sensor Ground	GND LEVEL	Always

## ESP(Electronic Stability Program) System

## BR-81

Connector Terminal		Specifications	Conditions
No	Description		
35	CAN High	not communicating: $2.5 \pm 0.5$ V communication : 	IG ON
14	CAN Low		
30	BRAKE LIGHT SWITCH	voltage(High) : $0.8 * IG$ ON more voltage(Low) : $0.3 * IG$ ON lower	BRAKE ON/OFF

# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران





**BR-82****Brake System****Troubleshooting****FAILURE DIAGNOSIS**

1. In principle, ESP and TCS controls are prohibited in case of ABS failure.
2. When ESP or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESP failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESP is not installed.

**MEMORY OF FAIL CODE**

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as long as the HCU power is on. (X)

**FAILURE CHECKUP**

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.
4. Initial checkup is made in the following cases.
  - 1) When no failure is detected
  - 2) When ABS and ESP are not in control.
  - 3) Initial checkup is not made after ECU power on.
  - 4) If the vehicle speed is over 5 mph(8 km/h) when the brake lamp switch is off.
  - 5) When the vehicle speed is over 24.8 mph(40 km/h).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESP control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
  - 1) When the power is normal.
  - 2) From the point in which the vehicle speed reaches 4.9 mph(8 km/h) after HECU power on.

**COUNTERMEASURES IN FAIL**

1. Shut the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Do not perform any ABS/TCS/ESC functions until normal operating condition is restored.

**WARNING LAMP ON**

1. ABS warning lamp turns on when ABS is malfunctioning.
2. ESP operation lamp turns on when ESP is malfunctioning.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.



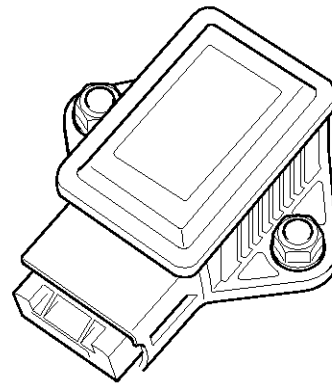
# ESP(Electronic Stability Program) System

BR-83

## Yaw-rate and Lateral G Sensor

### DESCRIPTION

1. The yaw-rate & lateral G sensor is applied for the ESP system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the crash pad lower floor on vehicle.



KJRE504E

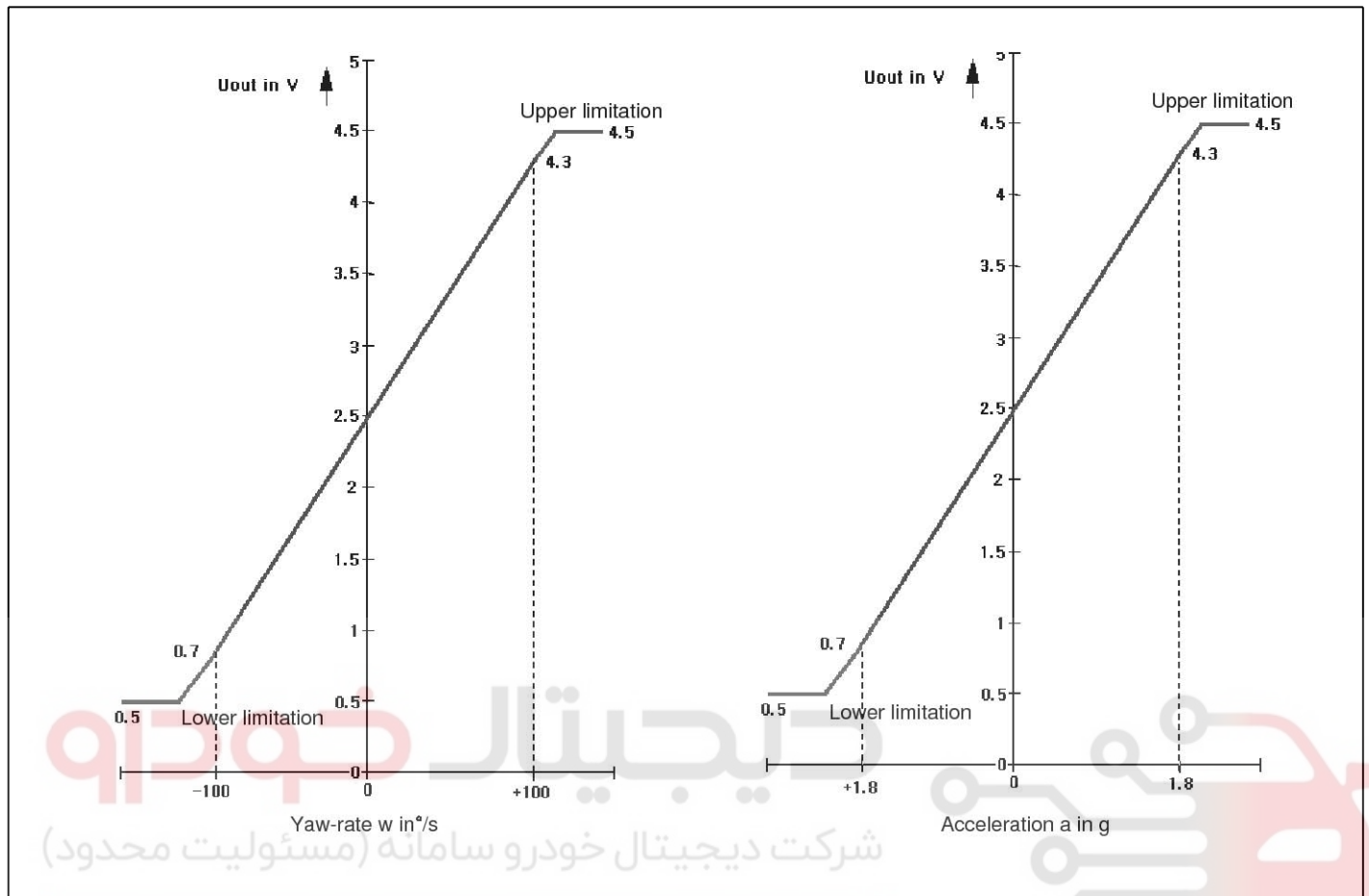
### SPECIFICATION

Description		Specification	Remark
Nominal supply voltage		11.5 ~ 12.5 V	
Supply voltage range		8 ~ 16 V	
Supply current		Max. 120 mA	Typ. 75 mA
Reference Voltage Output		2.464 ~ 2.536 V	Typ. 2.5 V
Operating temperature range		-40 ~ 85 °C	
Yaw-rate sensor	Measurement range	+w direction, left turn	Min. 100 °/s Typ. 111 °/S
		-w direction, right turn	Min. -100 °/s Typ. -111 °/S
	Non-linearity		-1 ~ 1 %
	Offset (within life, within operating temperature)		3.75 °/S
	Upper cut-off frequency		Min. 45 Hz Typ. 60 Hz
Lateral G sensor	Measurement range	+y direction, left turn	Min. 1.8 g Typ. 2 g
		-y direction, right turn	Min. -1.8 g Typ. -2 g
	Non-linearity		-4 ~ 4 %
	Offset (within life, within operating temperature)		-0.09 ~ 0.09 g
	Upper cut-off frequency		Min. 20 Hz Typ. 40 Hz

# BR-84

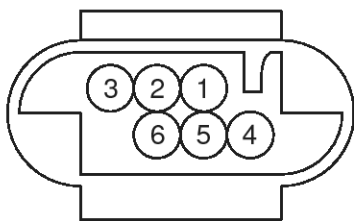
# Brake System

## OUTPUT CHARACTERISTIC

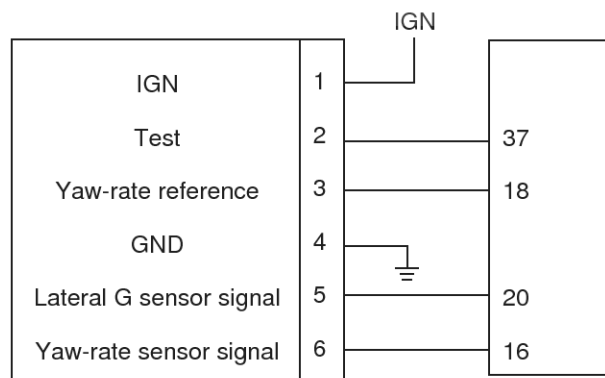


EJRF502E

## CIRCUIT DIAGRAM (YAW-RATE & LATERAL G SENSOR)



[Yaw-rate & lateral G sensor connector]



Yaw-rate & lateral G sensor

ESP HECU

SBLBR6546L

# ESP(Electronic Stability Program) System

BR-85

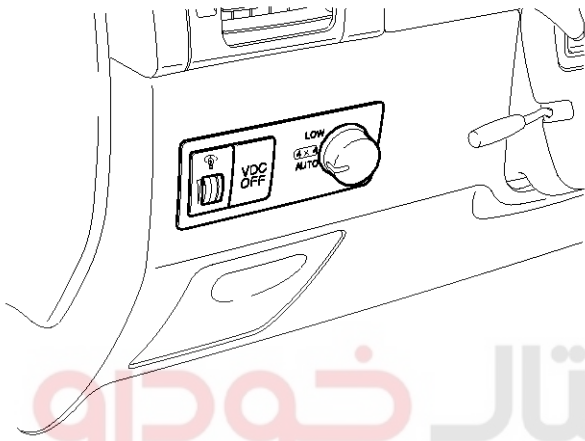
## ESP OFF Switch

### DESCRIPTION

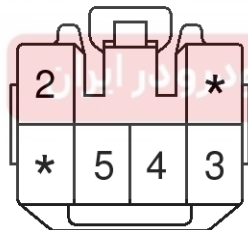
1. The ESP OFF switch is for the user to turn off the ESP system.
2. The ESP OFF lamp is on when ESP OFF switch is engaged.

### INSPECTION

1. Remove the ESP OFF switch from the switch panel on the crach pad of the driver's side.



SBLBR6550D



SBLBR6549D

2. Check the continuity between the switch terminals as the ESP OFF switch is engaged. (Refer to circuit diagram)

# BR-86

# Brake System

## Steering Angle Sensor

### DESCRIPTION

#### GENERAL DATA

The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.

### MEASUREING PRINCIPLE

A non contact, analog angle sensor carrying out absolute measuring by the use of the Anisotropic-Magneto-Resistive effect (AMR). Measuring of the absolute angle by means of a toothed measuring gear with magnetic properties in combination with different ratios. Corresponding AMR elements that change their electrical resistance according to the magnetic field direction detect the angle position of the measuring gears. A micro-controller decodes the measured voltage signals after A/D converting with the help of a mathematical function. Output of the digital angle value and velocity via CAN-interface.

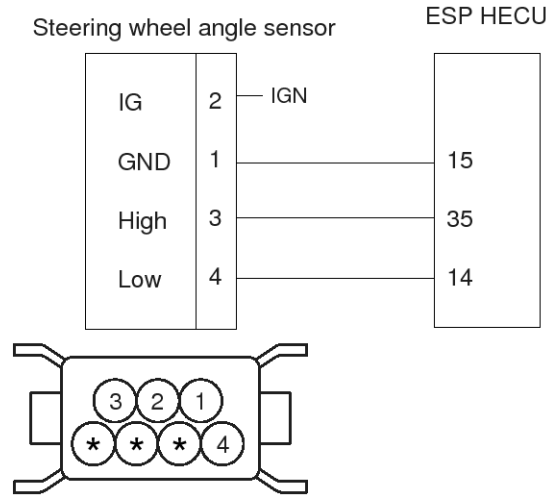
### SPECIFICATION

Description	Specification	
Operating voltage	8~16 V	
Operating temperature	-40 ~ 85 °C	
Current consumption	Max.150 mA	
Steering angle velocity	Max. ±2000 °/sec	
Connection delay time	t < 200 ms	
Reverse voltage	-13.5 V	
Measuring range	Angle	-780 ° ~ 779 °
	Angular velocity	0~ 1016 °/s
Nonlinearity angle	-2.5 ° ~ +2.5 °	
Hysteresis angle	0 ° ~ 5 °	
Rotational friction torque measuring	10 °/s	

# ESP(Electronic Stability Program) System

# BR-87

## CIRCUIT DIAGRAM( STEERING WHEEL SPEED ANGLE SENSOR)



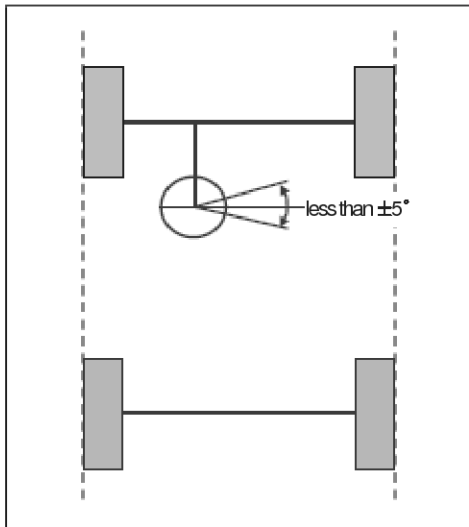
SBLBR6547L

### STEERING ANGLE SENSOR (SAS) calibration

#### 1. PURPOSE OF calibration

- On vehicle control, an ESP analyzes the intention of the driver.
- An ESP recognizes a steering angle which a driver rotates through the steering angle sensor.
- A steering angle sensor used in ESP adjusts 0° setting of steering wheel through K-line or CAN communication.

#### 2. STEERING ANGLE SENSOR (SAS) CALIBRATION METHOD



SBLBR6540L

1) Align the wheel to the straight line. (steering

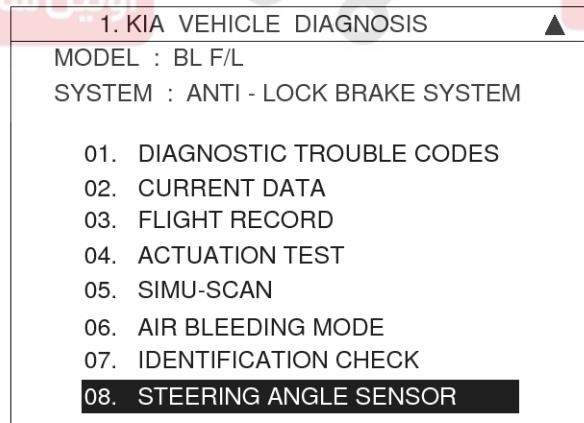
wheel <math>\lt; \pm 5^\circ </math>)

ex) Perform the wheel alignment first.

Align the wheel to the straight line.

A driver moves the vehicle to the front and back about 5 meters twice or three times.

- 2) Connect Scan tool to the vehicle.
- 3) Select Brake system.
- 4) Select Steering angle sensor(SAS) calibration.



SBLBR6541L

# BR-88

# Brake System

5) Perform the Steering angle sensor(SAS) calibration.

1.9 .STEERING ANGLE SENSOR	
<p>★ AIM THIS FUNCTION RESET THE SAS VALVE TO ZERO-SET. PERFORM THIS FUNCTION WHEN YOU REPLACE SENSOR OR STEERING COLUMN.</p> <p>IF YOU READY, PRESS [ENTER] KEY.</p>	

EJRF703M

6) Perform the procedure continuously.

1.9 STEERING ANGLE SENSOR	
STEERING ANGLE SENSOR	
CONDITION	STRAIGHTEN THE FRONT TIRE, AND ARRANGE THE STEERING WHEEL AT THE CENTER POSITION. IG.KEY ON, ENGINE STOP
PRESS [REST], IF YOU ARE READY!	
[REST]	

EJRF703N

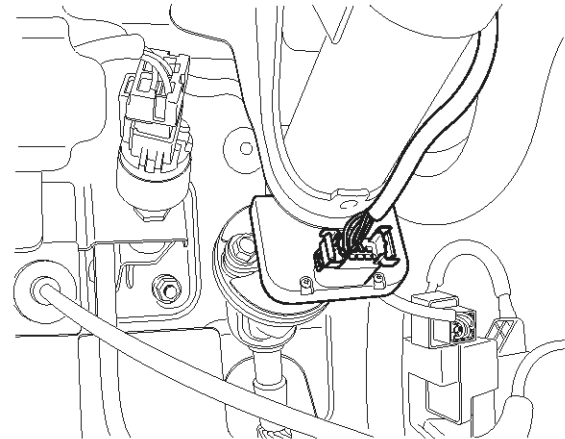
7) The procedure is finished. Push the "ESC" key.

1.9 STEERING ANGLE SENSOR	
STEERING ANGLE SENSOR	
STRAIGHTEN THE FRONT TIRE.	
CALIBRATION COMPLETION! PRESS [ESC] KEY.	
IG.KEY ON, ENGINE STOP	
PRESS [REST], IF YOU ARE READY!	
[REST]	

EJRF703O

- 8) Scanner OFF.
- 9) Remove the scanner from the vehicle.
- 10) Confirm the Steering angle sensor(SAS) calibration as driving the vehicle.(turn left once, turn right once)

### COMPONENT LOCATION



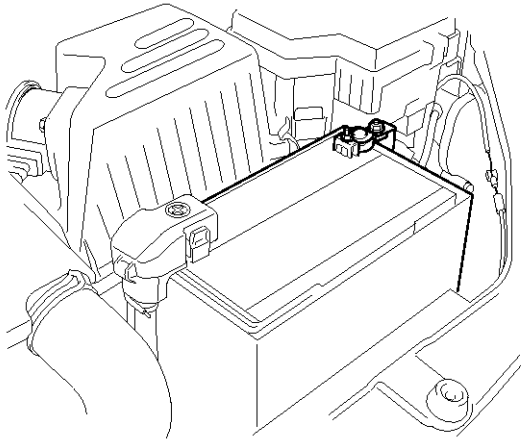
SBLBR6005D

# ESP(Electronic Stability Program) System

BR-89

C1101

## COMPONENT LOCATION



SCMBR6544D

### General Description

The ABS ECU(Electronic Control Unit) checks the battery voltage to and alternator output voltage determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

### DTC Description

The ABS ECU monitors battery voltage and alternator output voltage by reading the value of voltage. When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/ESP functions are prohibited. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operation as well.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Battery Voltage Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Poor connection in power supply circuit (IGN+)</li> <li>Inoperative Alternator</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (Over voltage faults will be always stored.)</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>When Vign is higher than 16.8 V.</li> <li>- If the voltage is recovered to 16.7 V, the controller returns to normal state.</li> <li>- The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>The ABS/EBD/ESP functions are inhibited.</li> <li>- The proper function of valves and return pump is not guaranteed.</li> <li>The ABS/EBD/ESP warning lamps are activated.</li> </ul>	



# BR-90

# Brake System

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".

1.2 CURRENT DATA	
ENGINE SPEED	1102 rpm
VEHICLE SPEED SENSOR	0.0 MPH
ABSOLUTE THROTTLE POS.	0.0 %
TRANSAXLE RANGE SW	P, N
BATTERY VOLTAGE	14.2 V
WHEEL SPD SNSOR-FL	0.0 MPH
WHEEL SPD SNSOR-FR	0.0 MPH
WHEEL SPD SNSOR-RL	0.0 MPH

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal Data

3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.

Specification : Approx. Below. 16.7 V

4. Is parameter displayed within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in power harness (IGN+) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal & Connector Inspection

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

SCMBR6532L

3. Has a problem been found?

**YES**

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

**NO**

▶ Confirm the DTC status at another system to be able to confirm C1101 or DTC code related to over voltage.

▶ If there isn't C1101 code at another system, Go to "Power Circuit Inspection" procedure.

▶ If there is C1101 or DTC code related to over voltage at another system, Go to "Alternator Output Voltage Inspection" procedure.

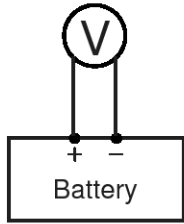
## Alternator Output Voltage Inspection

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and the battery terminal(-) with maintaining ENG RPM 2,500RPM (idle).over 2 minutes.

Specification : Below. 16.7 V

# ESP(Electronic Stability Program) System

# BR-91



1. Battery Terminal(+)
2. Battery Terminal(-)

SCMBR6533L

3. Is the measured voltage within specifications?

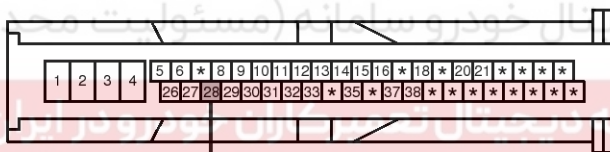
**YES**

▶ Go to "Power Circuit Inspection" procedure.

**NO**

▶ Check that the tension of driving belt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and check for damaged harness and poor connection between alternator and battery. If OK repair or replace alternator and then go to "Verification Of Vehicle Repair" procedure.

<ESP HECU>



## Power Supply Circuit Inspection

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and terminal "28(ESP), 18(ABS)" of the HECU harness connector.

Specification : Approx. below 0.2 V



SBLBR6505L

3. Is the measured voltage within specifications?

**YES**

▶ Go to "Ground Circuit Inspection" procedure.

**NO**

▶ Check for damaged harness and poor connection between the battery terminal(+) and terminal "28(ESP), 18(ABS)" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Ground Circuit Inspection

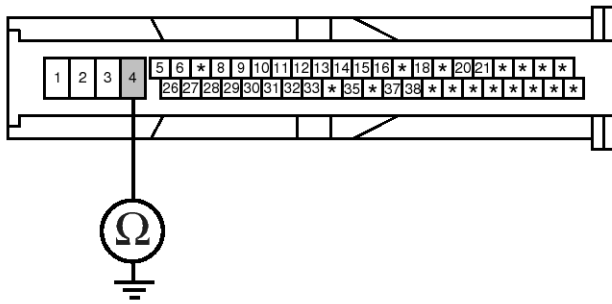
1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω

# BR-92

# Brake System

<ESP HECU>



<ABS, ESP>  
4. Ground

SBLBR6506L

4. Is the measured resistance within specifications?

**YES**

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

**NO**

▶ Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

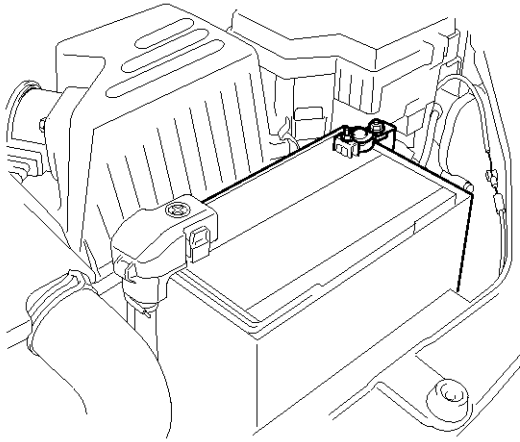
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

# ESP(Electronic Stability Program) System

**BR-93****C1102****COMPONENT LOCATION**

SCMBR6544D

**General Description**

The ABS ECU(Electronic Control Unit) checks the battery voltage to and alternator output voltage determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as intended.

**DTC Description**

The ABS ECU monitors the battery voltage and alternator output voltage by reading the value of voltage. When the voltage is lower than the expected normal value, this code is set. The ABS/ESP functions are prohibited and the EBD function is allowed on LOW VOLTAGE CONDITION, the ABS/EBD/ESP functions are prohibited on UNDER VOLTAGE CONDITION. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operations as well.

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## BR-94

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Battery Voltage Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Poor connection in power supply circuit (IGN+)</li> <li>Inoperative Alternator</li> </ul>
Monitoring Period		<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Case1 (Low voltage)	Enable Conditions	<ul style="list-style-type: none"> <li>When Vign is lower than 9.3 V outside ABS/ESP control.</li> <li>When Vign is lower than 9.2V inside ABS/ESP control.</li> <li>- If IGN voltage is recovered to 9.6 V, the system recovers to normal state.</li> <li>- The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.</li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>The ABS/ESP functions are inhibited.</li> <li>The ABS/ESP warning lamps are activated.</li> </ul>	
Case2 (Under voltage)	Enable Conditions	<ul style="list-style-type: none"> <li>When Vign is lower than 7.7V.</li> <li>-If IGN voltage is recovered to 7.8V, the system recovers to normal state.</li> <li>- The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.</li> <li>Under voltage faults are only entered in the EEPROM if the vehicle speed is &gt; 6km/h.</li> <li>If FSA test detect under voltage. this will ve entered, because no vehicle speed is available during test.</li> <li>※ FSA test : fail save circuit test</li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>The ABS/EBD/ESP functions are inhibited.</li> <li>The ABS/EBD/ESP warning lamps are activated.</li> </ul>	

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# ESP(Electronic Stability Program) System

# BR-95

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".

1.2 CURRENT DATA	
ENGINE SPEED	1102 rpm
VEHICLE SPEED SENSOR	0.0 Km/h
ABSOLUTE THROTTLE POS.	0.0 %
TRANSAXLE RANGE SW	P, N
BATTERY VOLTAGE	14.2 V
WHEEL SPD SNSOR-FL	0.0 Km/h
WHEEL SPD SNSOR-FR	0.0 Km/h
WHEEL SPD SNSOR-RL	0.0 Km/h

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON". Normal Data

3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.

Specification : Above. 9.6 V

4. Is parameter displayed within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in power harness (IGN+) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure

**NO**

▶ Go to "W/Harness Inspection" procedure.

SCMBR6536L

## Terminal & Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Alternator Output Voltage" procedure.

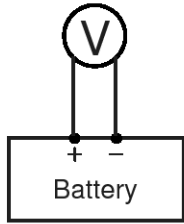
## Alternator Output Voltage Inspection

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and the battery terminal(-) with maintaining ENG RPM 2,500RPM (idle) over 2 minutes.

Specification : Above. 9.6 V

# BR-96

# Brake System



1. Battery Terminal(+)
2. Battery Terminal(-)

SCMBR6533L

3. Is the measured voltage within specifications?

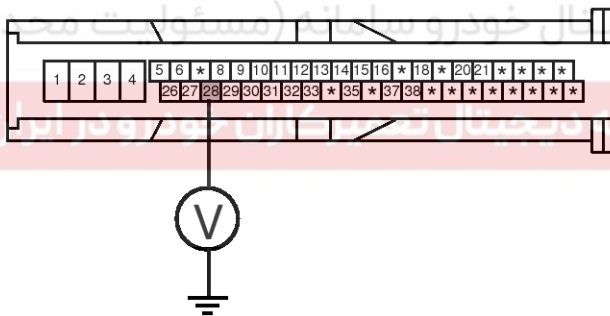
**YES**

▶ Go to "Power Circuit Inspection" procedure.

**NO**

▶ Check that the tension of driving belt, ENG RPM, fuse, terminal of battery, all terminals of alternator are in good condition and check for damaged harness and poor connection between alternator and battery. If OK repair or replace alternator and then go to "Verification Of Vehicle Repair" procedure.

<ESP HECU>



## Power Circuit Inspection

1. Ignition "OFF"
2. Disconnect HECU connector.
3. Ignition "ON" & Engine "OFF".
4. Measure voltage between terminal "28(ESP), 18(ABS)" of the HECU harness connector and chassis ground.

Specification : Approx. B+



<ABS>  
18. IGNITION(+)

<ESP>  
28. IGNITION(+)

SBLBR6507L

5. Is the measured voltage within specifications?

**YES**

▶ Go to "Ground Circuit Inspection" procedure.

**NO**

▶ Check for damaged harness and poor connection between the battery terminal(+) and terminal "28(ESP), 18(ABS)" of the HECU harness connector. Check for open or blown 10A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Ground Circuit Inspection

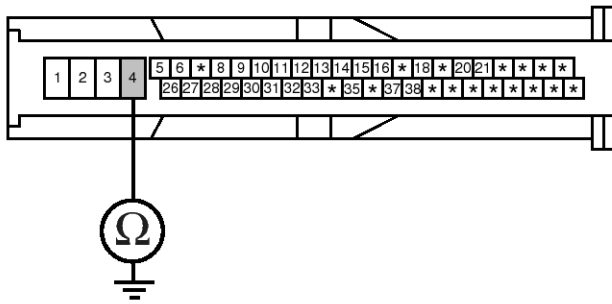
1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω

# ESP(Electronic Stability Program) System

# BR-97

<ESP HECU>



<ABS, ESP>  
4. Ground

SBLBR6506L

4. Is the measured resistance within specifications?

**YES**

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

**NO**

▶ Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

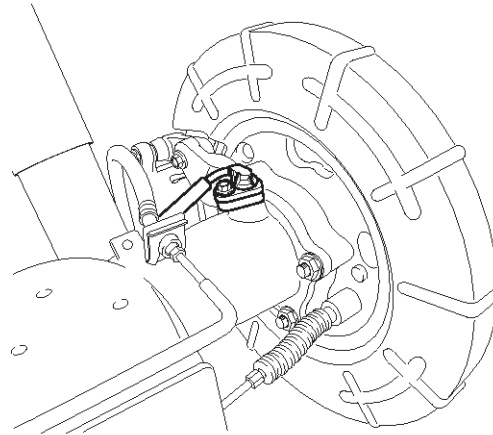
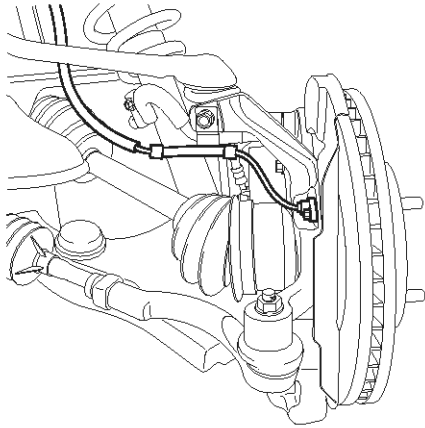
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.



**BR-98****Brake System****C1200****COMPONENT LOCATION**

SBLBR6516D

**General Description**

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

**DTC Description**

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

# ESP(Electronic Stability Program) System

BR-99

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized.</li> <li>In case of a WSS power line short to V_batt, this FSA test will detect an under voltage failure. (ABS only)</li> <li>※ FSA test : fail save circuit test</li> <li>※ UZ : Ignition Voltage</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>When the sensor current levels are out of permissible range( LOW : 7 mA, HIGH : 14 mA) for 200 ms.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Open or short of Wheel speed sensor circuit</li> <li>Inoperative Wheel speed sensor</li> <li>Inoperative HECU</li> </ul>

# BR-100

# Brake System

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6 mph)

4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	▲
* WHEEL SPD SNSOR-FL	10.0 Km/h	■
* WHEEL SPD SNSOR-FR	10.0 Km/h	
* WHEEL SPD SNSOR-RL	10.0 Km/h	
* WHEEL SPD SNSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig1

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	▲
* WHEEL SPD SNSOR-FL	0.0 Km/h	■
* WHEEL SPD SNSOR-FR	10.0 Km/h	
* WHEEL SPD SNSOR-RL	10.0 Km/h	
* WHEEL SPD SNSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 10km/h or more. (6mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 10km/h or more. (6mph or more) Abnormal Data (Open)

5. Is parameter displayed within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal & Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Power Circuit Inspection" procedure.

SCMBR6538L

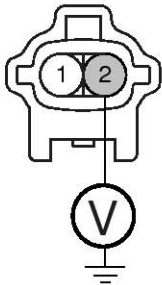
# ESP(Electronic Stability Program) System BR-101

## Power Supply Circuit Inspection

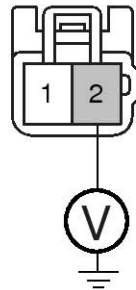
1. Ignition "ON".

2. Measure voltage between terminal (FL, FR : 2, RL, RR : 2) of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



1. Wheel speed sensor(-)  
2. Wheel speed sensor(+)



1. Wheel speed sensor(-)  
2. Wheel speed sensor(+)

SBLBR6543L

3. Is the measured voltage within specifications?

**YES**

▶ Go to "Signal Circuit Inspection" procedure.

**NO**

▶ Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 2, RL, RR : 2" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

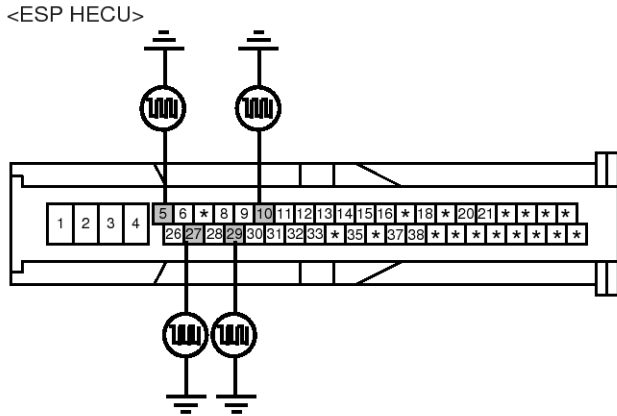
DTC	LOCATION	HECU harness connector (Power supply)	
		ABS	ESP
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

# BR-102

# Brake System

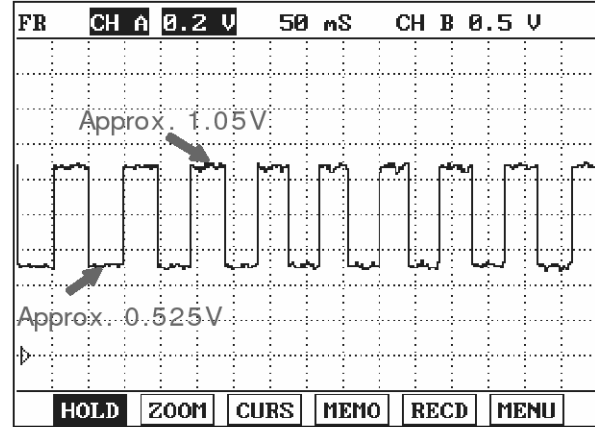
## Signal Circuit Inspection

1. Lift the vehicle.
2. Ignition "ON".



3. Turn the wheel with hand.
4. Measure waveform between terminal of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



SBLBR6508L

DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESP
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

5. Is the measured waveform within specifications?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Go to "Component Inspection" procedure.

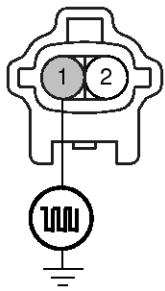
## Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

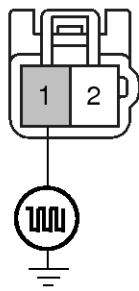
Specification : Approx. High : 1.05 V , Low : 0.525 V

# ESP(Electronic Stability Program) System

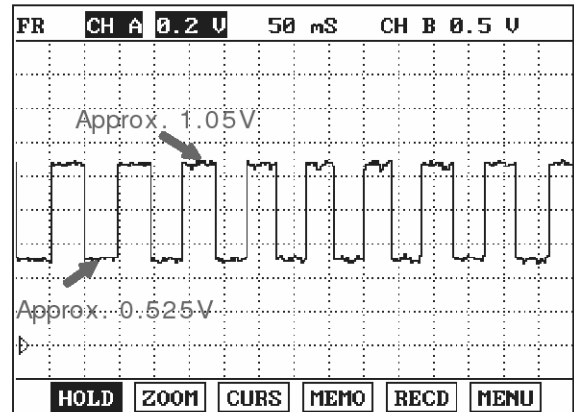
# BR-103



- 1. Wheel speed sensor (FL-, FR-)
- 2. Wheel speed sensor (FL+, FR+)



- 1. Wheel speed sensor (RL-, RR-)
- 2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

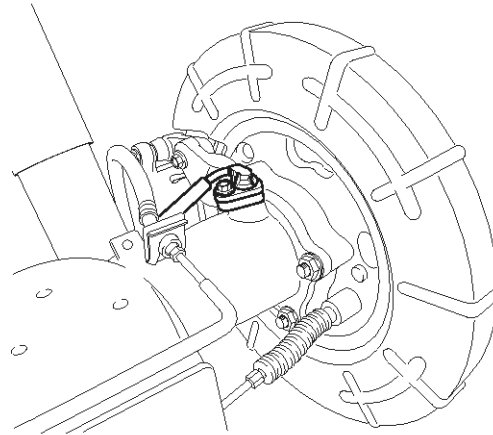
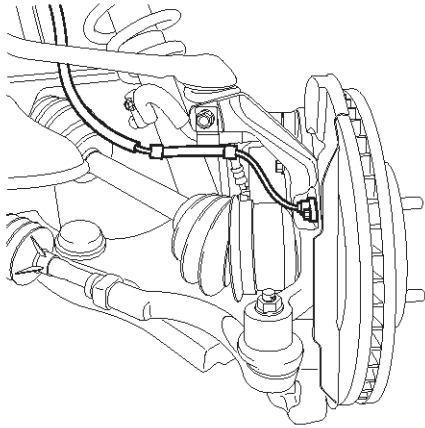
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.

**BR-104****Brake System****C1201****COMPONENT LOCATION**

SBLBR6516D

**General Description**

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

**DTC Description**

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

# ESP(Electronic Stability Program) System

BR-105

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>The monitoring is active from 10 km/h to 80 km/h and if no ABS-control is active at a front wheel and a rear wheel.</li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of wheel speed sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Inoperative Wheel speed sensor</li> <li>External noise</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>If following interference and signal disturbance is detected, a failure is set after 10 s.               <ul style="list-style-type: none"> <li>non-plausible high frequency received.</li> <li>non-plausible high wheel acceleration.</li> <li>non-plausible high wheel jurk.</li> <li>non-plausible delta T and edges at low speed.</li> </ul> </li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	



# BR-106

# Brake System

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h(7 mph)

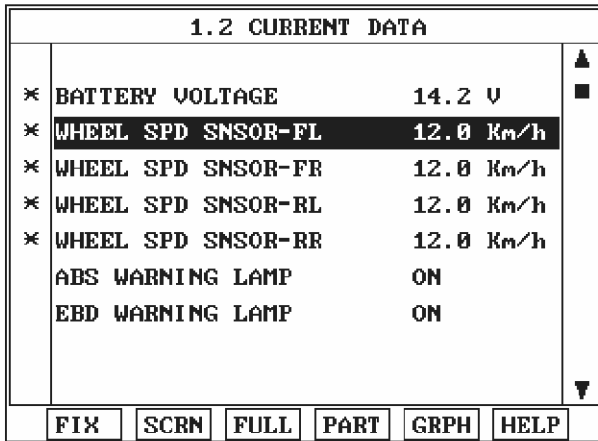


Fig1

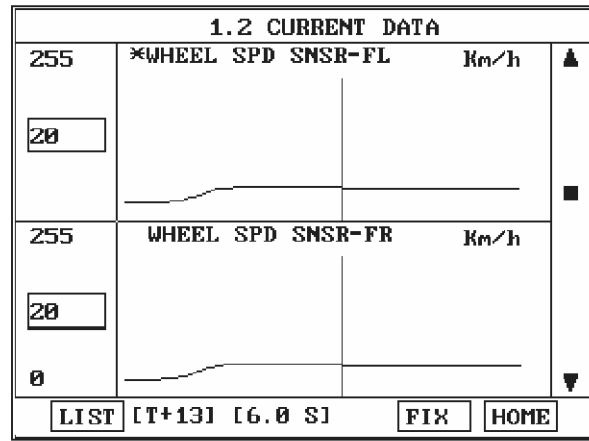


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 12 km/h or more. (7 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 20 km/h or more. (12 mph or more) Normal Graph

5. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" Procedure.

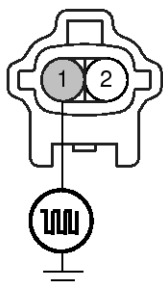
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition

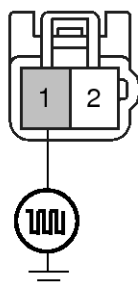
## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

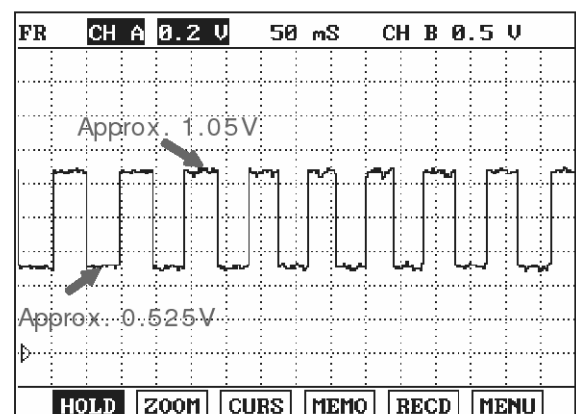
Specification : High : 1.05 V , Low : 0.525 V



1. Wheel speed sensor (FL-, FR-)
2. Wheel speed sensor (FL+, FR+)



1. Wheel speed sensor (RL-, RR-)
2. Wheel speed sensor (RL+, RR+)



# ESP(Electronic Stability Program) System

# BR-107

SBLBR6509L

5. Is the measured waveform within specifications?

## YES

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## NO

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h (7 mph))
4. Are any DTCs present ?

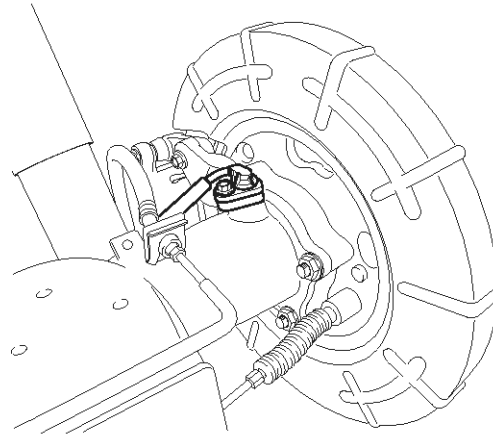
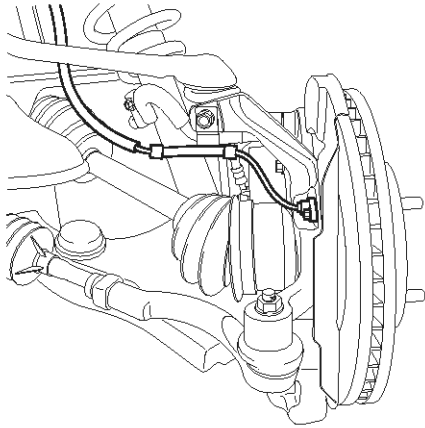
## YES

▶ Go to the applicable troubleshooting procedure.

## NO

▶ System performing to specification at this time.



**BR-108****Brake System****C1202****COMPONENT LOCATION**

SBLBR6516D

**General Description**

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

**DTC Description**

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h while the vehicle speed is at 12 km/h. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

# ESP(Electronic Stability Program) System

## BR-109

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of wheel speed sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Inoperative Wheel speed sensor</li> </ul>
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only no under voltage is not detected)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If one (or two) wheel are at 2.75 km/h and the other wheels are above 12 km/h for longer than 1s.</li> <li>During driving, when the vehicle accelerates 18 km/h after a particular wheel speed gets to 2.75 km/h and stays there. At that time, If one (or two) wheel are at 2.75 km/h.               <ul style="list-style-type: none"> <li>This monitoring is performed at the following condition.                   <ol style="list-style-type: none"> <li>At the time the vehicle is accelerated to 12 km/h</li> <li>Once after energizing the system.</li> <li>If the vehicle was stationary for approx. 2s.</li> </ol> </li> </ul> </li> <li>If one (or two) wheels are under 5 km/h and the two fastest wheels have a velocity above 12 km/h for more than 20s.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous ( If vehicle speed &gt; 12 m/s)</li> <li>- but this monitoring is disabled in the following event               <ol style="list-style-type: none"> <li>Aquaplaning.</li> <li>Interference.</li> <li>Supply voltage below 7.6 or above 18 Volts</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>No wheel speed signals within 10 ms to 20 ms at a vehicle speed &gt; 12 m/s (43.2 km/h ).</li> <li>- If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</li> <li>- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.</li> </ul>	

## BR-110

## Brake System

Case3 - ABS Only	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Vehicle &lt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; 1.7m/s (6km/h).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; 1.7m/s + 1.1m/s.</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; 1.7m/s + 2.2m/s.</li> <li>※ If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted.</li> </ul> </li> <li>• Vehicle &gt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; (6% × Vref).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; (6% × Vref + 1.1m/s).</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; (6% × Vref + 2.2m/s).</li> <li>※ V_ref : Vehicle Reference Speed</li> </ul> </li> <li>• Detection filter time <ul style="list-style-type: none"> <li>- Response and detection filter time depend on the amount of the speed difference and additional conditions as shown below.</li> <li>1. 18s - if fault threshold is exceeding &gt; 1.7m/s resp.6%</li> <li>2. 9s - if fault threshold is exceeding &gt; 3.3m/s resp. 12%</li> <li>3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s.</li> <li>4. If spinning wheel is detected the fault detection filter time is not shorter than 72s.</li> </ul> </li> <li>• Fault allocation <ul style="list-style-type: none"> <li>If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s.</li> <li>Otherwise a general WSS_Generic faulty (C1213) is set.</li> </ul> </li> </ul>	

## ESP(Electronic Stability Program) System

## BR-111

Case4 - ESP Only	Monitoring Period	<ul style="list-style-type: none"> <li>• Main Monitoring <ul style="list-style-type: none"> <li>- The main monitor needs additional information of the ESP-sensors and is active for a velocity &gt; 20 km/h and no under voltage is detected.</li> </ul> </li> <li>• Backup Monitoring <ul style="list-style-type: none"> <li>- Continuous</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Main Monitoring <ol style="list-style-type: none"> <li>1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%.</li> <li>2. Detection filter time : <ul style="list-style-type: none"> <li>- the above conditions apply for 20s for 1 defective wheel speed sensor.</li> <li>- the above conditions apply for 40s for 2 defective wheel speed sensor.</li> </ul> </li> </ol> <p>If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set.</p> </li> <li>• Backup Monitoring <ol style="list-style-type: none"> <li>1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h.</li> <li>2. When the velocity is below 50 km/h, if the deviation exceeds an absolute value of 3km/h.</li> <li>3. Detection filter time : normally 20s <ul style="list-style-type: none"> <li>- In case of a detected curve, the threshold is increased with an additional value of 4 km/h.</li> </ul> </li> </ol> </li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>

# BR-112

# Brake System

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h(31 mph)

4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

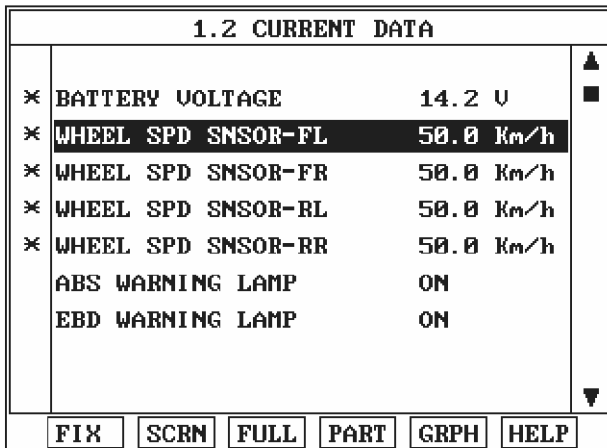


Fig1

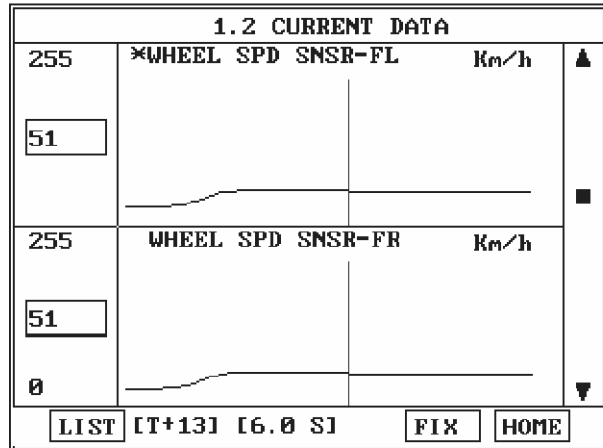


Fig2

SCMBR6543L

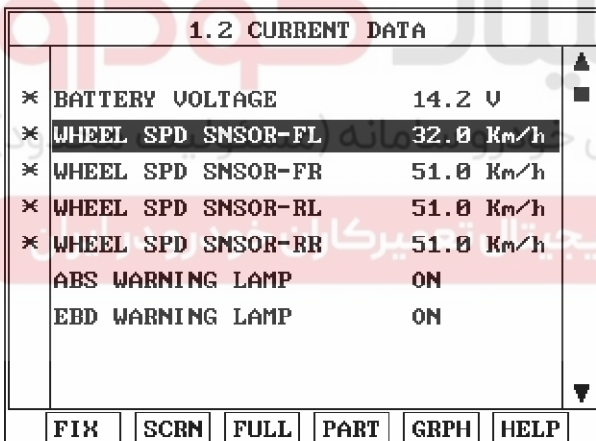


Fig3

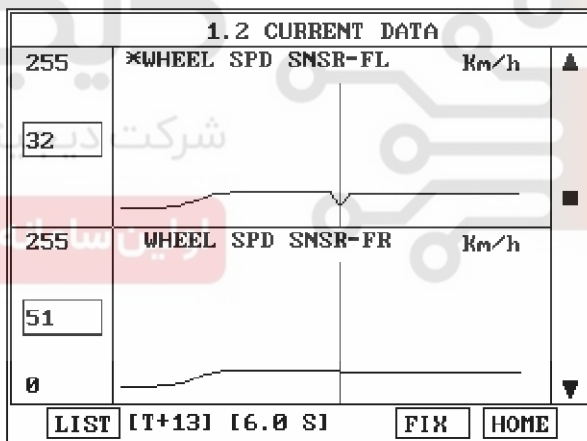


Fig4

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Normal Graph

Fig 3) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Data

Fig 4) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Graph

SCMBR6544L

5. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of

Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" Procedure.

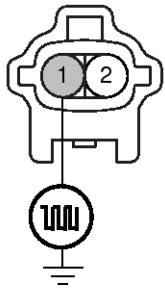
# ESP(Electronic Stability Program) System

# BR-113

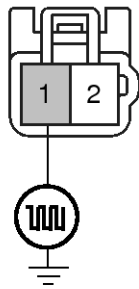
## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

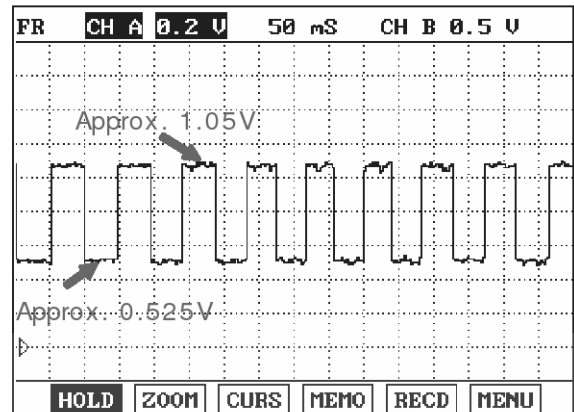
Specification : High : 1.05 V , Low : 0.525 V



1. Wheel speed sensor (FL-, FR-)
2. Wheel speed sensor (FL+, FR+)



1. Wheel speed sensor (RL-, RR-)
2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h (31 mph))
4. Are any DTCs present ?

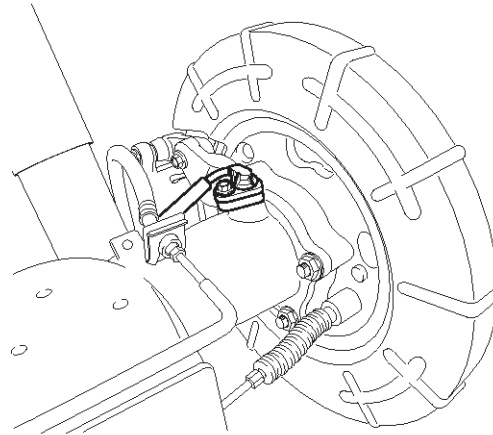
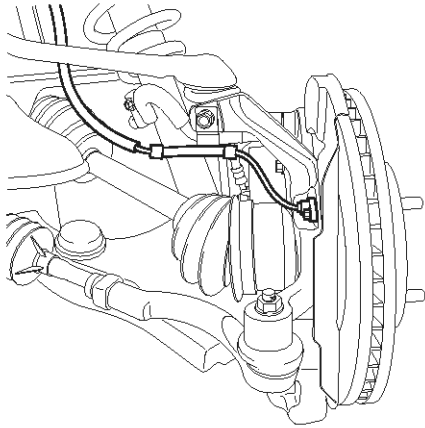
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.



**BR-114****Brake System****C1203****COMPONENT LOCATION**

SBLBR6516D

**General Description**

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

**DTC Description**

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

# ESP(Electronic Stability Program) System

BR-115

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized.</li> <li>In case of a WSS power line short to V_batt, this FSA test will detect an under voltage failure. (ABS only)</li> <li>※ FSA test : fail save circuit test</li> <li>※ UZ : Ignition Voltage</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>When the sensor current levels are out of permissible range( LOW : 7 mA, HIGH : 14 mA) for 200 ms.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Open or short of Wheel speed sensor circuit</li> <li>Inoperative Wheel speed sensor</li> <li>Inoperative HECU</li> </ul>

# BR-116

# Brake System

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6 mph)

4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	▲
* WHEEL SPD SNSOR-FL	10.0 Km/h	■
* WHEEL SPD SNSOR-FR	10.0 Km/h	
* WHEEL SPD SNSOR-RL	10.0 Km/h	
* WHEEL SPD SNSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig1

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	▲
* WHEEL SPD SNSOR-FL	0.0 Km/h	■
* WHEEL SPD SNSOR-FR	10.0 Km/h	
* WHEEL SPD SNSOR-RL	10.0 Km/h	
* WHEEL SPD SNSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 10km/h or more. (6mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 10km/h or more. (6mph or more) Abnormal Data (Open)

5. Is parameter displayed within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal & Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Power Circuit Inspection" procedure.

SCMBR6538L

# ESP(Electronic Stability Program) System

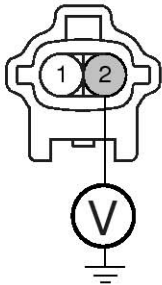
# BR-117

## Power Supply Circuit Inspection

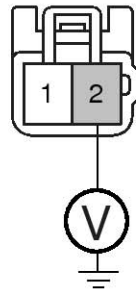
1. Ignition "ON".

2. Measure voltage between terminal (FL, FR : 2, RL, RR : 2) of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



1. Wheel speed sensor(-)  
2. Wheel speed sensor(+)



1. Wheel speed sensor(-)  
2. Wheel speed sensor(+)

SBLBR6543L

3. Is the measured voltage within specifications?

**YES**

▶ Go to "Signal Circuit Inspection" procedure.

**NO**

▶ Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 2, RL, RR : 2" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

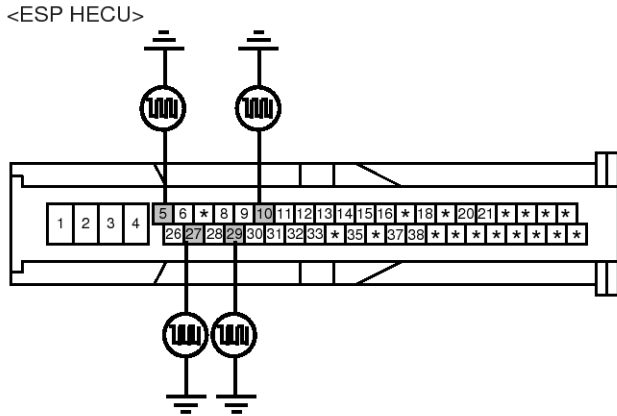
DTC	LOCATION	HECU harness connector (Power supply)	
		ABS	ESP
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

# BR-118

# Brake System

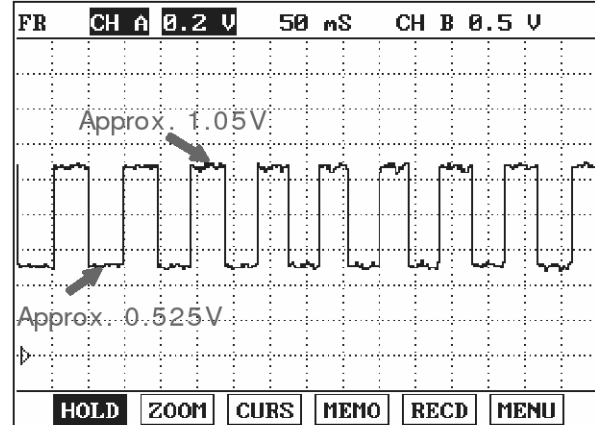
## Signal Circuit Inspection

1. Lift the vehicle.
2. Ignition "ON".



3. Turn the wheel with hand.
4. Measure waveform between terminal of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



SBLBR6508L

DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESP
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

5. Is the measured waveform within specifications?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Go to "Component Inspection" procedure.

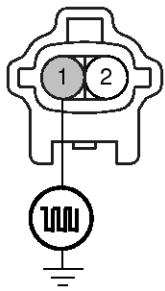
## Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

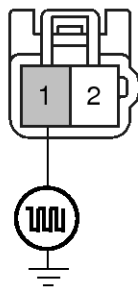
Specification : Approx. High : 1.05 V , Low : 0.525 V

# ESP(Electronic Stability Program) System

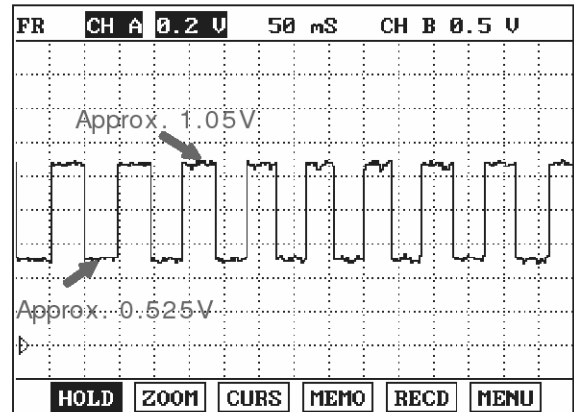
# BR-119



- 1. Wheel speed sensor (FL-, FR-)
- 2. Wheel speed sensor (FL+, FR+)



- 1. Wheel speed sensor (RL-, RR-)
- 2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

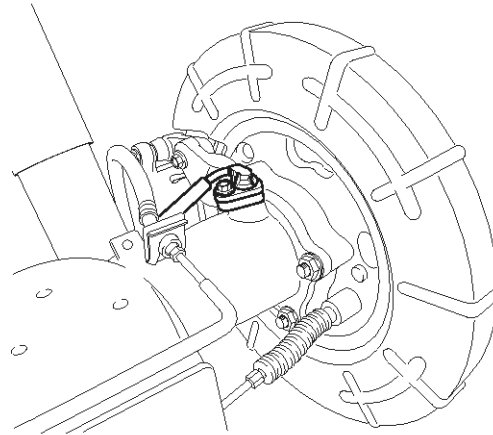
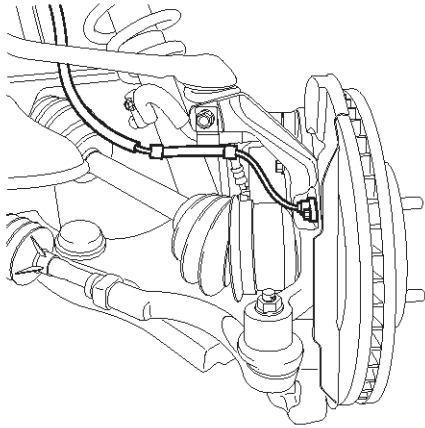
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.

**BR-120****Brake System****C1204****COMPONENT LOCATION**

SBLBR6516D

**General Description**

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

**DTC Description**

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

# ESP(Electronic Stability Program) System

# BR-121

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>The monitoring is active from 10 km/h to 80 km/h and if no ABS-control is active at a front wheel and a rear wheel.</li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of wheel speed sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Inoperative Wheel speed sensor</li> <li>External noise</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>If following interference and signal disturbance is detected, a failure is set after 10 s.               <ul style="list-style-type: none"> <li>non-plausible high frequency received.</li> <li>non-plausible high wheel acceleration.</li> <li>non-plausible high wheel jerk.</li> <li>non-plausible delta T and edges at low speed.</li> </ul> </li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	



# BR-122

# Brake System

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).

3. Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h(7 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition

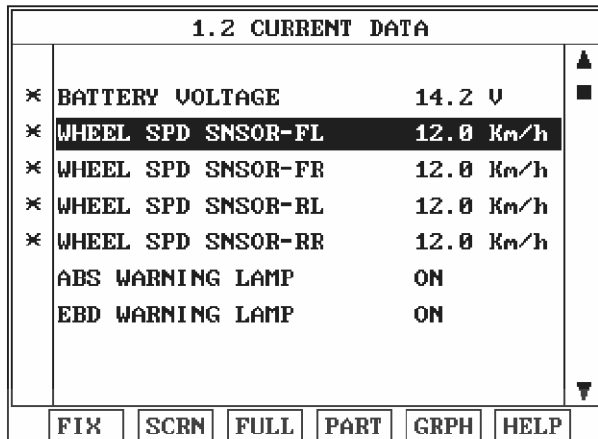


Fig1

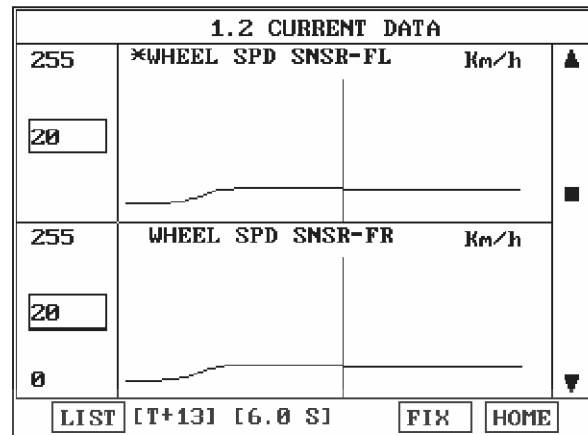


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 12 km/h or more. (7 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 20 km/h or more. (12 mph or more) Normal Graph

5. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

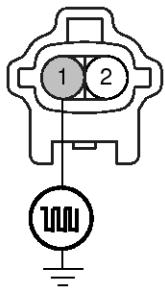
1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V

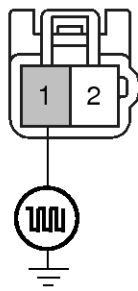
SCMBR6542L

# ESP(Electronic Stability Program) System

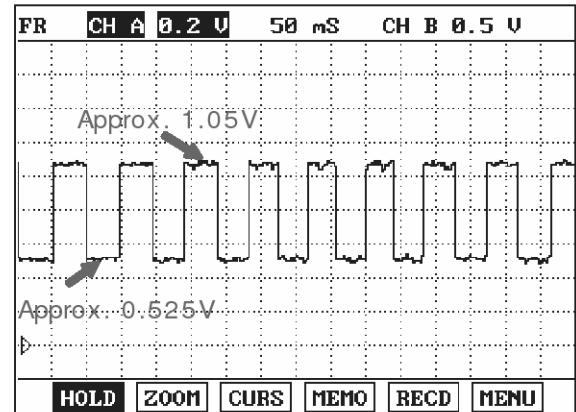
# BR-123



- 1. Wheel speed sensor (FL-, FR-)
- 2. Wheel speed sensor (FL+, FR+)



- 1. Wheel speed sensor (RL-, RR-)
- 2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

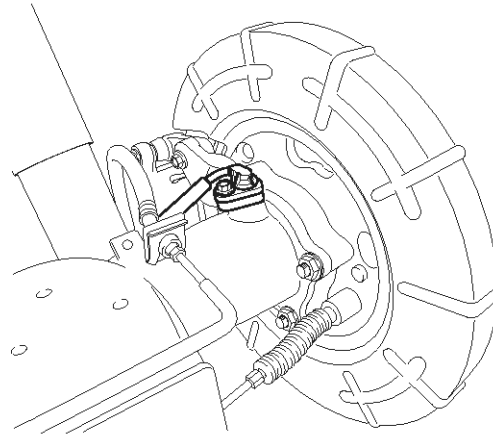
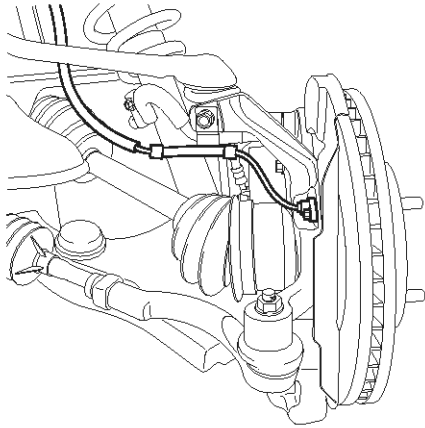
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h (7 mph))
4. Are any DTCs present ?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

**BR-124****Brake System****C1205****COMPONENT LOCATION**

SBLBR6516D

**General Description**

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

**DTC Description**

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h while the vehicle speed is at 12 km/h. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

# ESP(Electronic Stability Program) System

## BR-125

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of wheel speed sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Inoperative Wheel speed sensor</li> </ul>
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only no under voltage is not detected)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If one (or two) wheel are at 2.75 km/h and the other wheels are above 12 km/h for longer than 1s.</li> <li>During driving, when the vehicle accelerates 18 km/h after a particular wheel speed gets to 2.75 km/h and stays there. At that time, If one (or two) wheel are at 2.75 km/h.               <ul style="list-style-type: none"> <li>This monitoring is performed at the following condition.                   <ol style="list-style-type: none"> <li>At the time the vehicle is accelerated to 12 km/h</li> <li>Once after energizing the system.</li> <li>If the vehicle was stationary for approx. 2s.</li> </ol> </li> </ul> </li> <li>If one (or two) wheels are under 5 km/h and the two fastest wheels have a velocity above 12 km/h for more than 20s.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous ( If vehicle speed &gt; 12 m/s)</li> <li>- but this monitoring is disabled in the following event               <ol style="list-style-type: none"> <li>Aquaplaning.</li> <li>Interference.</li> <li>Supply voltage below 7.6 or above 18 Volts</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>No wheel speed signals within 10 ms to 20 ms at a vehicle speed &gt; 12 m/s (43.2 km/h ).</li> <li>- If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</li> <li>- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.</li> </ul>	

## BR-126

## Brake System

Case3 - ABS Only	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Vehicle &lt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; 1.7m/s (6km/h).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; 1.7m/s + 1.1m/s.</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; 1.7m/s + 2.2m/s.</li> <li>※ If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted.</li> </ul> </li> <li>• Vehicle &gt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; (6% × Vref).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; (6% × Vref + 1.1m/s).</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; (6% × Vref + 2.2m/s).</li> <li>※ V_ref : Vehicle Reference Speed</li> </ul> </li> <li>• Detection filter time <ul style="list-style-type: none"> <li>- Response and detection filter time depend on the amount of the speed difference and additional conditions as shown below.</li> <li>1. 18s - if fault threshold is exceeding &gt; 1.7m/s resp.6%</li> <li>2. 9s - if fault threshold is exceeding &gt; 3.3m/s resp. 12%</li> <li>3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s.</li> <li>4. If spinning wheel is detected the fault detection filter time is not shorter than 72s.</li> </ul> </li> <li>• Fault allocation <ul style="list-style-type: none"> <li>If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s.</li> <li>Otherwise a general WSS_Generic faulty (C1213) is set.</li> </ul> </li> </ul>	

## ESP(Electronic Stability Program) System

BR-127

Case4 - ESP Only	Monitoring Period	<ul style="list-style-type: none"> <li>• Main Monitoring <ul style="list-style-type: none"> <li>- The main monitor needs additional information of the ESP-sensors and is active for a velocity &gt; 20 km/h and no under voltage is detected.</li> </ul> </li> <li>• Backup Monitoring <ul style="list-style-type: none"> <li>- Continuous</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Main Monitoring <ol style="list-style-type: none"> <li>1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%.</li> <li>2. Detection filter time : <ul style="list-style-type: none"> <li>- the above conditions apply for 20s for 1 defective wheel speed sensor.</li> <li>- the above conditions apply for 40s for 2 defective wheel speed sensor.</li> </ul> </li> </ol> <p>If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set.</p> </li> <li>• Backup Monitoring <ol style="list-style-type: none"> <li>1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h.</li> <li>2. When the velocity is below 50 km/h, if the deviation exceeds an absolute value of 3km/h.</li> <li>3. Detection filter time : normally 20s <ul style="list-style-type: none"> <li>- In case of a detected curve, the threshold is increased with an additional value of 4 km/h.</li> </ul> </li> </ol> </li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	

# BR-128

# Brake System

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h(31 mph)

4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

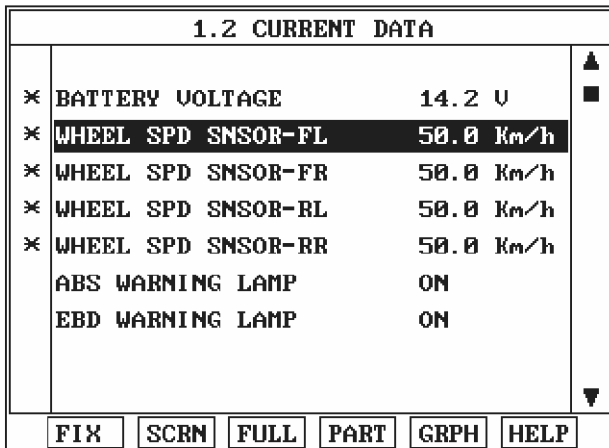


Fig1

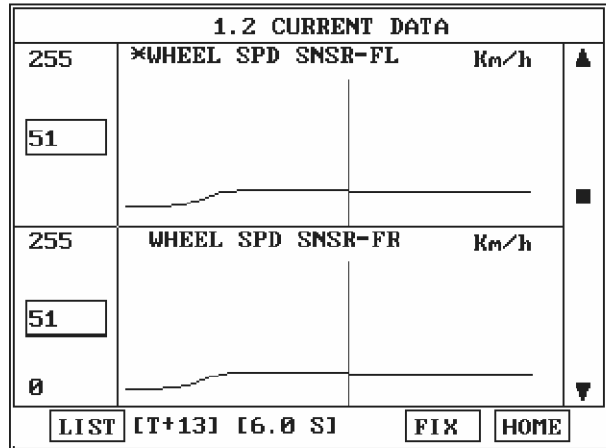


Fig2

SCMBR6543L

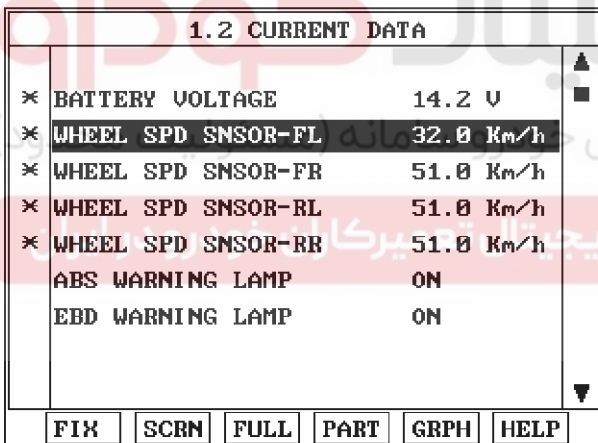


Fig3

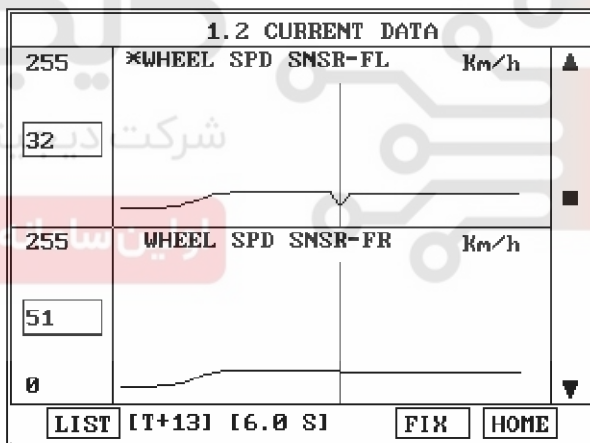


Fig4

- Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31 mph or more) Normal Data  
 Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Normal Graph  
 Fig 3) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Data  
 Fig 4) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Graph

SCMBR6544L

# ESP(Electronic Stability Program) System

# BR-129

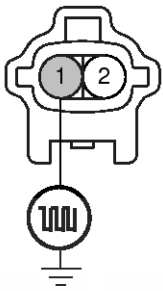
5. Is parameter displayed within specifications?

**YES**

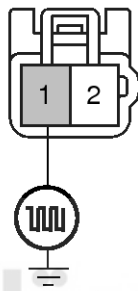
► Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" Procedure.



- 1. Wheel speed sensor (FL-, FR-)
- 2. Wheel speed sensor (FL+, FR+)

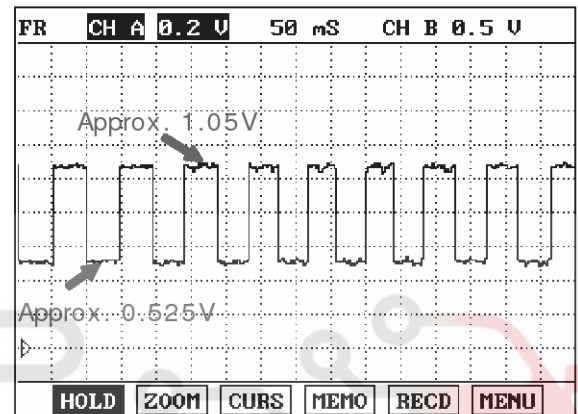


- 1. Wheel speed sensor (RL-, RR-)
- 2. Wheel speed sensor (RL+, RR+)

## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

► If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

- Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.
- Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.
- Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.



## BR-130

## Brake System

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h (31 mph))
4. Are any DTCs present ?

#### **YES**

- ▶ Go to the applicable troubleshooting procedure.

#### **NO**

- ▶ System performing to specification at this time.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

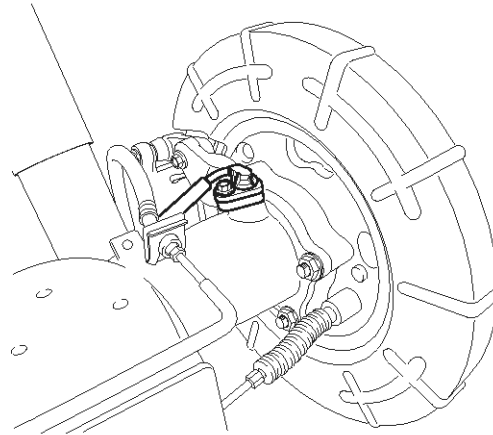
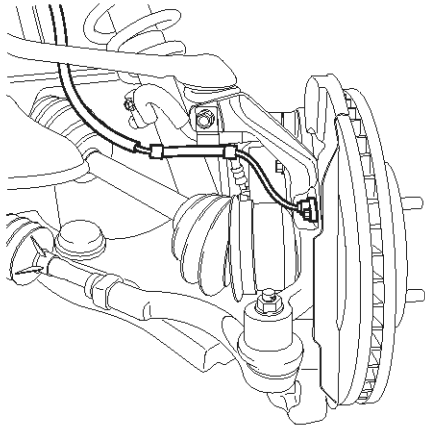


# ESP(Electronic Stability Program) System

# BR-131

**C1206**

## COMPONENT LOCATION



SBLBR6516D

### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

## BR-132

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized.</li> <li>In case of a WSS power line short to V_batt, this FSA test will detect an under voltage failure. (ABS only)</li> <li>※ FSA test : fail save circuit test</li> <li>※ UZ : Ignition Voltage</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>When the sensor current levels are out of permissible range( LOW : 7 mA, HIGH : 14 mA) for 200 ms.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Open or short of Wheel speed sensor circuit</li> <li>Inoperative Wheel speed sensor</li> <li>Inoperative HECU</li> </ul>

# ESP(Electronic Stability Program) System

# BR-133

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6 mph)

4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	▲
* WHEEL SPD SNSOR-FL	10.0 Km/h	■
* WHEEL SPD SNSOR-FR	10.0 Km/h	
* WHEEL SPD SNSOR-RL	10.0 Km/h	
* WHEEL SPD SNSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig1

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	▲
* WHEEL SPD SNSOR-FL	0.0 Km/h	■
* WHEEL SPD SNSOR-FR	10.0 Km/h	
* WHEEL SPD SNSOR-RL	10.0 Km/h	
* WHEEL SPD SNSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 10km/h or more. (6mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 10km/h or more. (6mph or more) Abnormal Data (Open)

5. Is parameter displayed within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal & Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Power Circuit Inspection" procedure.

SCMBR6538L

# BR-134

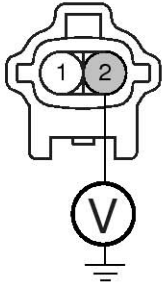
# Brake System

## Power Supply Circuit Inspection

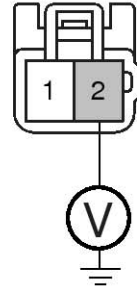
1. Ignition "ON".

2. Measure voltage between terminal (FL, FR : 2, RL, RR : 2) of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



1. Wheel speed sensor(-)  
2. Wheel speed sensor(+)



1. Wheel speed sensor(-)  
2. Wheel speed sensor(+)

SBLBR6543L

3. Is the measured voltage within specifications?

**YES**

▶ Go to "Signal Circuit Inspection" procedure.

**NO**

▶ Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 2, RL, RR : 2" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

DTC	LOCATION	HECU harness connector (Power supply)	
		ABS	ESP
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

# ESP(Electronic Stability Program) System

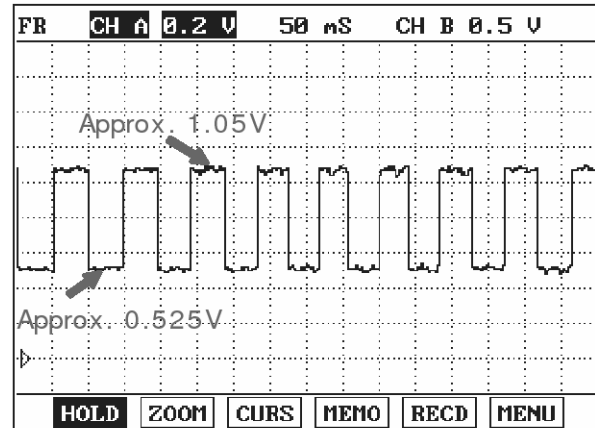
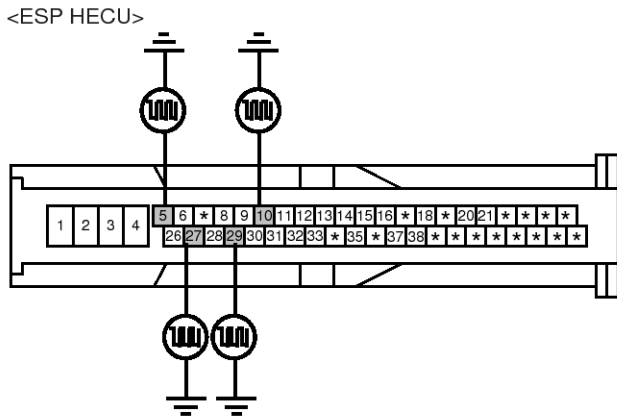
# BR-135

## Signal Circuit Inspection

1. Lift the vehicle.
2. Ignition "ON".

3. Turn the wheel with hand.
4. Measure waveform between terminal of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



SBLBR6508L

DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESP
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

5. Is the measured waveform within specifications?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Go to "Component Inspection" procedure.

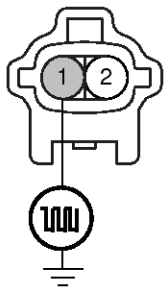
## Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

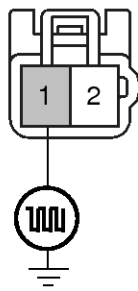
Specification : Approx. High : 1.05 V , Low : 0.525 V

# BR-136

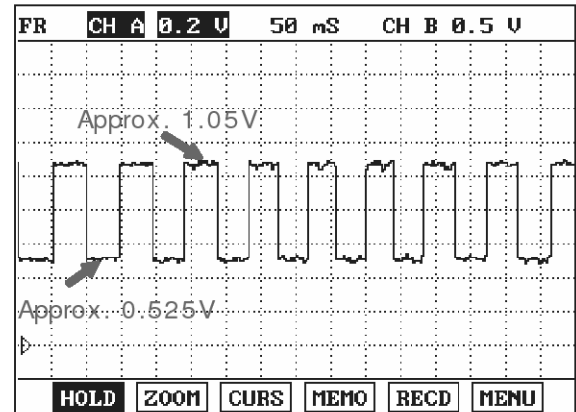
# Brake System



- 1. Wheel speed sensor (FL-, FR-)
- 2. Wheel speed sensor (FL+, FR+)



- 1. Wheel speed sensor (RL-, RR-)
- 2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

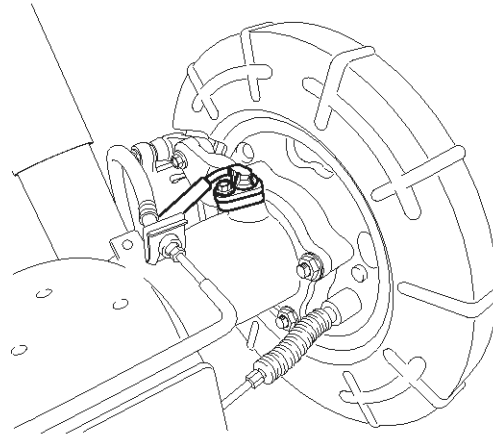
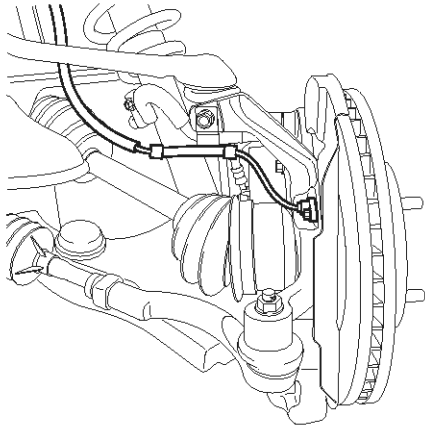
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.

**ESP(Electronic Stability Program) System****BR-137****C1207****COMPONENT LOCATION**

SBLBR6516D

**General Description**

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

**DTC Description**

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.



## BR-138

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>The monitoring is active from 10 km/h to 80 km/h and if no ABS-control is active at a front wheel and a rear wheel.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If following interference and signal disturbance is detected, a failure is set after 10 s. <ul style="list-style-type: none"> <li>non-plausible high frequency received.</li> <li>non-plausible high wheel acceleration.</li> <li>non-plausible high wheel jerk.</li> <li>non-plausible delta T and edges at low speed.</li> </ul> </li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle <ol style="list-style-type: none"> <li>Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>Sensor failure inside the ABS control cycle <ol style="list-style-type: none"> <li>One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of wheel speed sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Inoperative Wheel speed sensor</li> <li>External noise</li> </ul>

# ESP(Electronic Stability Program) System

# BR-139

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h(7 mph)
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition

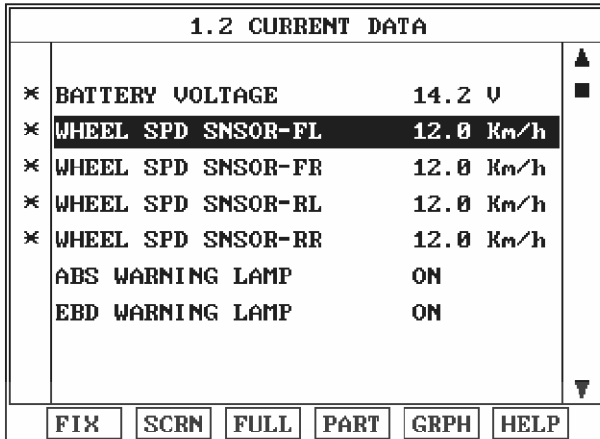


Fig1

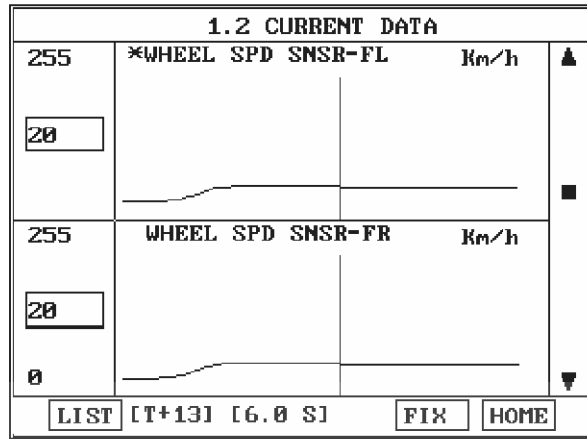


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 12 km/h or more. (7 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 20 km/h or more. (12 mph or more) Normal Graph

5. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" Procedure.

## COMPONENT INSPECTION

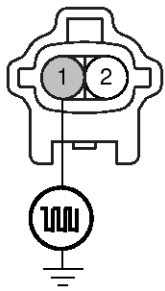
1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

Specification : High : 1.05 V , Low : 0.525 V

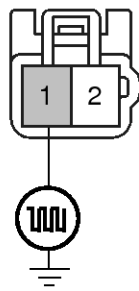
SCMBR6542L

# BR-140

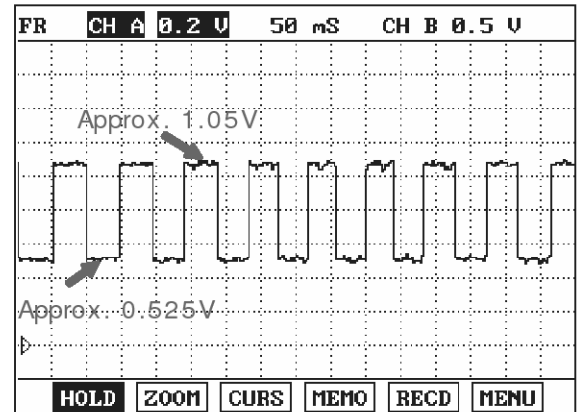
# Brake System



- 1. Wheel speed sensor (FL-, FR-)
- 2. Wheel speed sensor (FL+, FR+)



- 1. Wheel speed sensor (RL-, RR-)
- 2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

► If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

► Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

► Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h (7 mph))
4. Are any DTCs present ?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

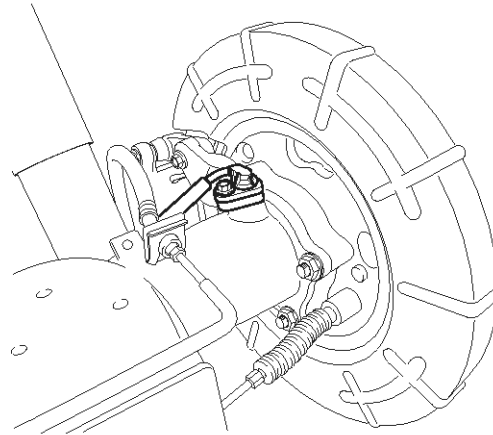
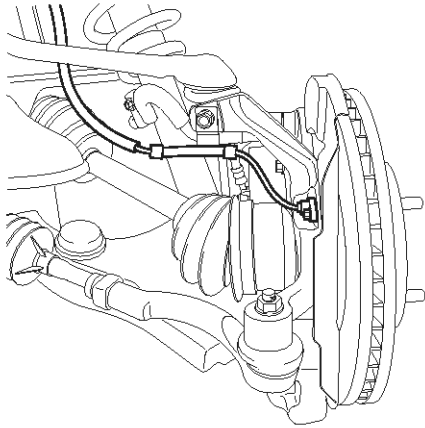
► System performing to specification at this time.

# ESP(Electronic Stability Program) System

# BR-141

**C1208**

## COMPONENT LOCATION



SBLBR6516D

### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h while the vehicle speed is at 12 km/h. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

## BR-142

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of wheel speed sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Inoperative Wheel speed sensor</li> </ul>
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only no under voltage is not detected)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If one (or two) wheel are at 2.75 km/h and the other wheels are above 12 km/h for longer than 1s.</li> <li>During driving, when the vehicle accelerates 18 km/h after a particular wheel speed gets to 2.75 km/h and stays there. At that time, If one (or two) wheel are at 2.75 km/h.               <ul style="list-style-type: none"> <li>This monitoring is performed at the following condition.                   <ol style="list-style-type: none"> <li>At the time the vehicle is accelerated to 12 km/h</li> <li>Once after energizing the system.</li> <li>If the vehicle was stationary for approx. 2s.</li> </ol> </li> </ul> </li> <li>If one (or two) wheels are under 5 km/h and the two fastest wheels have a velocity above 12 km/h for more than 20s.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous ( If vehicle speed &gt; 12 m/s)</li> <li>- but this monitoring is disabled in the following event               <ol style="list-style-type: none"> <li>Aquaplaning.</li> <li>Interference.</li> <li>Supply voltage below 7.6 or above 18 Volts</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>No wheel speed signals within 10 ms to 20 ms at a vehicle speed &gt; 12 m/s (43.2 km/h ).</li> <li>- If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</li> <li>- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.</li> </ul>	

## ESP(Electronic Stability Program) System

## BR-143

Case3 - ABS Only	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Vehicle &lt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; 1.7m/s (6km/h).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; 1.7m/s + 1.1m/s.</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; 1.7m/s + 2.2m/s.</li> <li>※ If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted.</li> </ul> </li> <li>• Vehicle &gt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; (6% × Vref).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; (6% × Vref + 1.1m/s).</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; (6% × Vref + 2.2m/s).</li> <li>※ V_ref : Vehicle Reference Speed</li> </ul> </li> <li>• Detection filter time <ul style="list-style-type: none"> <li>- Response and detection filter time depend on the amount of the speed difference and additional conditions as shown below. <ol style="list-style-type: none"> <li>1. 18s - if fault threshold is exceeding &gt; 1.7m/s resp.6%</li> <li>2. 9s - if fault threshold is exceeding &gt; 3.3m/s resp. 12%</li> <li>3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s.</li> <li>4. If spinning wheel is detected the fault detection filter time is not shorter than 72s.</li> </ol> </li> </ul> </li> <li>• Fault allocation <ul style="list-style-type: none"> <li>If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s.</li> <li>Otherwise a general WSS_Generic faulty (C1213) is set.</li> </ul> </li> </ul>	

## BR-144

## Brake System

Case4 - ESP Only	Monitoring Period	<ul style="list-style-type: none"> <li>• Main Monitoring <ul style="list-style-type: none"> <li>- The main monitor needs additional information of the ESP-sensors and is active for a velocity &gt; 20 km/h and no under voltage is detected.</li> </ul> </li> <li>• Backup Monitoring <ul style="list-style-type: none"> <li>- Continuous</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Main Monitoring <ol style="list-style-type: none"> <li>1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%.</li> <li>2. Detection filter time : <ul style="list-style-type: none"> <li>- the above conditions apply for 20s for 1 defective wheel speed sensor.</li> <li>- the above conditions apply for 40s for 2 defective wheel speed sensor.</li> </ul> </li> </ol> <p>If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set.</p> </li> <li>• Backup Monitoring <ol style="list-style-type: none"> <li>1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h.</li> <li>2. When the velocity is below 50 km/h, if the deviation exceeds an absolute value of 3km/h.</li> <li>3. Detection filter time : normally 20s <ul style="list-style-type: none"> <li>- In case of a detected curve, the threshold is increased with an additional value of 4 km/h.</li> </ul> </li> </ol> </li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	

# ESP(Electronic Stability Program) System

# BR-145

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h(31 mph)

4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

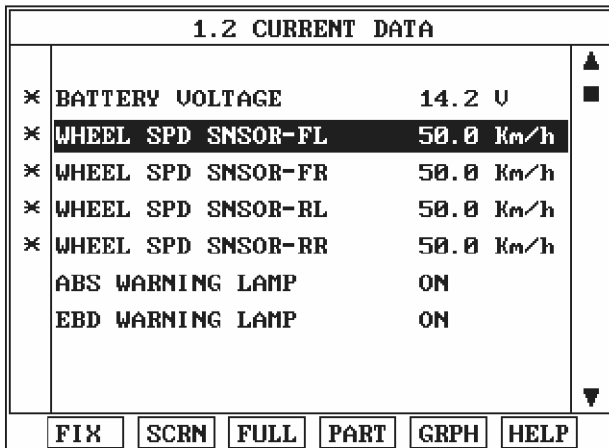


Fig1

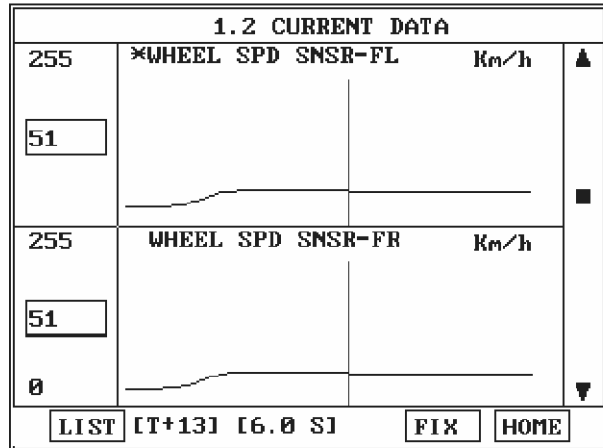


Fig2

SCMBR6543L

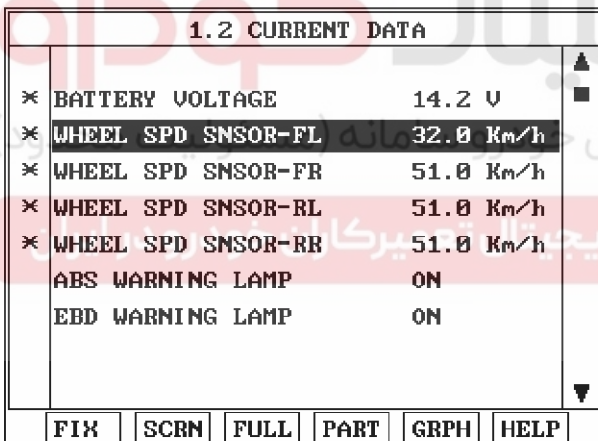


Fig3

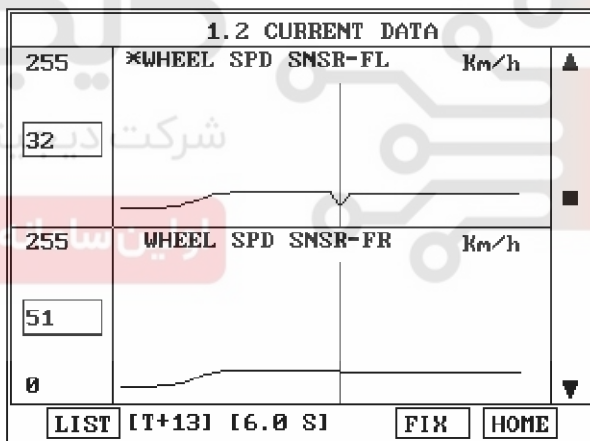


Fig4

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Normal Graph

Fig 3) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Data

Fig 4) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Graph

SCMBR6544L

5. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of

Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" Procedure.



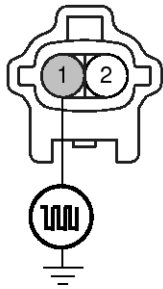
# BR-146

# Brake System

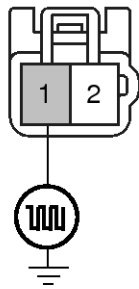
## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

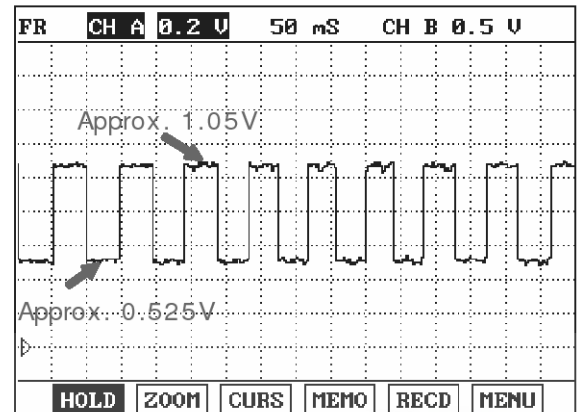
Specification : High : 1.05 V , Low : 0.525 V



1. Wheel speed sensor (FL-, FR-)
2. Wheel speed sensor (FL+, FR+)



1. Wheel speed sensor (RL-, RR-)
2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h (31 mph))
4. Are any DTCs present ?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

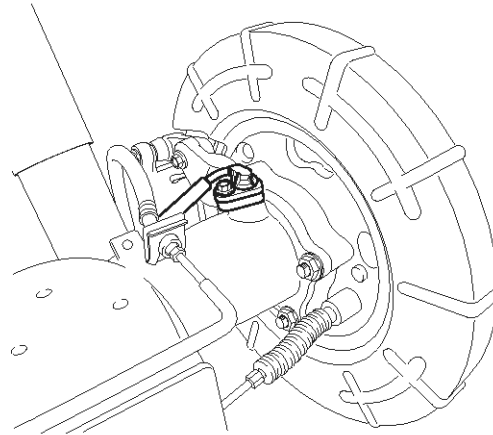
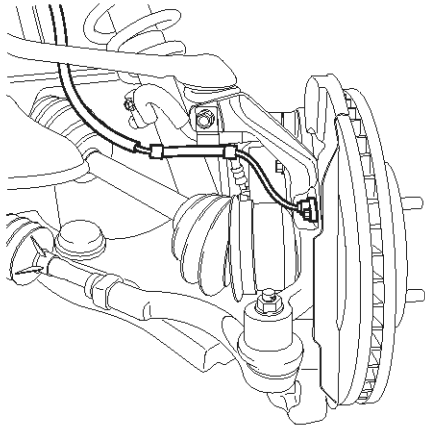
▶ System performing to specification at this time.

# ESP(Electronic Stability Program) System

# BR-147

C1209

## COMPONENT LOCATION



SBLBR6516D

## General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

## DTC Description

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cuts off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again.

## BR-148

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is recognized.</li> <li>In case of a WSS power line short to V_batt, this FSA test will detect an under voltage failure. (ABS only)</li> <li>※ FSA test : fail save circuit test</li> <li>※ UZ : Ignition Voltage</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>When the sensor current levels are out of permissible range( LOW : 7 mA, HIGH : 14 mA) for 200 ms.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Open or short of Wheel speed sensor circuit</li> <li>Inoperative Wheel speed sensor</li> <li>Inoperative HECU</li> </ul>

# ESP(Electronic Stability Program) System

# BR-149

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6 mph)

4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	▲
* WHEEL SPD SNSOR-FL	10.0 Km/h	■
* WHEEL SPD SNSOR-FR	10.0 Km/h	
* WHEEL SPD SNSOR-RL	10.0 Km/h	
* WHEEL SPD SNSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig1

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.2 V	▲
* WHEEL SPD SNSOR-FL	0.0 Km/h	■
* WHEEL SPD SNSOR-FR	10.0 Km/h	
* WHEEL SPD SNSOR-RL	10.0 Km/h	
* WHEEL SPD SNSOR-RR	10.0 Km/h	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	
▼		
FIX	SCRN	FULL PART GRPH HELP

Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 10km/h or more. (6mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 10km/h or more. (6mph or more) Abnormal Data (Open)

5. Is parameter displayed within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal & Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Power Circuit Inspection" procedure.

SCMBR6538L

# BR-150

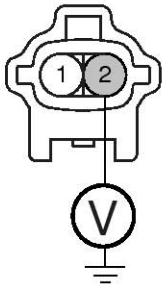
# Brake System

## Power Supply Circuit Inspection

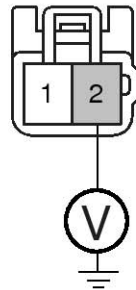
1. Ignition "ON".

2. Measure voltage between terminal (FL, FR : 2, RL, RR : 2) of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



1. Wheel speed sensor(-)  
2. Wheel speed sensor(+)



1. Wheel speed sensor(-)  
2. Wheel speed sensor(+)

SBLBR6543L

3. Is the measured voltage within specifications?

**YES**

▶ Go to "Signal Circuit Inspection" procedure.

**NO**

▶ Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 2, RL, RR : 2" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

DTC	LOCATION	HECU harness connector (Power supply)	
		ABS	ESP
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

# ESP(Electronic Stability Program) System

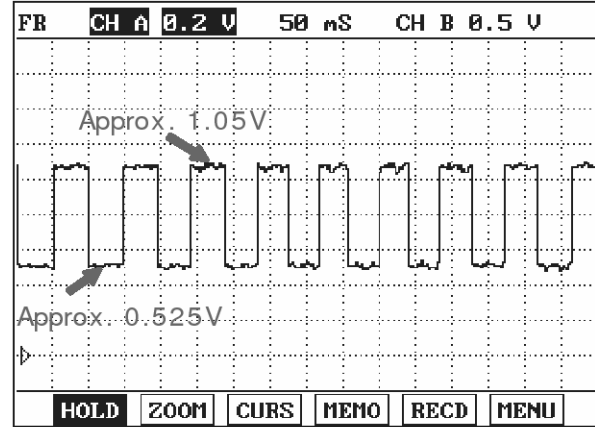
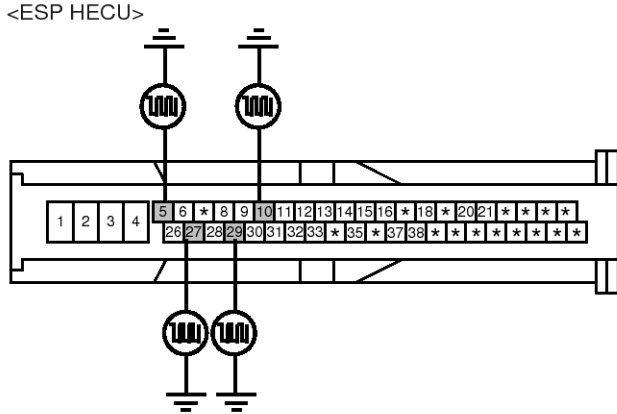
# BR-151

## Signal Circuit Inspection

1. Lift the vehicle.
2. Ignition "ON".

3. Turn the wheel with hand.
4. Measure waveform between terminal of the HECU harness connector and chassis ground.

Specification : Approx. High : 1.05 V , Low : 0.525 V



SBLBR6508L

DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESP
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

5. Is the measured waveform within specifications?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for open or short to GND in wheel speed sensor harness between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Go to "Component Inspection" procedure.

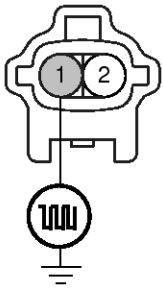
## Component Inspection

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

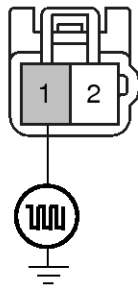
Specification : Approx. High : 1.05 V , Low : 0.525 V

# BR-152

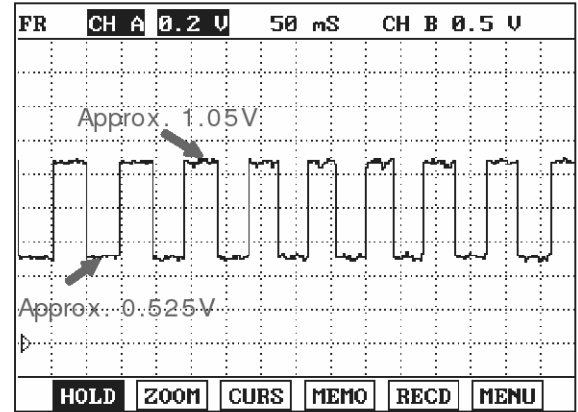
# Brake System



- 1. Wheel speed sensor (FL-, FR-)
- 2. Wheel speed sensor (FL+, FR+)



- 1. Wheel speed sensor (RL-, RR-)
- 2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

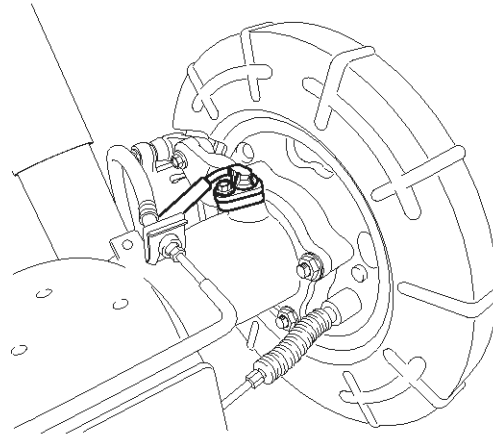
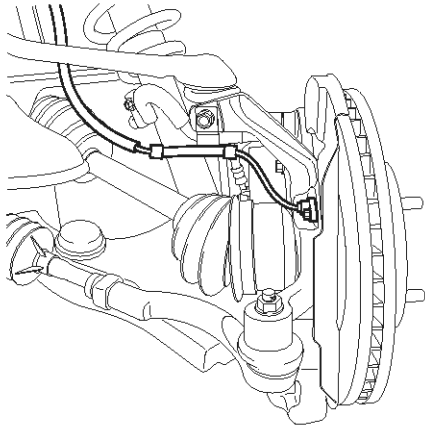
► System performing to specification at this time.

# ESP(Electronic Stability Program) System

## BR-153

C1210

### COMPONENT LOCATION



SBLBR6516D

### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.



## BR-154

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>The monitoring is active from 10 km/h to 80 km/h and if no ABS-control is active at a front wheel and a rear wheel.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If following interference and signal disturbance is detected, a failure is set after 10 s.               <ul style="list-style-type: none"> <li>non-plausible high frequency received.</li> <li>non-plausible high wheel acceleration.</li> <li>non-plausible high wheel jerk.</li> <li>non-plausible delta T and edges at low speed.</li> </ul> </li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Sensor failure outside of the ABS control cycle               <ol style="list-style-type: none"> <li>Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>Sensor failure inside the ABS control cycle               <ol style="list-style-type: none"> <li>One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of wheel speed sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Inoperative Wheel speed sensor</li> <li>External noise</li> </ul>

# ESP(Electronic Stability Program) System BR-155

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h(7 mph)

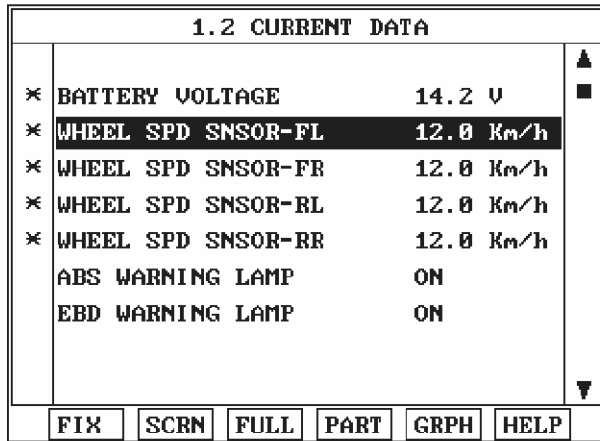


Fig1

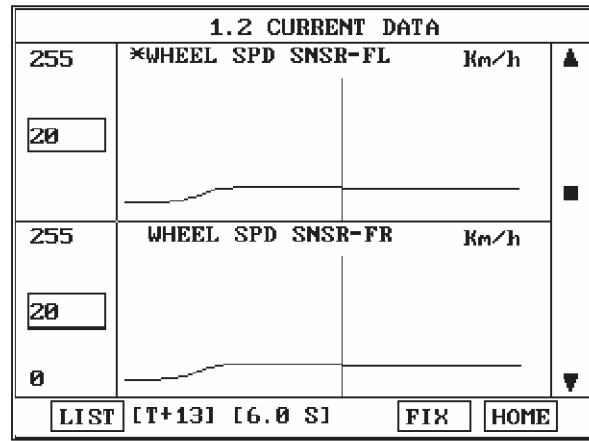


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 12 km/h or more. (7 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 20 km/h or more. (12 mph or more) Normal Graph

5. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by faulty HECU or external noise, was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" Procedure.

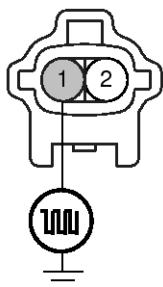
4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition

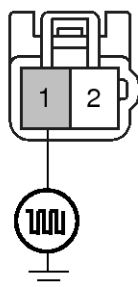
## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

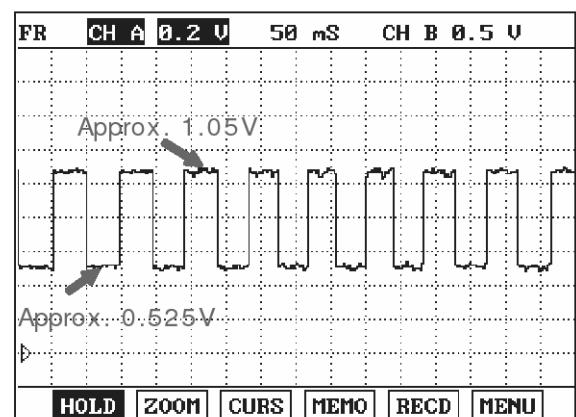
Specification : High : 1.05 V , Low : 0.525 V



1. Wheel speed sensor (FL-, FR-)
2. Wheel speed sensor (FL+, FR+)



1. Wheel speed sensor (RL-, RR-)
2. Wheel speed sensor (RL+, RR+)



**BR-156****Brake System**

SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

**Verification of Vehicle Repair**

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 12 km/h (7 mph))

4. Are any DTCs present ?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

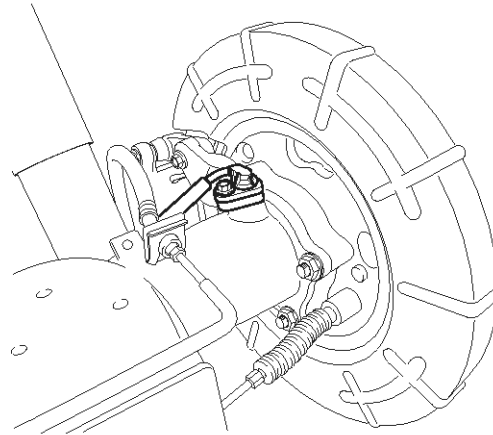
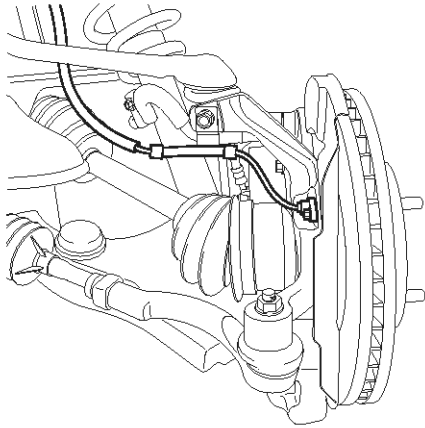


# ESP(Electronic Stability Program) System

## BR-157

**C1211**

### COMPONENT LOCATION



SBLBR6516D

### General Description

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

### DTC Description

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h while the vehicle speed is at 12 km/h. Warning lamp is turned OFF unless additional faults are detected when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

## BR-158

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of wheel speed sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Inoperative Wheel speed sensor</li> </ul>
Case1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only no under voltage is not detected)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If one (or two) wheel are at 2.75 km/h and the other wheels are above 12 km/h for longer than 1s.</li> <li>During driving, when the vehicle accelerates 18 km/h after a particular wheel speed gets to 2.75 km/h and stays there. At that time, If one (or two) wheel are at 2.75 km/h.               <ul style="list-style-type: none"> <li>This monitoring is performed at the following condition.                   <ol style="list-style-type: none"> <li>At the time the vehicle is accelerated to 12 km/h</li> <li>Once after energizing the system.</li> <li>If the vehicle was stationary for approx. 2s.</li> </ol> </li> </ul> </li> <li>If one (or two) wheels are under 5 km/h and the two fastest wheels have a velocity above 12 km/h for more than 20s.</li> </ul>	
Case2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous ( If vehicle speed &gt; 12 m/s)</li> <li>- but this monitoring is disabled in the following event               <ol style="list-style-type: none"> <li>Aquaplaning.</li> <li>Interference.</li> <li>Supply voltage below 7.6 or above 18 Volts</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>No wheel speed signals within 10 ms to 20 ms at a vehicle speed &gt; 12 m/s (43.2 km/h ).</li> <li>- If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms.</li> <li>- If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.</li> </ul>	

## ESP(Electronic Stability Program) System

## BR-159

Case3 - ABS Only	Monitoring Period	<ul style="list-style-type: none"> <li>• Continuous</li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Vehicle &lt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; 1.7m/s (6km/h).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; 1.7m/s + 1.1m/s.</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; 1.7m/s + 2.2m/s.</li> <li>※ If at least one wheel is at 1.4m/s or lower, a wheel speed difference of adjoining wheels up to 3.3m/s(or 3.3m/s + 1.1m/s) is permitted.</li> </ul> </li> <li>• Vehicle &gt; 100Km/h <ul style="list-style-type: none"> <li>- Difference of two wheel speeds at FL to RL/FR to RR &gt; (6% × Vref).</li> <li>- Difference of two wheel speeds at FL to FR/RL to RR &gt; (6% × Vref + 1.1m/s).</li> <li>- Difference of two wheel speeds at FL to RR/FR to RL &gt; (6% × Vref + 2.2m/s).</li> <li>※ V_ref : Vehicle Reference Speed</li> </ul> </li> <li>• Detection filter time <ul style="list-style-type: none"> <li>- Response and detection filter time depend on the amount of the speed difference and additional conditions as shown below. <ol style="list-style-type: none"> <li>1. 18s - if fault threshold is exceeding &gt; 1.7m/s resp.6%</li> <li>2. 9s - if fault threshold is exceeding &gt; 3.3m/s resp. 12%</li> <li>3. If any wheel shows strong deceleration the fault detection filter time is not shorter than 18s.</li> <li>4. If spinning wheel is detected the fault detection filter time is not shorter than 72s.</li> </ol> </li> </ul> </li> <li>• Fault allocation <ul style="list-style-type: none"> <li>If the exact fault location can be determined the wheel specific fault will be set. This is the case if at the time of detection the faulty wheel speed is at or below 1.4m/s.</li> <li>Otherwise a general WSS_Generic faulty (C1213) is set.</li> </ul> </li> </ul>	

## BR-160

## Brake System

Case4 - ESP Only	Monitoring Period	<ul style="list-style-type: none"> <li>• Main Monitoring <ul style="list-style-type: none"> <li>- The main monitor needs additional information of the ESP-sensors and is active for a velocity &gt; 20 km/h and no under voltage is detected.</li> </ul> </li> <li>• Backup Monitoring <ul style="list-style-type: none"> <li>- Continuous</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>• Main Monitoring <ol style="list-style-type: none"> <li>1. If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5%.</li> <li>2. Detection filter time : <ul style="list-style-type: none"> <li>- the above conditions apply for 20s for 1 defective wheel speed sensor.</li> <li>- the above conditions apply for 40s for 2 defective wheel speed sensor.</li> </ul> </li> </ol> <p>If the faulty wheel is always the same, a wheel specific wheel speed sensor fault is set, otherwise a generic wheel speed sensor fault (C1213) is set.</p> </li> <li>• Backup Monitoring <ol style="list-style-type: none"> <li>1. If the deviation between the fastest and the slowest wheel exceeds 6% related to the fastest wheel when the velocity is higher than 50 km/h.</li> <li>2. When the velocity is below 50 km/h, if the deviation exceeds an absolute value of 3km/h.</li> <li>3. Detection filter time : normally 20s <ul style="list-style-type: none"> <li>- In case of a detected curve, the threshold is increased with an additional value of 4 km/h.</li> </ul> </li> </ol> </li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>• Sensor failure outside of the ABS control cycle <ol style="list-style-type: none"> <li>1. Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure :System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> <li>• Sensor failure inside the ABS control cycle <ol style="list-style-type: none"> <li>1. One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>2. Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> <li>3. More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.</li> </ol> </li> </ul>	

# ESP(Electronic Stability Program) System BR-161

## Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h(31 mph)

4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

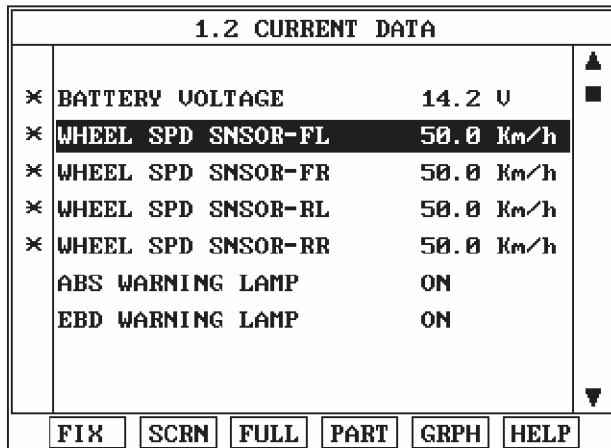


Fig1

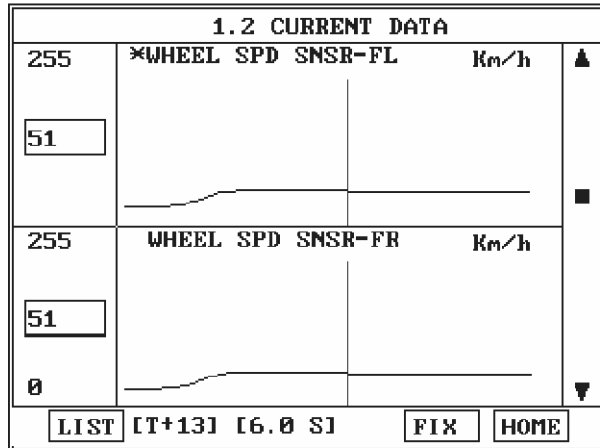


Fig2

SCMBR6543L

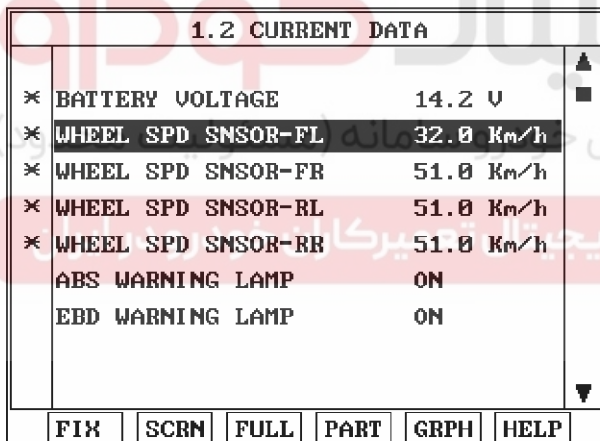


Fig3

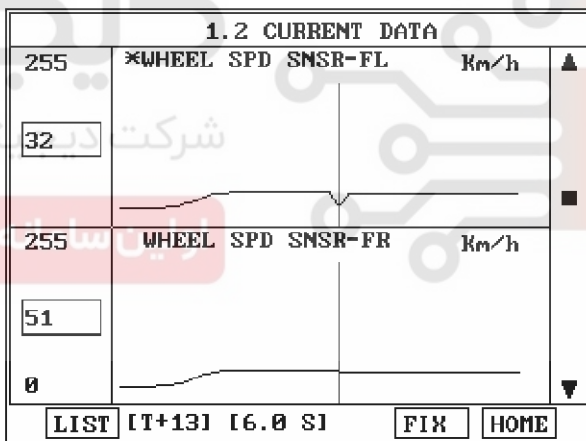


Fig4

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Normal Graph

Fig 3) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Data

Fig 4) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Graph

SCMBR6544L

5. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of

Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" Procedure.



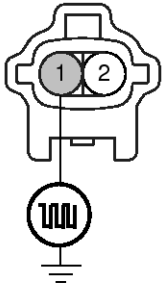
# BR-162

# Brake System

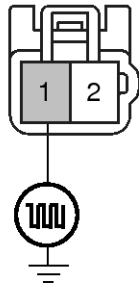
## COMPONENT INSPECTION

1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "FL, FR : 1, RL, RR : 1" of the wheel speed sensor harness connector and chassis ground.

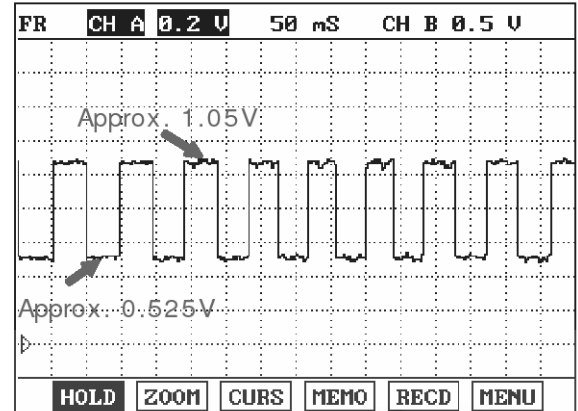
Specification : High : 1.05 V , Low : 0.525 V



1. Wheel speed sensor (FL-, FR-)
2. Wheel speed sensor (FL+, FR+)



1. Wheel speed sensor (RL-, RR-)
2. Wheel speed sensor (RL+, RR+)



SBLBR6509L

5. Is the measured waveform within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness or external noise, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage and external noise, an interference between harnesses. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

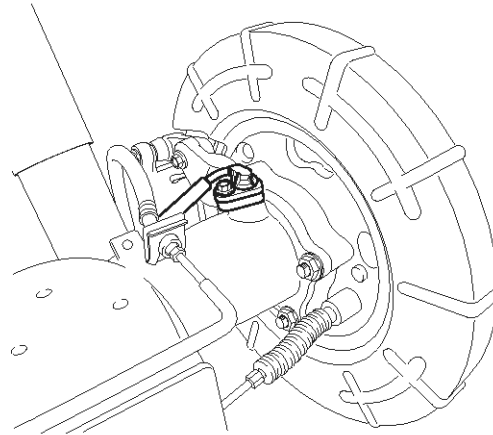
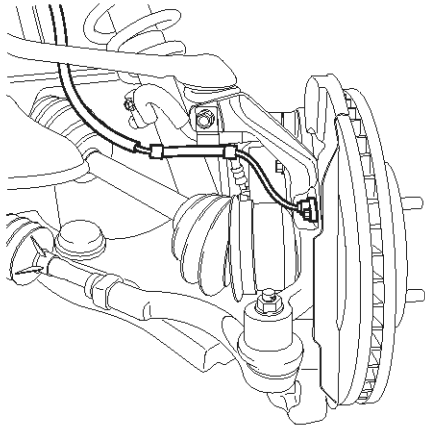
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed at or above 50 km/h (31 mph))
4. Are any DTCs present ?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

**ESP(Electronic Stability Program) System****BR-163****C1213****COMPONENT LOCATION**

SBLBR6516D

**General Description**

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a reference value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise characteristic. Digital waveform is produced as tone wheel rotate according as hall sensor principle. Frequency of duty waveform is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

**DTC Description**

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set, if the speed difference with adjacent wheel is out of permissible range or the ABS control cycle is abnormal.

# BR-164

# Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
Case 1	DTC Strategy	• Signal motorning	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Monitoring Period	• Continuous	
	Enable C-conditions	• When short cut between the wheel speed sensor supply and the battery.	
	Fail Safe	• Wheel speed sensor signals are not reliable.	
Case 2	DTC Strategy	• Signal motorning	<ul style="list-style-type: none"> <li>• Improper installation of wheel speed sensor</li> <li>• Abnormal Rotor and wheel bearing</li> <li>• Inoperative Wheel speed sensor</li> </ul>
	Monitoring Period	• Continuous	
	Enable C-conditions	<ul style="list-style-type: none"> <li>• The monitoring reports a failure if the ABS target slip is exceeded for a time period <math>\geq 10</math> s at one or more wheels.</li> <li>- If the driver brakes or the velocity is lower than 50 km/h the detection time is enlarged to 60 s.</li> </ul>	
	Fail Safe	• Reduced function of the ESP system	

### Monitor Scantool Data

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed at or above 10 km/h(6 mph)

4. Monitor the "Wheel Speed Sensor" parameter on the Scantool.

Specification : Compare with another parameters related to wheel speed sensor. If it is the same as another parameters, it is in normal condition.

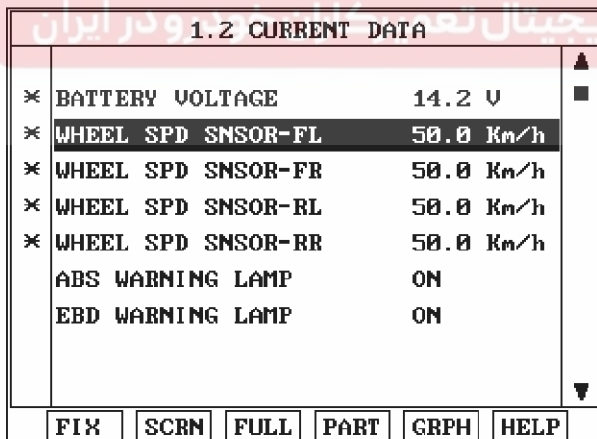


Fig1

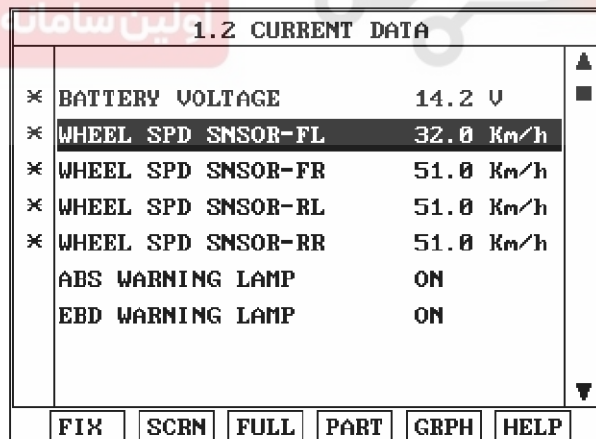


Fig2

Fig 1) Test Condition : Drive vehicle at a speed of 50 km/h or more. (31 mph or more) Normal Data

Fig 2) Test Condition : Drive vehicle at a speed of 51 km/h or more. (31 mph or more) Abnormal Data

SCMBR6545L

# ESP(Electronic Stability Program) System

# BR-165

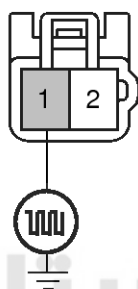
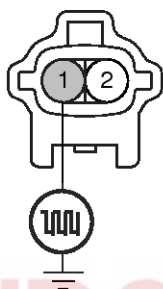
5. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure..

**NO**

► Go to "Component Inspection" Procedure.



- 1. Wheel speed sensor (FL-, FR-)
- 2. Wheel speed sensor (FL+, FR+)

- 1. Wheel speed sensor (RL-, RR-)
- 2. Wheel speed sensor (RL+, RR+)

## Component Inspection

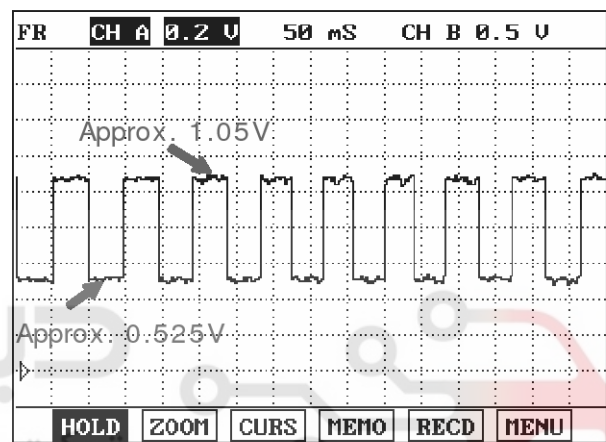
1. Lift the vehicle.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure waveform between terminal "1" of the wheel speed sensor harness connector and chassis ground.

Specification :

High : 1.05 V , Low : 0.525 V

Compare waveforms of all wheel speed sensors.

If they have same waveform, it is in normal condition.



SBLBR6510L

5. Is the measured waveform within specifications?

**YES**

► Fault is intermittent caused by poor connection in wheel speed sensor harness, Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

► Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

- Check following point at wheel speed sensor which has abnormal waveform.
- Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.
- Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification Of Vehicle Repair" procedure.
- Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification Of Vehicle Repair" procedure.

## BR-166

## Brake System

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 50km/h or more(31mph or more))
4. Are any DTCs present ?

#### **YES**

- ▶ Go to the applicable troubleshooting procedure.

#### **NO**

- ▶ System performing to specification at this time.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

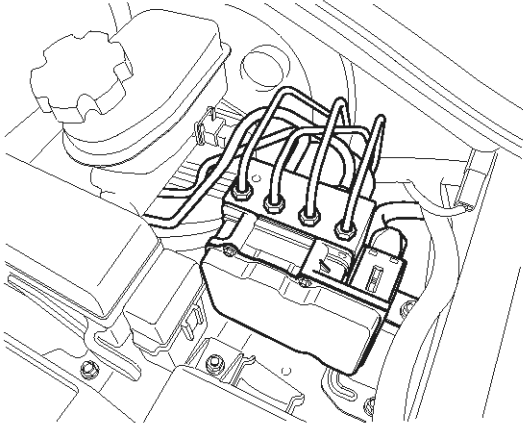
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



# ESP(Electronic Stability Program) System

**BR-167****C1235**

## COMPONENT LOCATION



SBLBR6003D

### General Description

The pressure sensor, installed in the HECU, sense the brake oil pressure to judge driver's brake intention when ESP is operating. If pressure of master cylinder is applied to pressure sensor, the strain of the piezo element is changed and then the resistance of bridge circuit is changed according to changed strain. Therefore this changed resistance changes output voltage of bridge circuit and output voltage changes linearly. The sensor output is a analog signal in proportion to supply voltage, and the HECU recognizes a pressure value according to signal ratio about supply voltage.

### DTC Description

Each unfiltered input signal voltage is monitored to be in the range of  $4.7\text{ V} < \text{input signal voltage} < 5.3\text{ V}$ . A failure is detected if the output signal value is out of specified range for more than 100 ms or pressure sensor self test form is out of specification during self test.

## BR-168

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage Monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	<ul style="list-style-type: none"> <li>Open or short of pressure sensor circuit</li> <li>Inoperative pressure sensor</li> <li>Inoperative HECU</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>A sensor supply failure is detected if Sensor Supply Voltage &gt; 5.3 V or Sensor Supply Voltage &lt; 4.7 V for t ≥ 60 ms.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A Fault is set if the DSO signal is voltage of DSO &gt; 4.7 V or voltage of DSO &lt; 0.3V for a time t ≥ 100 ms.</li> <li>- DSO : original pressure value.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A Fault is set if the DSI signal is voltage of DSI &gt; 4.7 V or voltage of DSI &lt; 0.3V for a time t ≥ 100 ms.</li> <li>- DSI : inverted pressure value.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A Fault is set if the voltage of DSO + DSI &gt; 5.5V or voltage of DSO + DSI &lt; 4.5V for a time t ≥ 100ms.</li> <li>- DSO : original pressure value.</li> <li>- DSI : inverted pressure value.</li> </ul>	
Case 5	Monitoring Period	<ul style="list-style-type: none"> <li>Once during Power Up</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>POS detects internal sensor malfunctions (sensor element, amplification, etc.). The POS is triggered if no low voltage is present and supply voltage is switched on. The test phase is divided in two 60 ms parts. DSO signal must be &lt; 0.5 V for 30 ms. In phase 2 DSO signal must be between 1.9V and 3.1V for also 30 ms then the POS Test is passed. The test phase is divided in two 60 ms parts. DSO and DSI signal must be &lt; 0.5 V for 30 ms. In phase 2 DSO and DSI signal must be between 1.9 V and 3.1 V for also 30 ms then the POS Test is passed. A fault is set if POS does not satisfy the above conditions</li> <li>- POS : Power on selftest.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>No Pressure Signal available..</li> <li>Sensor failure outside the ABS control cycle <ul style="list-style-type: none"> <li>- Only the ABS/ESP functions are inhibited, allow the EBD. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> </ul> </li> <li>Sensor failure inside the ABS control cycle <ul style="list-style-type: none"> <li>- Inhibit the ESP control, allow the EBD. The ESP warning lamps are activated. After the control, the ABS functions are inhibited. The ABS warning lamps are activated.</li> </ul> </li> </ul>	

# ESP(Electronic Stability Program) System BR-169

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Press the brake pedal.

1.2 CURRENT DATA			
*	BATTERY VOLTAGE	14.1 V	▲
*	STOP LAMP SWITCH	ON	
*	STEERING ANGLE SNSR	0 DEG	■
*	YAW RATE SNSR-LATERAL	0 G	
*	YAW RATE SNSR-YAW	0 deg/s	
*	PRESSUR SENSOR	114 bar	
	ABS WARNING LAMP	ON	
	EBD WARNING LAMP	ON	▼

FIX
SCRN
FULL
PART
GRPH
HELP

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed parameter according to braking force)

5. Whenever brake pedal is pushed down, is the pressure sensor's scantool data changed?

**YES**

▶ Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "Component Inspection" procedure.

## Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

4. Monitor the "Pressure Sensor" parameter on the Scantool.

Specification : Approx. 60 bar ~150 bar (There are difference in displayed parameter according to braking force)

EJBF502S

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

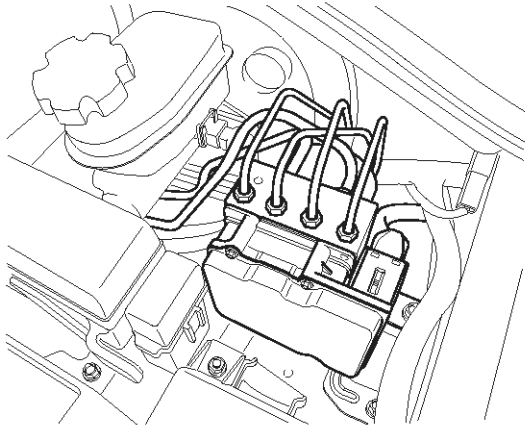


# BR-170

# Brake System

C1237

## COMPONENT LOCATION



SBLBR6003D

### General Description

The pressure sensor, installed in the HECU, sense the brake oil pressure to judge driver's brake intention when ESP is operating. If pressure of master cylinder is applied to pressure sensor, the strain of the piezo element is changed and then the resistance of bridge circuit is changed according to changed strain. Therefore this changed resistance changes output voltage of bridge circuit and output voltage changes linearly. The sensor output is an analog signal in proportion to supply voltage, and the HECU recognizes a pressure value according to signal ratio about supply voltage.

### DTC Description

With the driver torque demand and the lateral acceleration a driver braking demand is calculated. Unless the pump motor is operating or there is a brake signal, The offset compensation is executed. A failure is detected if offset value exceeded  $\pm 15$  bar.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Voltage Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Open or short of pressure sensor circuit</li> <li>Inoperative pressure sensor</li> <li>Inoperative HECU</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>After Pressure sensor initialization.</li> <li>No under voltage</li> <li>No pumps are running.</li> <li>No BLS-signal is set.</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>The pressure sensor-offset value must be in the range of <math>\pm 15</math> bar. A failure is detected if this range is exceeded.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Reduced function caused by faulty pressure sensor signal.</li> <li>Sensor failure outside the ABS control cycle                             <ul style="list-style-type: none"> <li>Only the ABS/ESP functions are inhibited, allow the EBD. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated.</li> </ul> </li> <li>Sensor failure inside the ABS control cycle                             <ul style="list-style-type: none"> <li>Inhibit the ESP control, allow the EBD. The ESP warning lamps are activated. After the control, the ABS functions are inhibited. The ABS warning lamps are activated.</li> </ul> </li> </ul>	

# ESP(Electronic Stability Program) System BR-171

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Press the brake pedal.

1.2 CURRENT DATA			
*	BATTERY VOLTAGE	14.1 V	▲
*	STOP LAMP SWITCH	ON	
*	STEERING ANGLE SNSR	0 DEG	■
*	YAW RATE SNSR-LATERAL	0 G	
*	YAW RATE SNSR-YAW	0 deg/s	
*	PRESSUR SENSOR	114 bar	
	ABS WARNING LAMP	ON	
	EBD WARNING LAMP	ON	▼

FIX
SCRN
FULL
PART
GRPH
HELP

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed parameter according to braking force)

5. Whenever brake pedal is pushed down, is the pressure sensor's scantool data changed?

**YES**

▶ Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "Component Inspection" procedure.

## Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

4. Monitor the "Pressure Sensor" parameter on the Scantool.

Specification : Approx. 60 bar ~150 bar (There are difference in displayed parameter according to braking force)

**NO**

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

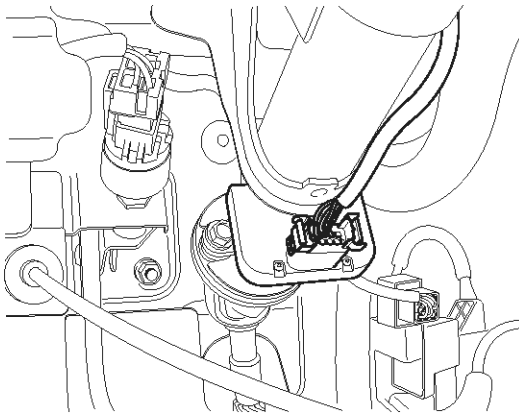
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

EJBF502S

**BR-172****Brake System****C1260****COMPONENT LOCATION**

SBLBR6520D

**General Description**

The Steering angle sensor(SAS) is joined to the multi function switch and uses a CAN communication. The SAS is used to determine turning direction and speed of the steering wheel. The HECU uses the signals from the SAS when performing ESP-related calculations.

**DTC Description**

If the SAS signal is different from calculated value by yaw-rate sensor and wheel speed sensor, mechanically impossible SAS signal is detected, there is a difference between SAS signal and driving condition of the vehicle calculated from yaw-rate sensor and lateral G sensor, a failure is detected.

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



## ESP(Electronic Stability Program) System


BR-173

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal Monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	<ul style="list-style-type: none"> <li>Open or short of steering angle sensor circuit</li> <li>Inoperative steering angle sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered SAS-value is equivalent to the offset. If the offset value exceeds a threshold of approximately 15 deg a SAS-fault is determined. Failure detection time depends on the driving distance, vehicle speed and on the amount of failed SAS signal. Within 30 km of symmetrical driving the calculated offset corresponds to the sensor offset.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (If the following conditions are satisfied)               <ol style="list-style-type: none"> <li>After SAS-initialization and vehicle reference speed &gt; 1.4 m/s (5 km/h)</li> <li>No under voltage</li> <li>At least one SAS-message was sent in the current 20 ms-cycle.</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A SAS-gradient-failure is set, if               <ol style="list-style-type: none"> <li>Signal gradient (steering angle velocity) from one 20 ms-cycle to another is higher than 40° or</li> <li>Change of this gradient (steering angle acceleration) is higher than 15° : <math> (LwlnK0K1 - LwlnK1K2)  &gt; 15^\circ</math> and <math> (LwlnK0K1 + LwlnK1K2)  &gt; 15^\circ</math> <ul style="list-style-type: none"> <li>- LwlnK0K1 : Difference of the SAS-signal between the current 20 ms-cycle and the last 20 ms-cycle.</li> <li>- LwlnK1K2 : Difference of the SAS-signal between the last 20 ms-cycle and 20 ms-cycle before.</li> </ul> </li> </ol> </li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (After initialization and no under voltage detected)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If value is higher than 665° + 90° tolerance for more than 300 ms a fault is determined.</li> </ul>	

## BR-174

## Brake System

Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during driving)</li> </ul>	<ul style="list-style-type: none"> <li>Open or short of steering angle sensor circuit</li> <li>Inoperative steering angle sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>Based on a vehicle model a reference SAS signal is build. The difference between measured SAS signal and SAS signal calculated from yaw-rate sensor signal is evaluated for fault detection.</li> <li>Dependent on the driving conditions failures in size of <math>[10 + 60 \text{ m/s} / \text{vehicle reference speed}] \text{ deg}</math> at steering angle are recognized within 400 ~ 4800 ms through three possible recognition paths:               <ol style="list-style-type: none"> <li>Curve Branch (lateral <math>G &gt; 2 \text{ m/s}^2</math> and left and right curve driving)</li> <li>Stability Branch (no large wheel speed differences and stable acceleration)</li> <li>Straight ahead Branch (lateral <math>G &lt; 0.5 \text{ m/s}^2</math> and yaw rate <math>&lt; 2 \text{ deg/s}</math>).</li> </ol> <li>The recognition time depends on the active branch (the time is shorter in a relation 1):2):3)-4:2:1) and the value of the permissible time threshold dependent on the deviation between the compared signals (small deviation → long detection time, large deviation → small detection time).</li> </li></ul>	
Case 5	Monitoring Period	<ul style="list-style-type: none"> <li>Initialization once in every ignition cycle.</li> <li>The monitoring is active until a reset by a change in the SAS signal or until a right and left cornering can be recognized.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If there is no change in the signal, but a right and left cornering has been recognized, a fault is determined. (lateral <math>G &gt; 2 \text{ m/s}^2</math> in combination with a yaw rate <math>&gt; 6 \text{ }^\circ/\text{s}</math> in both directions)</li> <li>- At a minimum change of e.g. <math>5^\circ</math> in the signal, the monitoring is reset.</li> </ul>	
Case 6	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during driving)</li> </ul>	<ul style="list-style-type: none"> <li>Open or short of steering angle sensor circuit</li> <li>Inoperative steering angle sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>The measured yaw rate and the yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals don't fit and forwards driving is detected, a fault is determined</li> </ul>	
Case 7	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during driving)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Under normal conditions, two SAS messages are sent in one 20 ms cycle, which is shown by an increase of the message counter by 2. If the message counter shows an increase higher than 3 or lower than 1 in one 20 ms-cycle, a fault is stored after 160 ms.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Reduced controller function caused by inoperative SAS signal . ABS/EBD control is available.</li> <li>The ESP warning lamp is activated.</li> </ul>	

# ESP(Electronic Stability Program) System

# BR-175

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".

3. Turn the steering wheel to the left or right.
4. Monitor the "Steering Angle Sensor" parameters on the Scantool.

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.1 V	
* STOP LAMP SWITCH	ON	
* STEERING ANGLE SNSR	0 DEG	
* YAW RATE SNSR-LATERAL	0 G	
* YAW RATE SNSR-YAW	0 deg/s	
* PRESSUR SENSOR	114 bar	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON". Normal data

SCMBR6547L

5. Whenever steering wheel is turned, is the steering sensor's scantool data changed?

**YES**

- 3) Turn the steering wheel to the full left or right position.
- 4) Monitor the "steering sensor" parameters on the Scantool.

- 1) Connect scantool to Data Link Connector (DLC).
- 2) Ignition "ON" & Engine "ON".

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.1 V	
* STOP LAMP SWITCH	OFF	
* STEERING ANGLE SNSR	-589 DEG	
* YAW RATE SNSR-LATERAL	0 G	
* YAW RATE SNSR-YAW	0 deg/s	
* PRESSUR SENSOR	0 bar	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	

Fig2

Fig 2) Test Condition : Ignition "ON" & Engine "ON". Normal data (Right side)

1.2 CURRENT DATA		
* BATTERY VOLTAGE	14.1 V	
* STOP LAMP SWITCH	OFF	
* STEERING ANGLE SNSR	593 DEG	
* YAW RATE SNSR-LATERAL	0 G	
* YAW RATE SNSR-YAW	0 deg/s	
* PRESSUR SENSOR	0 bar	
ABS WARNING LAMP	ON	
EBD WARNING LAMP	ON	

Fig3

Fig 3) Test Condition : Ignition "ON" & Engine "ON". Normal data (Left side)

SCMBR6548L

## BR-176

## Brake System

5) Is parameter displayed within specifications?

**YES**

▶ Go to "W/Harness Inspection" procedure.

**NO**

▶ Go to number 6. procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

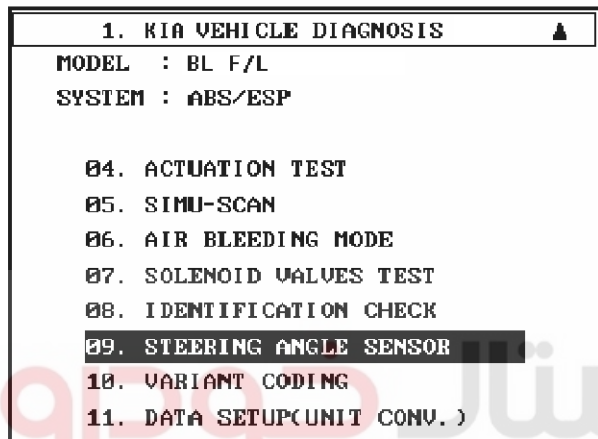


Fig4

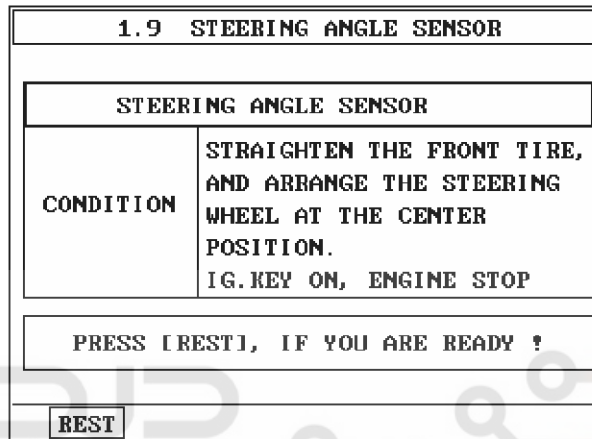


Fig5

7) Whenever steering wheel is turned, is the steering sensor's scantool data changed HIGH/LOW?

**YES**

▶ Fault is intermittent caused by poor connection in steering sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

6. Perform steering angle sensor calibration.

- 1) Ignition "ON" & Engine "OFF".
- 2) Line up the steering wheel in a straight.
- 3) Connect scantool to Data Link Connector(DLC).
- 4) Go in Anti-Rock brake system. (figure 4).
- 5) Perform steering angle sensor calibration. (figure 5).
- 6) Go to "Component Inspection" Procedure.

### Terminal and Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Component Inspection" procedure.

SBLBR6544L

# ESP(Electronic Stability Program) System

## BR-177

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Operate the vehicle within DTC Detecting Condition in General Information. (turn right and left at least 1 time)
6. Select "Diagnostic Trouble Codes (DTCs)" mode again.
7. Are any DTCs present ?

**YES**

- 1) Substitute with a known-good steering angle sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.
- 2) Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

**NO**

- Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

- Go to the applicable troubleshooting procedure.

**NO**

- System performing to specification at this time.



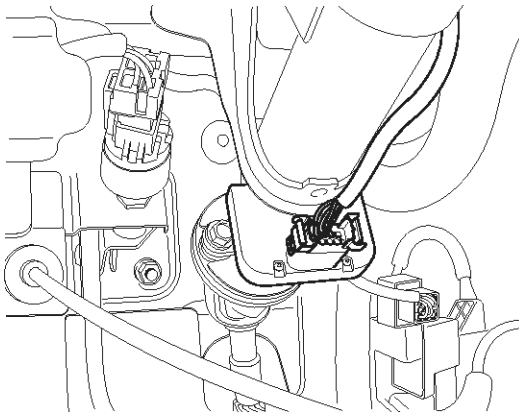


## BR-178

## Brake System

C1261

## COMPONENT LOCATION



SBLBR6520D

## General Description

The Steering angle sensor(SAS) is joined to the multi function switch and uses a CAN communication. The SAS is used to determine turning direction and speed of the steering wheel. The HECU uses the signals from the SAS when performing ESP-related calculations.

## DTC Description

The SAS used for ESP control needs zero point adjustment because the SAS measures an absolute angle. Zero point adjustment is done by using the scantool device. If abnormal zero point adjustment is detected, a failure is recognized.

## DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Signal Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>A fail of SAS zero point adjustment</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>During SAS zero point adjustment.</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>The position of steering wheel is out of specified range (straight position, a max. error <math>\pm 5^\circ</math>) during SAS zero point adjustment.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Reduced controller function caused by inoperative SAS signal. ABS /EBD control is available.</li> <li>The ESP warning lamp is activated.</li> </ul>	

# ESP(Electronic Stability Program) System BR-179

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".

3. Monitor the "SAS CALIBRATED" parameters on the Scantool.

Specification : YES

1.2 CURRENT DATA			
* BATTERY VOLTAGE	14.1	U	▲
* STOP LAMP SWITCH	OFF		
* STEERING ANGLE SNSR	0	DEG	■
* SAS CALIBRATED	YES		
* YAW RATE SNSR-LATERAL	0	G	
* YAW RATE SNSR-YAW	0	deg/s	
PRESSUR SENSOR	0	bar	
ABS WARNING LAMP	ON		▼

Fig1

Fig 1) SAS Calibrate normal data - YES : SAS calibrated, NO : SAS not calibrated.

4. Is parameter displayed within specifications?

**YES**

► Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" procedure.

## Component Inspection

1. Line up wheels like (figure 1).
  - 1) Perform the wheel alignment.
  - 2) Line up the steering wheel in a straight.
  - 3) Go ahead and Go back the vehicle 2~3 times without holding steering wheel.
2. Connect scantool to Data Link Connector(DLC).
3. Go in Anti-Lock brake system. (figure 2).
4. Perform steering angle sensor calibration. (figure 3).
5. Disconnect scantool.
6. Check the condition of SAS zero point adjustment by operating the vehicle (turn right and left at least 1 time)

SCMBR6550L

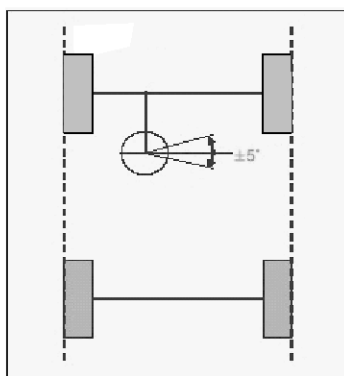


Fig1

1. KIA VEHICLE DIAGNOSIS
MODEL : BL F/L
SYSTEM : ABS/ESP
04. ACTUATION TEST
05. SIMU-SCAN
06. AIR BLEEDING MODE
07. SOLENOID VALVES TEST
08. IDENTIFICATION CHECK
<b>09. STEERING ANGLE SENSOR</b>
10. VARIANT CODING
11. DATA SETUP(UNIT CONV.)

Fig2

1.9 STEERING ANGLE SENSOR	
STEERING ANGLE SENSOR	
CONDITION	STRAIGHTEN THE FRONT TIRE, AND ARRANGE THE STEERING WHEEL AT THE CENTER POSITION. IG.KEY ON, ENGINE STOP
PRESS [REST], IF YOU ARE READY ?	
<b>REST</b>	

Fig3

SBLBR6511L

**BR-180****Brake System**

7. Is zero point adjustment completed?

**YES**

- ▶ Go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**Verification of Vehicle Repair**

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

- ▶ Go to the applicable troubleshooting procedure.

**NO**

- ▶ System performing to specification at this time.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

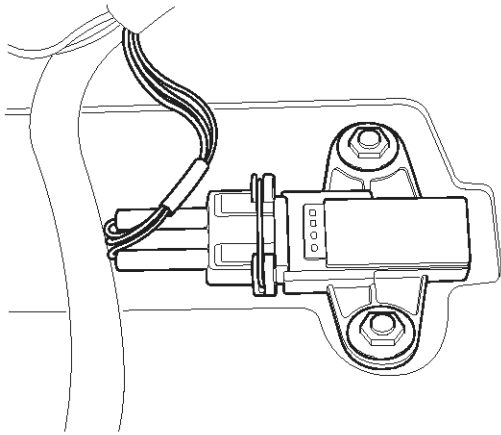


# ESP(Electronic Stability Program) System

# BR-181

C1274

## COMPONENT LOCATION



SBLBR6553D

### General Description

The 4WD vehicle measures the G-sensor signal to solve for 4WD vehicle unique problems. For example all 4 wheels are locked early on a low-friction road or control response is delayed when road friction coefficients vary. The HECU uses a filtered signal, as a supplementary value, to determine the road friction coefficient. This value is used for the accurate calculations of assumed vehicle speed, or precise division of control starting points.

### DTC Description

The HECU monitors the G-sensor signal continuously, and sets this code if the abnormal G-sensor signal is detected or the difference between the value calculated from vehicle speed deviation and measured value is out of range when the vehicle isn't decelerating (brake switch is OFF).

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Open or short of G-Sensor circuit</li> <li>Faulty G-Sensor</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>When the voltage of G-sensor signal is <math>&gt; 4.7V</math> or <math>&lt; 0.3V</math> continuously.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>ABS functions are inhibited, EBD function is allowed and the ABS warning lamps are activated.</li> </ul>	

# BR-182

# Brake System

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

3. Monitor the "G-sensor" parameter on the Scantool.

Specification : Approx.  $\pm 0.01G$

1.2 CURRENT DATA	
※ BATTERY VOLTAGE	14.2 U
※ WHEEL SPD SNSOR-FL	0.0 Km/h
※ WHEEL SPD SNSOR-FR	0.0 Km/h
※ WHEEL SPD SNSOR-RL	0.0 Km/h
※ WHEEL SPD SNSOR-RR	0.0 Km/h
G SENSOR	0.0 G

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Normal Data

4. Is parameter displayed within specifications?

**YES**

▶ Fault is intermittent caused by poor connection in G-sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

SBLBR6512L

## Terminal and Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Power Circuit Inspection" procedure.

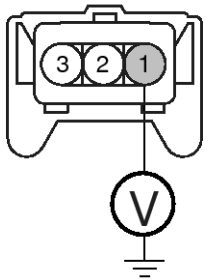
# ESP(Electronic Stability Program) System

# BR-183

## Power Circuit Inspection

1. Ignition "ON" & Engine "OFF".

<M02>



1. Battery (+)

2. Measure voltage between terminal "1" of the G-sensor harness connector and chassis ground.

Specification : Approx. B+

SBLBR6548L

3. Is the measured voltage within specifications?

**YES**

▶ Go to "Signal Circuit Inspection" procedure.

**NO**

▶ Check for open or short in the power harness between terminal "23" of the HECU harness connector and terminal "1" of the G-sensor harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Ground Circuit Inspection

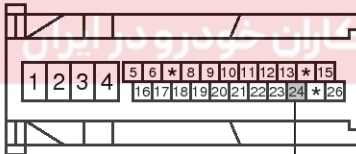
1. Ignition "OFF".

2. Disconnect G-sensor connector.

3. Measure resistance between terminal "3" of the G-sensor harness connector and terminal "24" of the HECU harness connector.

Specification : Approx. below 1Ω

<E10>



<M02>



3. Ground

4. Is the measured resistance within specifications?

**YES**

▶ Go to "Signal Circuit inspection" procedure.

**NO**

▶ Check for damaged harness and poor connection between terminal "3" of the G-sensor harness connector and terminal "24" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF".

2. Measure voltage between terminal "21" of the HECU harness connector and chassis ground.

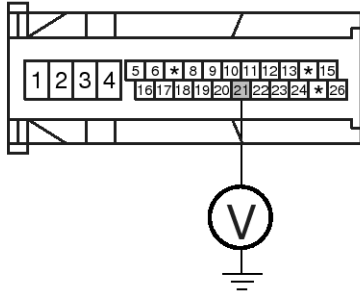
Specification : Approx. 2.5V

SBLBR6549L

## BR-184

## Brake System

&lt;E10&gt;



21. G-sensor Signal

SBLBR6550L

3. Is the measured voltage within specifications?

**YES**

► Fault is intermittent caused by open or short G-sensor and/or faulty G-sensor or was repaired and HECU memory was not cleared. Go to "Component Inspection" procedure.

**NO**

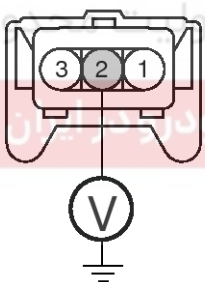
► Check for open or short in the G-sensor harness between terminal "2" of the G-sensor harness connector and terminal "21" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**Component Inspection**

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "2" of the G sensor harness connector and chassis ground.

Specification : Approx. 2.5V

&lt;M02&gt;



2. Signal

SBLBR6551L

3. Is the measured voltage within specifications?

**YES**

► Fault is intermittent caused by open or short G-sensor and/or faulty G-sensor or was repaired and HECU memory was not cleared. Go to "Component Inspection" procedure.

**NO**

► Substitute with a known-good G sensor and check for proper operation. If problem is corrected, replace G sensor and then go to "Verification Of Vehicle Repair" procedure.

**Verification of Vehicle Repair**

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

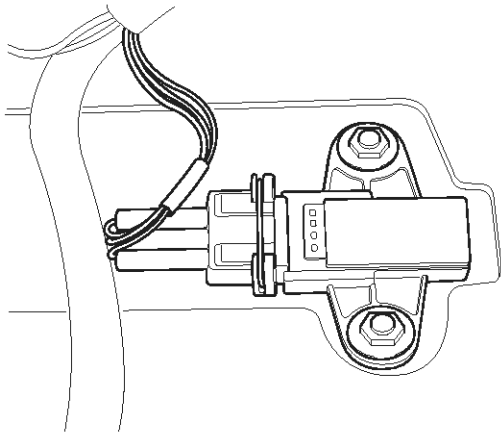
► System performing to specification at this time.

# ESP(Electronic Stability Program) System

# BR-185

C1275

## COMPONENT LOCATION



SBLBR6553D

### General Description

The 4WD vehicle measures the G-sensor signal to solve for 4WD vehicle unique problems. For example all 4 wheels are locked early on a low-friction road or control response is delayed when road friction coefficients vary. The HECU uses a filtered signal, as a supplementary value, to determine the road friction coefficient. This value is used for the accurate calculations of assumed vehicle speed, or precise division of control starting points.

### DTC Description

The HECU monitors the G-sensor signal continuously, and sets this code if the abnormal G-sensor signal is detected or the difference between measured longitudinal acceleration and longitudinal acceleration by differentiating vehicle speed is out of range when the vehicle isn't decelerating (brake switch is OFF).

### DTC Detecting Condition

Item	Detecting Condition	Possible cause	
DTC Strategy	<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Improper installation of G-Sensor</li> <li>Abnormal Rotor and wheel bearing</li> <li>Faulty G-Sensor</li> </ul>	
Case 1	Monitoring Period		<ul style="list-style-type: none"> <li>Continuous (If no under voltage, no BLS, no BLS failure is detected)</li> </ul>
	Enable Conditions		<ul style="list-style-type: none"> <li>If the G sensor signal is more than 0.4G for more than 20sec.</li> </ul>
Case 2	Monitoring Period		<ul style="list-style-type: none"> <li>Continuous (If no under voltage, no ABS control)</li> </ul>
	Enable Conditions		<ul style="list-style-type: none"> <li>the difference between measured longitudinal acceleration and longitudinal acceleration by differentiating vehicle speed exceeds the threshold (Approx. 1.5G). a fault is recognized after 2s.</li> </ul>
Fail Safe	<ul style="list-style-type: none"> <li>ABS function is inhibited, EBD function is allowed and the ABS warning lamps are activated.</li> </ul>		



## BR-186

## Brake System

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".

3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more (6mph or more) and then accelerate and decelerate the vehicle several times.

4. Monitor the "G-sensor" parameter on the Scantool.

Specification : Below 0.4G (at a uniform speed)

It is a normal condition if the data is changed at accelerating or decelerating vehicle

1.2 CURRENT DATA	
※ BATTERY VOLTAGE	14.2 V
※ WHEEL SPD SNSOR-FL	10.0 Km/h
※ WHEEL SPD SNSOR-FR	10.0 Km/h
※ WHEEL SPD SNSOR-RL	10.0 Km/h
※ WHEEL SPD SNSOR-RR	10.0 Km/h
G SENSOR	0.0 G

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Normal Data

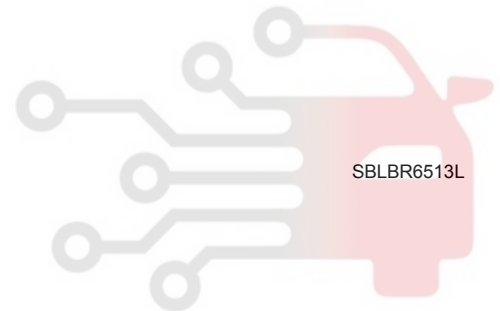
5. Is parameter displayed within specifications?

**YES**

▶ Fault is intermittent caused by faulty G-Sensor or was repaired and HECU memory was not cleared. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "Component Inspection" procedure.

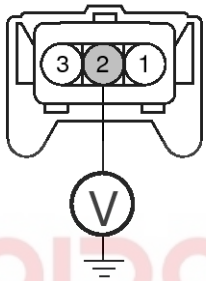


# ESP(Electronic Stability Program) System

## BR-187

### Component Inspection

<M02>



2. G sensor signal

5. Isn't the measured waveform fixed and is the measured waveform changed normally?

**YES**

► Fault is intermittent caused by improper installation of G-Sensor, abnormal Rotor and wheel bearing, and/or faulty G-sensor or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

**NO**

► Fault is intermittent caused by improper installation of G-Sensor, abnormal Rotor and wheel bearing, and/or faulty G-sensor or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

1. Check improper installation of G-sensor. If NG, repair as necessary and go to "Verification Of Vehicle Repair" procedure.
2. Check damage of rotor teeth or wheel bearing. If NG, repair as necessary and go to "Verification Of Vehicle Repair" procedure.
3. Ignition "ON" & Engine "OFF".
4. Measure waveform between terminal "2" of the G sensor harness connector and chassis ground by using an oscilloscope.

Specification :

Approx. 2.5V (standstill)

0.3V ~ 4.7V (acceleration or deceleration)

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed is approx. 10km/h or more (6mph or more))
4. Are any DTCs present?

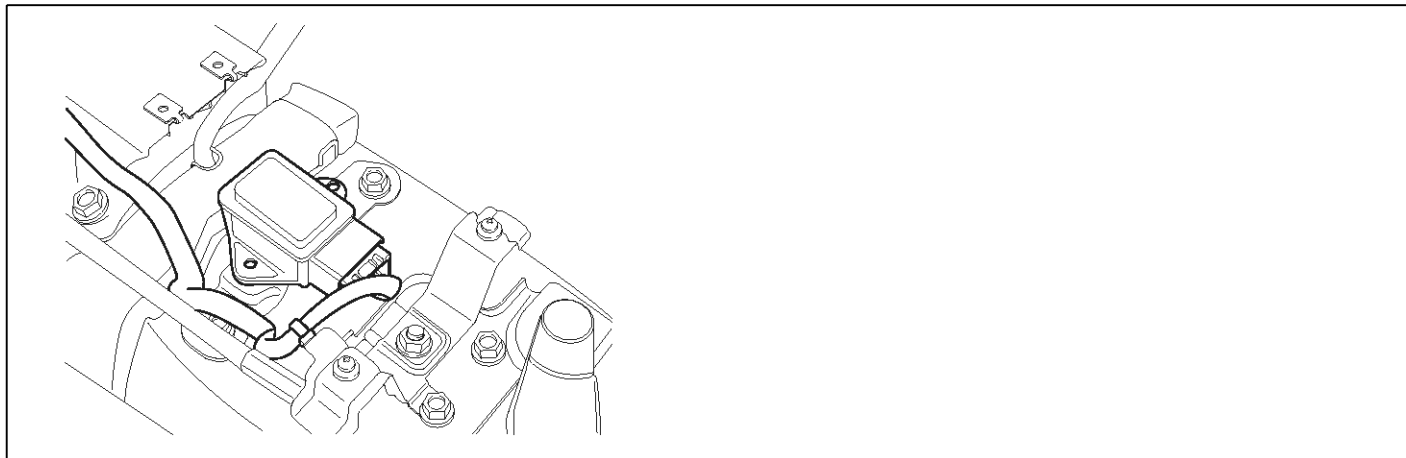
**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.

SBLBR6552L

**BR-188****Brake System****C1282****COMPONENT LOCATION**

EJBF503C

**General Description**

The yaw-rate and G sensor assembly is installed on the lower floor. The yaw-rate sensor detects acceleration of the vehicle around its vertical axis, while the G sensor detects lateral acceleration of the vehicle. When the vehicle is not moving, the G sensor output is approximately 2.5 V.

**DTC Description**

The HECU monitors a signal voltage of either yaw-rate sensor or lateral G sensor to detect open or short to battery or short to ground. A failure is detected if the lateral acceleration sensor or yaw rate sensor signal voltage stays in the fault range longer than 100 ms or the lateral acceleration sensor or yaw rate sensor reference voltage stays in the fault range longer than 200 ms, or the self test form is against specification during self test.

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# ESP(Electronic Stability Program) System

## BR-189

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
Case 1	DTC Strategy	<ul style="list-style-type: none"> <li>Voltage Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative Yaw Rate &amp; Lateral G sensor</li> <li>Open or short of Yaw Rate &amp; Lateral G sensor</li> <li>Inoperative HECU</li> </ul>
	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A line fault is detected if <math>V[LG] &lt; 0.3 \text{ V}</math> or <math>V[LG] &gt; 4.7 \text{ V}</math> for a time <math>t \geq 100\text{ms}</math>.</li> <li>A line fault is detected if <math>V[YAW] &lt; 0.225 \text{ V}</math> OR <math>V[YAW] &gt; 4.774 \text{ V}</math> for a time <math>t \geq 100 \text{ ms}</math>.</li> <li>A line fault is detected if <math>V[YAW \text{ REFERENCE}] &lt; 2.1 \text{ V}</math> OR <math>V[YAW \text{ REFERENCE}] &gt; 2.9 \text{ V}</math> for a time <math>t \geq 200 \text{ ms}</math>.</li> </ul>	
Case 2	DTC Strategy	<ul style="list-style-type: none"> <li>Selftest Monitoring</li> </ul>	
	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up and no low voltage.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A line fault is detected if <math>0.2 \text{ V} &lt; V[LG] &lt; 0.8 \text{ V}</math> isn't continued for a time <math>t \geq 60 \text{ ms}</math> during POS (POS : power on selftest)</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Reduced controller function.</li> <li>Inhibit the ESP control and ABS/EBD control is available.</li> <li>The ESP warning lamps are activated.</li> </ul>	

# BR-190

# Brake System

## Monitor Scantool Data

1. Connect scantool to Data Link Connector (DLC).
2. Ignition "ON".

1.2 CURRENT DATA			
* BATTERY VOLTAGE	14.1 V		▲
* STOP LAMP SWITCH	OFF		
* STEERING ANGLE SNSR	0 DEG		■
* YAW RATE SNSR-LATERAL	0 G		
* YAW RATE SNSR-YAW	0 deg/s		
* PRESSUR SENSOR	0 bar		
ABS WARNING LAMP	ON		
EBD WARNING LAMP	ON		

FIX   SCRN   FULL   PART   GRPH   HELP

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed Normal data)

4. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "W/Harness Inspection" procedure.

3. Monitor the "Yaw rate sensor-lateral & Yaw rate sensor-yaw" parameter on the Scantool.

Specification : Lateral G sensor : ± 0 G, YAW rate Sensor : ± 0 deg/s

## Terminal & Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

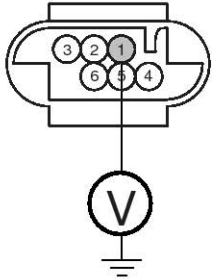
► Go to "Power Circuit Inspection" procedure.

SCMBR6552L

# ESP(Electronic Stability Program) System BR-191

## Power Supply Circuit Inspection

1. Ignition "ON" & Engine "OFF".



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal

2. Measure voltage between terminal "1" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 5 V

SBLBR6553L

3. Is the measured voltage within specifications?

**YES**

- ▶ Go to "Ground Circuit Inspection" procedure.

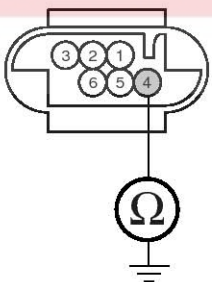
**NO**

- ▶ Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "1" of the Yaw Rate & Lateral G sensor harness connector and battery +. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect Yaw Rate & Lateral G sensor connector.
3. Measure resistance between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. below 1Ω



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal

SBLBR6554L

# BR-192

# Brake System

4. Is the measured resistance within specifications?

**YES**

▶ Go to "Signal Circuit Inspection" procedure.

**NO**

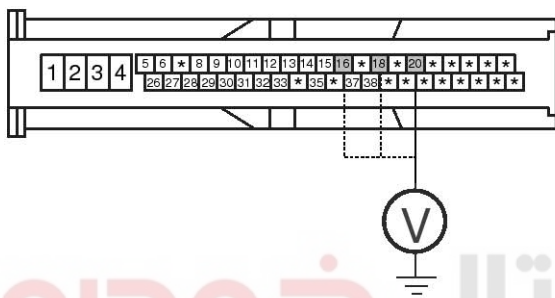
▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and terminal "15" of the HECU harness connector . Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "16, 18, 20" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5V ( Voltage between terminal "16,20" of the HECU harness connector and chassis ground.)

Specification : Approx. above 2.1V and below 2.9V ( Voltage between terminal "18" of the HECU harness connector and chassis ground.)



- 16. Yaw-Rate sensor signal
- 18. Yaw-Rate reference line
- 20. Lateral G sensor signal

3. Is the measured voltage within specifications?

**YES**

▶ Go to "Self Test Circuit Inspection" procedure.

**NO**

▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "6, 3, 5" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 18, 20" of the chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Go to "Component Inspection" procedure.

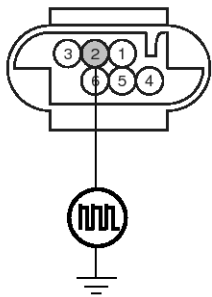
## Self Test Circuit Inspection

1. Measure waveform between terminal "2" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

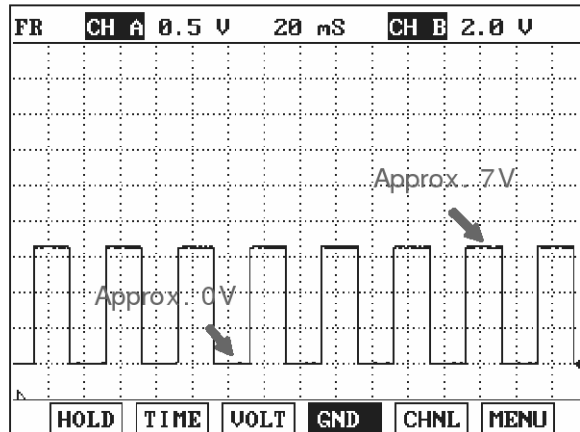
SBLBR6555L

# ESP(Electronic Stability Program) System

# BR-193



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal



Yaw-Rate self test line - Channel B

SBLBR6514L

2. Is the measured waveform within specifications?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

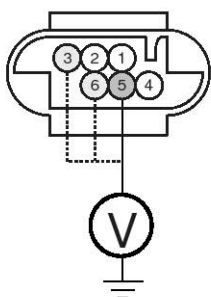
▶ Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "2" of the Yaw Rate & Lateral G sensor harness connector and terminal "37" of the chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "3,5,6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5V ( Voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)

Specification : Approx. above 2.1 V and below 2.9 V ( Voltage between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal

SBLBR6515L



**BR-194****Brake System**

3. Is the measured voltage within specifications?

**YES**

► Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification Of Vehicle Repair" procedure.

**Verification of Vehicle Repair**

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



# ESP(Electronic Stability Program) System

**BR-195****C1283****COMPONENT LOCATION**

EJBF503C

**General Description**

The yaw-rate and G sensor assembly is installed on the lower floor. The yaw-rate sensor detects acceleration of the vehicle around its vertical axis, while the G sensor detects lateral acceleration of the vehicle. When the vehicle is not moving, the G sensor output is approximately 2.5 V.

**DTC Description**

A lateral acceleration reference signal is calculated from the wheel speeds, the steering angle and the yaw rate signals to observe the lateral acceleration sensor signal. The difference between the reference signal and the sensor signal is evaluated for failure detection. A yaw rate reference signal is calculated from the wheel speeds, the steering angle and the lateral acceleration signals to observe the yaw rate sensor signal. The difference between the reference signal and the sensor signal, and the gradient of the measured sensor signal is evaluated for the failure detection. If the difference between estimated value and measured value of the sensor is larger than predefined value for predefined time, the failure is recognized. Plausibility faults (signals received which fall outside of the sensor characteristics) are also recognized.

## BR-196

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Signal Monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during stable driving)</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative Yaw Rate &amp; Lateral G sensor</li> <li>Open or short of Yaw Rate &amp; Lateral G sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>By building a reference lateral G from the yaw-rate sensor, wheel speed sensor and the SAS it is possible to test the lateral G Signal on plausibility. If during stable vehicle behavior an lateral G Failure larger than approximately 2.5 m/s<sup>2</sup> occurs, the ESP controller will disregard the lateral G sensor information so that a false ESP intervention is prevented. A fault is recognized after 1.6 s during model validity.</li> <li>The measured and offset compensated yaw rate signal is compared to the reference yaw rate signal calculated from yaw rate sensor, lateral G sensor, SAS and wheel speed sensor. If the measured yaw rate deviates more than 2.5 °/s plus a dynamic threshold from the reference yaw rate during model validity, a failure is recognized after 1.6 s. The dynamic threshold is between 2.5°/s and more than 5°/s. A typical value is 3°/s.</li> <li>- During the possibility to observe the recognition time depends on the amount of failure.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during driving)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered later G value is equivalent to the offset. If the offset value exceeds a threshold of approximately 2.25 m/s<sup>2</sup> an later G fault is determined. Failure detection time depends on the driving distance, vehicle speed and on the amount of failed later G signal. Within 30 km of symmetrical driving the calculated offset corresponds to the sensor offset.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (If no under voltage is detected)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A fault is detected If the lateral G is higher than 15 m/s<sup>2</sup> for more than 800 ms.</li> </ul>	

## ESP(Electronic Stability Program) System

BR-197

Item		Detecting Condition	Possible cause
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (during standstill)</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative Yaw Rate &amp; Lateral G sensor</li> <li>Open or short of Yaw Rate &amp; Lateral G sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>If the filtered value of <math> \text{lateral G} </math> is larger than <math>7 \text{ m/s}^2</math> for more than 400 m/s a fault is set.</li> </ul>	
Case 5	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (dependent on driving situation)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Standstill compensation : <ul style="list-style-type: none"> <li>The offset corresponds to the measured and filtered input value. Failure threshold <math>5.25 \text{ }^\circ/\text{s}</math>.</li> </ul> </li> <li>Fast compensation (during driving if no standstill compensation could be completed): <ul style="list-style-type: none"> <li>The offset corresponds to the slightly filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, lateral G sensor and wheel speed sensor. Failure threshold is <math>7.5 \text{ }^\circ/\text{s}</math>.</li> </ul> </li> <li>Long-term ("normal") compensation (during driving after successful standstill or fast offset compensation): <ul style="list-style-type: none"> <li>The offset corresponds to the strong filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, lateral G sensor and wheel speed sensor. Failure threshold is <math>7.5 \text{ }^\circ/\text{s}</math></li> </ul> </li> </ul>	
Case 6	Monitoring Period	<ul style="list-style-type: none"> <li>After every standstill.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Yaw-rate sensor sensitivity is estimated by comparison of the measured yaw rate and the yaw rates calculated from the wheel speed sensor and SAS during cornering. The fault criteria is approx. 25% sensitivity.</li> <li>The measured yaw rate and the model yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals doesn't fit and forward driving is reconized, a fault is determined. <ul style="list-style-type: none"> <li>Driving with a yaw rate of e.g. <math>10 \text{ }^\circ/\text{s}</math> requires a time of 3s and additional time to reach a velocity 20 m/s to recognize forward driving.</li> </ul> </li> </ul>	

## BR-198

## Brake System

Item		Detecting Condition	Possible cause
Case 7	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (after initialization of the YRS and if no under voltage is detected)</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative Yaw Rate &amp; Lateral G sensor</li> <li>Open or short of Yaw Rate &amp; Lateral G sensor</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>The yaw rate sensor BITE logic evaluates the BITE-signal by extraction of the measured yaw rate of the vehicle. The allowed range for the BITE-signal is <math>25 \text{ }^\circ/\text{s} \pm 7 \text{ }^\circ/\text{s}</math>. If the BITE-signal is not in the allowed range, a suspected failure bit is set after 200 ms. A failure is set within 400 ms.</li> </ul>	
Case 8	Monitoring Period	<ul style="list-style-type: none"> <li>After YRS-initialization, no under voltage</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Depending on the driving conditions a signal gradient higher than <math>10 \sim 23 \text{ }^\circ/\text{s} / 40 \text{ ms}</math> sets a suspected failure bit after 280 ms, unless a single signal peak is recognized by a peakfilter. A failure is set, if the good check is not settled successfully after 10 s.</li> </ul>	
Case 9	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (except spinning, use of handbrake, unsteady driving conditions or a detected under voltage)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>During standstill <ul style="list-style-type: none"> <li>The allowed range of the yaw rate sensor signal is <math>\pm 30 \text{ }^\circ/\text{s}</math>. Leaving this range for 5 s sets a fault. In case of driving off after the failure was present for longer than 500 ms during standstill, the fault is detected immediately.</li> </ul> </li> <li>While driving <ul style="list-style-type: none"> <li>The allowed range of the yaw rate sensor signal is <math>\pm 94.75 \text{ }^\circ/\text{s}</math> and a suspected failure bit is set, if the signal is out of this range for 500 ms. A fault is set after 1 s.</li> </ul> </li> </ul>	
Case 10	Monitoring Period	<ul style="list-style-type: none"> <li>Once after power up and no low voltage.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A line fault is detected if <math>0.2\text{V} &lt; \text{VLG} &lt; 0.8\text{V}</math> isn't continued for a time <math>t \geq 60\text{ms}</math> during POS (POS : power on selftest)</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Reduced controller function.</li> <li>Inhibit the ESP control and ABS/EBD control is available.</li> <li>The ESP warning lamps are activated.</li> </ul>	

# ESP(Electronic Stability Program) System BR-199

## Monitor Scantool Data

1. Connect scantool to Data Link Connector (DLC).
2. Ignition "ON".

3. Monitor the "Yaw rate sensor-lateral & Yaw rate sensor-yaw" parameter on the Scantool.

Specification : Lateral G sensor :  $\pm 0$  G, YAW rate Sensor :  $\pm 0$  deg/s

1.2 CURRENT DATA			
* BATTERY VOLTAGE	14.1	V	▲
* STOP LAMP SWITCH	OFF		
* STEERING ANGLE SNSR	0	DEG	■
* YAW RATE SNSR-LATERAL	0	G	
* YAW RATE SNSR-YAW	0	deg/s	
* PRESSUR SENSOR	0	bar	
ABS WARNING LAMP	ON		
EBD WARNING LAMP	ON		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed Normal data)

4. Is parameter displayed within specifications?

**YES**

► Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "W/Harness Inspection" procedure.

SCMBR6552L

## Terminal & Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Power Circuit Inspection" procedure.

# BR-200

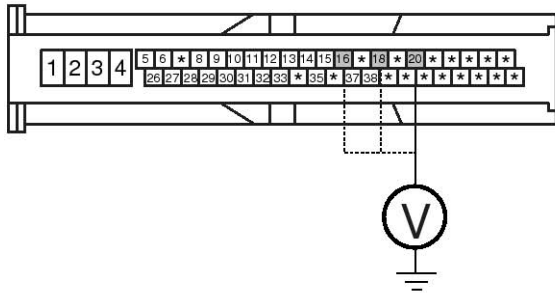
# Brake System

## Signal Circuit Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "16,18,20" of the HECU harness connector and chassis ground.

Specification : Approx. 2.5 V ( Voltage between terminal "16, 20" of the HECU harness connector and chassis ground.) If the voltage of the yaw & lateral G sensor is changed within normal voltage range (approx. 0.1 ~ 4.9 V) during shaking it, it is in normal condition.

Specification : Approx. above 2.1 V and below 2.9 V ( Voltage between terminal "18" of the HECU harness connector and chassis ground.)



- 16. Yaw-Rate sensor signal
- 18. Yaw-Rate reference line
- 20. Lateral G sensor signal

SBLBR6555L

3. Is the measured voltage within specifications?

### YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### NO

▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "6, 3, 5" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 18, 20" of the HECU harness connector . Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Go to "Component Inspection" procedure.

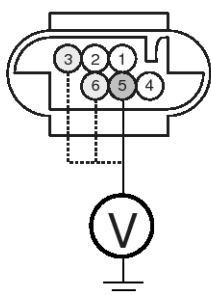
## Component Inspection

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "3, 5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5V ( Voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)

If the voltage of the yaw & lateral G sensor is changed within normal voltage range (approx. 0.1~4.9V) during shaking it, it is in normal condition.

Specification : Approx. above 2.1V and below 2.9V ( Voltage between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)



- 1. Battery +
- 2. Yaw-Rate self test line
- 3. Yaw-Rate reference line
- 4. Ground
- 5. Lateral G sensor signal
- 6. Yaw-Rate sensor signal

SBLBR6516L

# ESP(Electronic Stability Program) System

## BR-201

3. Is the measured voltage within specifications?

### YES

▶ Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness. Go to "Verification Of Vehicle Repair" procedure.

### NO

▶ Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace Yaw Rate & Lateral G sensor and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

### YES

▶ Go to the applicable troubleshooting procedure.

### NO

▶ System performing to specification at this time.

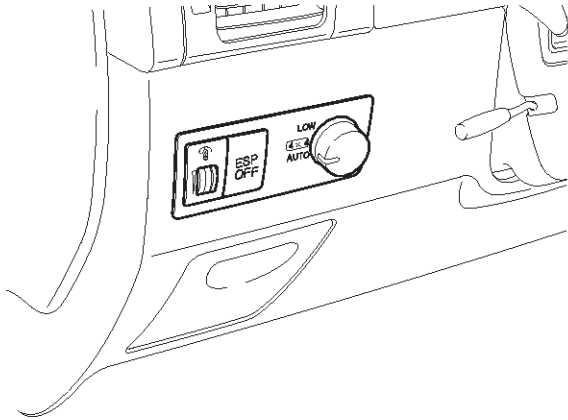
دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران





**BR-202****Brake System****C1503****COMPONENT LOCATION**

SBLBR6562L

**General Description**

Driver can inhibit the ESP control by ESC switch. When switch signal send into HECU, ESP warning lamp go ON and ESP control is stopped and if next switch signal is inputted again, ESP control is ready. This function is used for sporty driving or vehicle inspection.

**DTC Description**

Trouble code is set when the condition that the level of ESP switch is high is continued for 60 sec. When the ESP switch failure is set there is no signal in the warning lamp and HECU inhibit the ESP control and allow the ABS/EBD control.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Short circuit monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Open or short ESP switch</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>When the ESP switch is ON for 60 sec.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Inhibit the ESP control and allow the ABS/EBD control.</li> <li>The ESP warning lamps are activated.</li> </ul>	

# ESP(Electronic Stability Program) System

# BR-203

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "OFF".

3. Press the ESP SWITCH.
4. Monitor the "TCS/ESP SWITCH" parameter on the scantool.

1.2 CURRENT DATA	
ABS WARNING LAMP	ON
EBD WARNING LAMP	ON
ESP WARNING LAMP	OFF
ESP OFF LAMP	ON
<b>ESP OFF SWITCH</b>	<b>ON</b>
BRAKE LAMP SWITCH	OFF
PUMP RELAY	OFF
VALVE RELAY	ON

FIX    SCRN    FULL    PART    GRPH    HELP

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF". Normal data

SCMBR6588L

5. Whenever the switch is pushed up/down, is the esp off switch's scantool data changed ON/OFF?

**YES**

▶ Fault is intermittent caused by poor connection in esp switch line or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damageage.

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

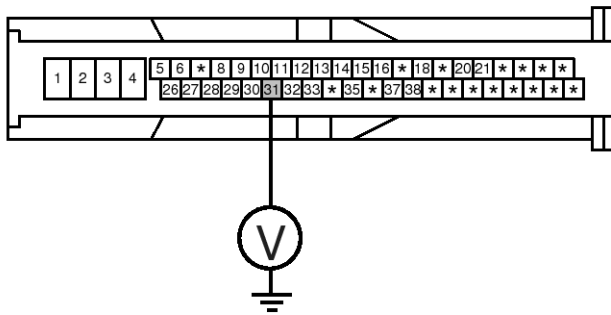
1. Ignition "ON" & Engine "OFF" & ESP Switch"ON".
2. Measure voltage between terminal "31" of the HECU harness connector and chassis ground.

Specification : Approx B+

# BR-204

# Brake System

<ESP HECU>



31. ESP Switch

SBLBR6558L

3. Is the measured voltage within specifications?

**YES**

▶ Go to "Component Inspection" Procedure.

**NO**

▶ Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "31" of the HECU harness connector . Check for open or blown 10 A fuse referring to "Circuit Diagram" . Repair as necessary and then go to "Verification Of vehicle Repair" procedure.

▶ If OK, Go to "Component Inspection" Procedure.

### Component Inspection

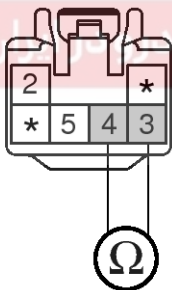
1. Ignition "ON".
2. Disconnect ESP switch connector.
3. Press the ESP switch.
4. Measure resistance between terminal "3, 4" of the ESP switch component connector.

Specification :

Approx. below 1 Ω - ESP switch is depressed.

Approx. ∞ Ω - ESP switch is not depressed.

<I52>



3. Power supply
4. Signal line



SBLBR6517L

# ESP(Electronic Stability Program) System

# BR-205

5. Is the measured resistance within specifications?

## YES

► Fault is intermittent caused by poor connection in ESP switch line or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

## NO

► Substitute with a known-good ESP switch and check for proper operation. If problem is corrected, replace ESP switch and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

## YES

► Go to the applicable troubleshooting procedure.

## NO

► System performing to specification at this time.

# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

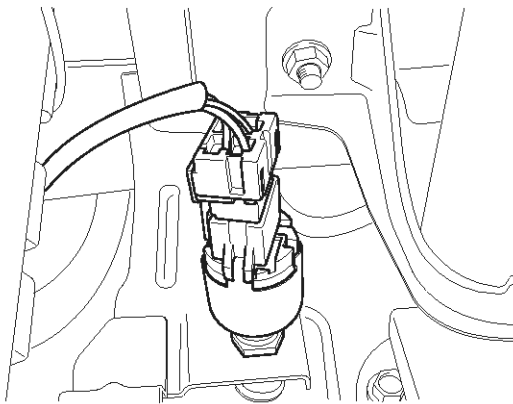


# BR-206

# Brake System

C1513

## COMPONENT LOCATION



SBLBR6532D

### General Description

The brake light switch indicates brake pedal status to the ABS control unit. The brake light switch which is dual switch type send brake light signal to HECU. The switch is turned on when brake is depressed. The brake light switch runs to battery voltage when brake depressed. but The brake light switch doesn't run to battery voltage when brake is not depressed.

### DTC Description

The brake light signal is a reference to judge driver's intention for braking and The HECU checks open or short circuit of brake light switch for normal ABS/ESP control. If an error exists, warning lamp will be turned ON.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only no under voltage is not detected)</li> </ul>	<ul style="list-style-type: none"> <li>Open circuit in brake switch line</li> <li>Inoperative brake light switch</li> </ul>
	Enable Conditions	<ul style="list-style-type: none"> <li>If the BLS-signals is high for 60 s at following condition.                             <ol style="list-style-type: none"> <li>the gas pedal is stepped</li> <li>vehicle speed &gt; 10.8km/h</li> <li>offset compensated pressure &lt; 5 bar</li> <li>no control is active</li> </ol> </li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous (only normal voltage)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>For redundancy reasons an additional BLSpVor-signal is created by the pressure sensor signal. If the pressure sensor is compensated, the threshold for generating the BLSpVor signal is 10 bar. If the pressure sensor is not compensated, the threshold is increased by 25 bar. If this signal is set without any hardware-BLS-signals being set for at least 1s.</li> <li>If the pressure signal is higher than 80bar and not both of the hardware-BLS are set, a fault is stored after 1s.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Inhibit the ESP control and ABS/EBD control is available.</li> <li>The ESP warning lamps are activated.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-207

### Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON"

1.2 CURRENT DATA	
ABS WARNING LAMP	ON
EBD WARNING LAMP	ON
ESP WARNING LAMP	OFF
ESP OFF LAMP	ON
ESP OFF SWITCH	OFF
<b>BRAKE LAMP SWITCH</b>	<b>ON</b>
PUMP RELAY	OFF
VALVE RELAY	ON

FIX SCRN FULL PART GRPH HELP

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF" Normal data

3. Press the brake pedal.
4. Monitor the "BRAKE SWITCH" parameter on the scantool.

SBLBR6545L

5. Whenever brake pedal is pushed down, is the brake switch's scantool data changed ON/OFF?

**YES**

► Fault is intermittent caused by poor connection in brake switch line or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

1. Many malfunctions in the electrical system are caused poor harness(es) and terminals condition. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Power Circuit Inspection" procedure.

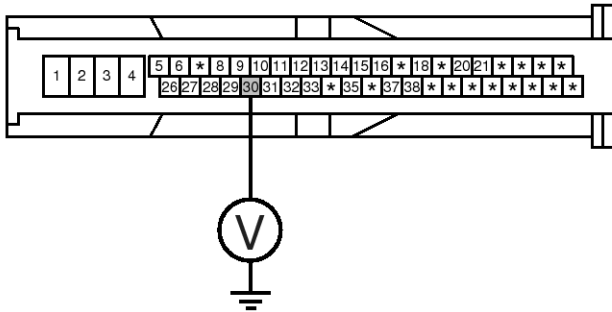
# BR-208

# Brake System

## Signal circuit inspection (brake pedal isn't depressed)

1. Ignition "ON" & Engine "OFF".
2. Don't press the brake pedal.

<ESP HECU>



4. Is the measured voltage within specifications?

**YES**

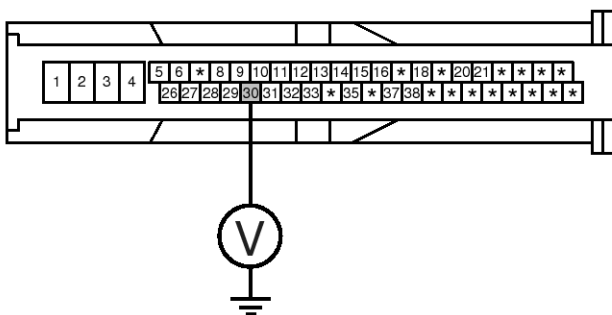
▶ Go to "Signal Circuit Inspection (brake pedal is depressed)" procedure.

**NO**

▶ Check for open or blown 20A STOP, 7.5A SNSR fuse referring to "Circuit Diagram". Check for open or short to battery between the battery terminal(+) and the terminal "30" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

▶ If OK, Go to "Component Inspection" Procedure.

<C281>



3. Measure voltage between the terminal "30" of the HECU harness connector and chassis ground.

Specification : Brake Light Switch - Approx. 0 V

30. Brake light switch

SBLBR6559L

## Signal circuit inspection (brake pedal is depressed)

1. Ignition "ON" & Engine "OFF".
2. Press the brake pedal.
3. Measure voltage between the terminal "30" of the HECU harness connector and chassis ground.

Specification : Brake Light Switch - Approx. B+

30. Brake light switch

SCMBR6590L

# ESP(Electronic Stability Program) System

## BR-209

4. Is the measured voltage within specifications?

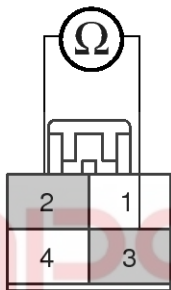
**YES**

► Fault is intermittent caused by open or short harness in brake light switch, faulty brake light switch or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Check for open or short to ground between the battery terminal(+) and the terminal "30" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

► If OK, Go to "Component Inspection" Procedure.



2. brake light switch power supply  
3. brake light switch signal

### Component Inspection

1. Ignition "OFF".
2. Disconnect brake switch connector.
3. Measure resistance between the terminal "2", "3" of the brake switch.

Resistance between the terminal "2, 3" of the brake switch -  $\infty\Omega$  (when the plunger is pushed down),  $0\Omega$  (when the plunger isn't pushed down).

4. Is the measured voltage within specifications?

**YES**

► Fault is intermittent caused by open or short harness in brake light switch, faulty brake light switch or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Substitute with a known-good brake lamp switch and check for proper operation. If problem is corrected, replace brake light switch and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.

SBLBR6518L

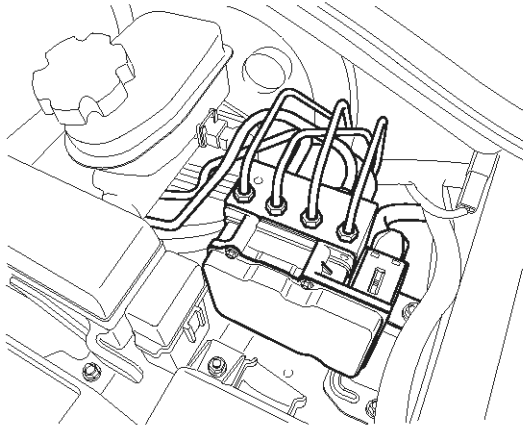


# BR-210

# Brake System

C1604

## COMPONENT LOCATION



SBLBR6003D

### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and a HCU( Hydraulic Control Unit) , HCU is composed of a source of hydraulic pressure and modulator valve block. Increase and decrease of hydraulic pressure is operated by electronic motor, According to a detected signal by wheel speed sensor, The hydraulic pressure which is needed for control is supplied by pump. The HCU' function which is composed of a accumulator, return pump, solenoid valve is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper by operating return pump according to HECU control signal while ABS control is active.

### DTC Description

The HECU monitors the operation of the IC components such as memory, register, A/D converter and so on. The ECU sets this code when the EEPROM data read by the master processor is different than prior data written, or when the master/slave processor detects abnormal operation in RAM, Status Register, Interrupt, Timer, A/D converter or cycle time.

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Internal monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>If Internal control unit failures of the master/slave processor or peripheral integrated circuits is detected.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Directly after ignition on, during reading of EEPROM-values</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>Failure is set if checksum not correct or PSW-EEPROM-Handler reported unknown failure during EEPROM-value reading.</li> <li>If EEPROM reading sequence take longer then 3 s, a failure is set.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>The ABS/EBD/ESP functions are inhibited.</li> <li>The ABS/EBD/ESP warning lamps are activated.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-211

### Terminal and Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

► Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

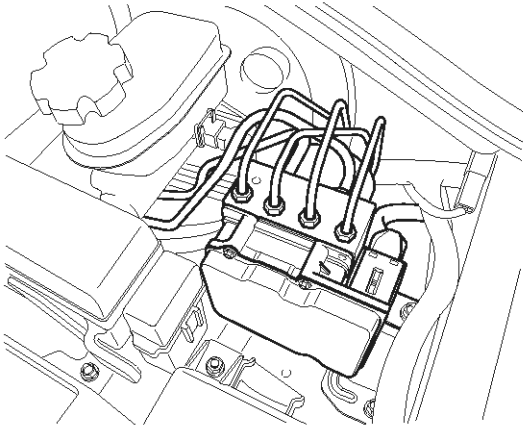
**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.



**BR-212****Brake System****C1605****COMPONENT LOCATION**

SBLBR6003D

**General Description**

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

**DTC Description**

The HECU checks the CAN control module for normal TCS control, and sets this code if CAN control module malfunction is detected.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>CAN control module monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Immediate during start up</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>Faults are detected immediately if the initialization software can't have write access to the configuration registers of the CAN-controller module.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Inhibit the ESP control and ABS/EBD control is available.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-213

### Terminal and Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

► Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.

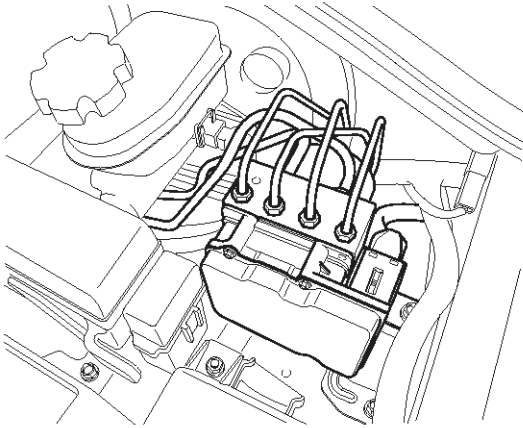


# BR-214

# Brake System

C1611

## COMPONENT LOCATION



SBLBR6003D

### General Description

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

### DTC Description

The HECU checks the CAN communication lines for normal ESP control, and sets this code if a PCM(ECM) message is not received within predefined time.

### DTC Detecting Condition

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>CAN message monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative PCM(ECM)</li> <li>Inoperative HECU</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>Faults are detected if PCM(ECM) message was not received on time by the CAN controller of HECU.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Inhibit the ESP control and ABS/EBD control is available.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-215

### Terminal and Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present?

**YES**

► Substitute with a known-good PCM(ECM) and check for proper operation. If problem is corrected, replace PCM(ECM) and then go to "Verification Of Vehicle Repair" procedure.If NG, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

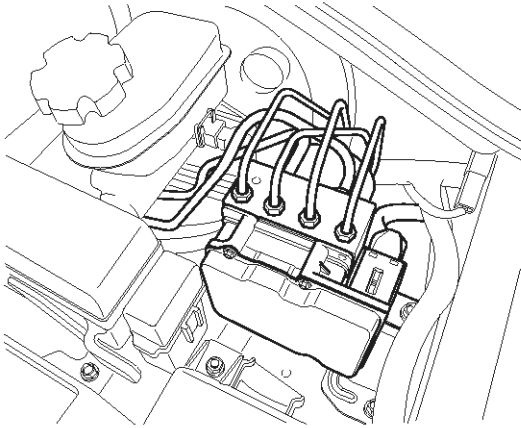
**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.



**BR-216****Brake System****C1612****COMPONENT LOCATION**

SBLBR6003D

**General Description**

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

**DTC Description**

The HECU checks the CAN communication lines for normal TCS control, and sets this code if a PCM(TCM) message is not received within predefined time.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN control module monitoring	• Inoperative PCM(TCM)
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if PCM(TCM) message was not received on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESP control and ABS/EBD control is available.	

# ESP(Electronic Stability Program) System

## BR-217

### Terminal and Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present?

**YES**

▶ Substitute with a known-good PCM(ECM) and check for proper operation. If problem is corrected, replace PCM(ECM) and then go to "Verification Of Vehicle Repair" procedure.If NG, replace HECU and then go to "Verification of Vehicle Repair" procedure.

**NO**

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

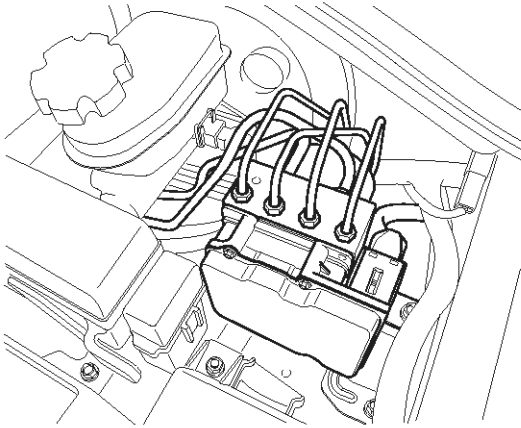
▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.





**BR-218****Brake System****C1616****COMPONENT LOCATION**

SBLBR6003D

**General Description**

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

**DTC Description**

The HECU checks the CAN communication lines for normal TCS control, and sets this code if re-initialization is tried for 15 times in sequence without success.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Open or short monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit in CAN line</li> <li>Inoperative HECU</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>A CAN BUS off fault is established if re-initialization is tried for 15 times in sequence without success.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Inhibit the ESP control and ABS/EBD control is available. Meanwhile, stop checking the ESP switch failure under the ESP control.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-219

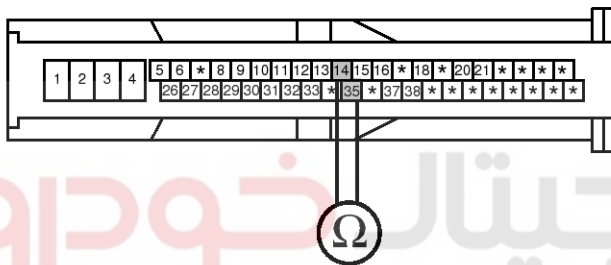
### Terminal & Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

<ESP HECU>



**NO**

► Go to "Signal Circuit Inspection" procedure.

### Signal Circuit Inspection

1. Ignition "OFF".
2. Disconnect the HECU harness connector.
3. Measure resistance between terminal "14" of the HECU harness connector and terminal "35" of the HECU harness connector.

Specification : Approx. 60Ω

<ESP>

- 14. CAN (LOW)
- 35. CAN (HIGH)

<ABS>

- 15. CAN (LOW)
- 26. CAN (HIGH)

4. Is the measured resistance within specifications?

**YES**

► Fault is intermittent caused by open or short in CAN signal harness or was repaired and HECU memory was not cleared. go to "CAN Bus Short (to ground) Inspection" procedure.

**NO**

► Check for open or short in CAN signal harness between terminal "14" of the HECU harness connector and terminal "35" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

### CAN Bus Short (to ground) Inspection

1. Ignition "OFF".
2. Disconnect the HECU harness connector.
3. Measure resistance between terminal "14, 35" of the HECU harness connector and chassis ground.

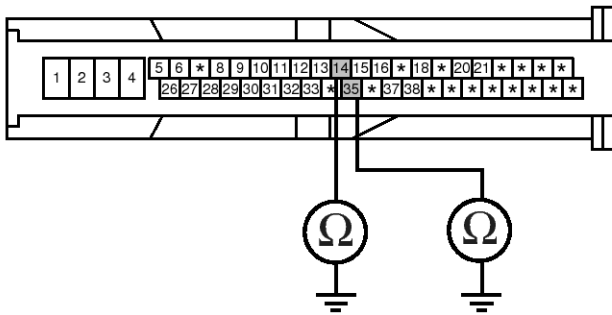
Specification : Approx. ∞ Ω

SBLBR6519L

# BR-220

# Brake System

<ESP HECU>



<ESP>  
 14. CAN (LOW)  
 35. CAN (HIGH)

<ABS>  
 15. CAN (LOW)  
 26. CAN (HIGH)

SBLBR6520L

4. Is the measured resistance within specifications?

**YES**

▶ Go to "CAN Bus Short (to battery) Inspection" procedure.

**NO**

▶ Check for short to ground in CAN HIGH signal harness in case of abnormal resistance measured between terminal "35" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

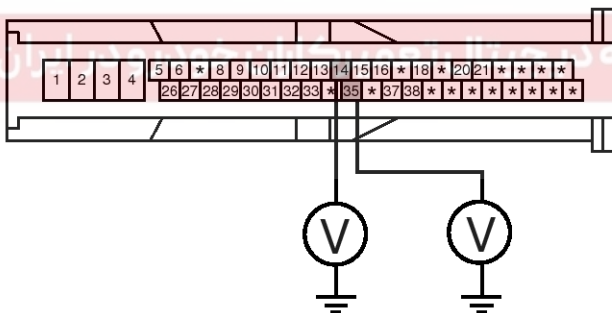
▶ Check for short to ground in CAN LOW signal harness in case of abnormal resistance measured between terminal "14" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

### CAN Bus Short (to battery) Inspection

1. Ignition "OFF".
2. Disconnect the HECU harness connector.
3. Measure voltage between terminal "14, 35" of the HECU harness connector and chassis ground.

Specification : Below. 0.2 V

<ESP HECU>



<ESP>  
 14. CAN (LOW)  
 35. CAN (HIGH)

<ABS>  
 15. CAN (LOW)  
 26. CAN (HIGH)

SBLBR6521L

4. Is the measured voltage within specifications?

**YES**

▶ Go to "CAN Bus Short (between HIGH and LOW) Inspection" procedure.

**NO**

▶ Check for short to battery in CAN HIGH signal harness in case of abnormal resistance measured between terminal "14" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

# ESP(Electronic Stability Program) System

## BR-221

► Check for short to battery in CAN LOW signal harness in case of abnormal resistance measured between terminal "35" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

### CAN Bus Short (between HIGH and LOW) Inspection

1. Ignition "OFF".
2. Disconnect all the connector related to CAN such as HECU, PCU, EPS, ECS harness connector.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



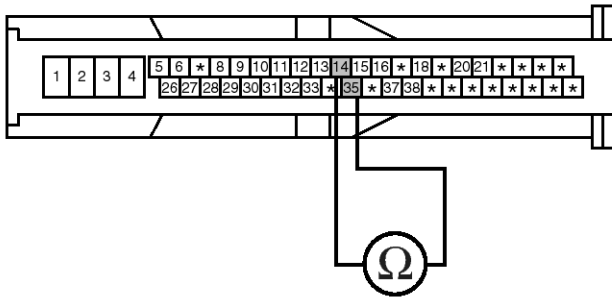
# BR-222

# Brake System

3. Measure resistance between terminal "14, 35" of the HECU harness.

Specification : Approx. 120 Ω

<ESP HECU>



<ESP>  
14. CAN (LOW)  
35. CAN (HIGH)

<ABS>  
15. CAN (LOW)  
26. CAN (HIGH)

SBLBR6564L

4. Is the measured resistance within specifications?

**YES**

▶ Go to "Component Inspection" procedure.

**NO**

▶ Check for short in CAN signal harness between terminal "14" of the HECU harness connector and terminal "35" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.

6. Are any DTCs present?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

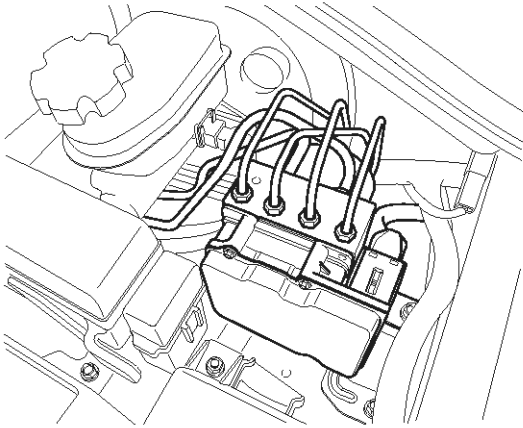
▶ System performing to specification at this time.

# ESP(Electronic Stability Program) System

## BR-223

C1623

### COMPONENT LOCATION



SBLBR6003D

### General Description

The Steering angle sensor(SAS) is joined to the multi function switch and uses a CAN communication. The SAS is used to determine turning direction and speed of the steering wheel. The HECU uses the signals from the SAS when performing ESP-related calculations.

### DTC Description

The HECU checks the CAN communication lines for normal ESP control, and sets this code if a SAS message is not received within predefined time.

### DTC Detecting Condition

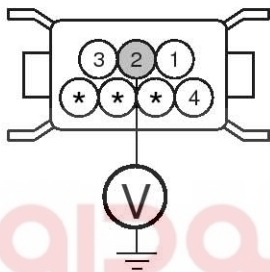
Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>CAN message monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative SAS</li> <li>Open circuit in SAS line</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>Faults are detected if SAS message was not received on time by the CAN controller of HECU.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Inhibit the ESP control and ABS/EBD control is available.</li> </ul>	

## BR-224

## Brake System

## Terminal &amp; Connector Inspection

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



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

3. Has a problem been found?

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Power Circuit Inspection" procedure.

## Power Supply Circuit Inspection

1. Ignition "ON".
2. Measure voltage between terminal "2" of the steering angle sensor harness connector and chassis ground.

Specification : Approx. B+

3. Is the measured voltage within specifications?

**YES**

► Go to "Ground Circuit Inspection" procedure.

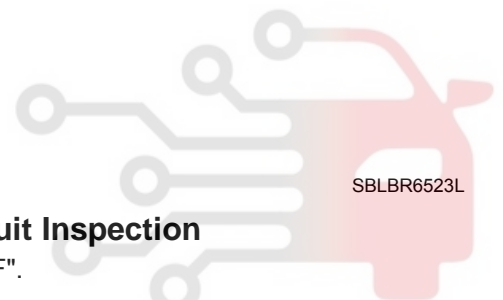
**NO**

► Check for damaged harness and poor connection between the battery terminal(+) and terminal "2" of the steering angle sensor harness connector. Check for open or blown 10 A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

## Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect SAS connector.
3. Measure resistance between terminal "1" of the steering angle sensor harness connector and chassis ground.

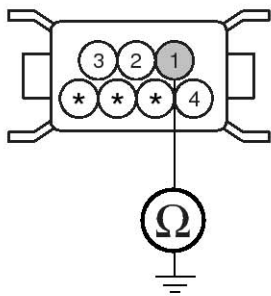
Specification : Approx. below 1 Ω



SBLBR6523L

# ESP(Electronic Stability Program) System

## BR-225



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

SBLBR6524L

4. Is the measured resistance within specifications?

**YES**

► Go to "CAN Circuit Inspection" procedure.

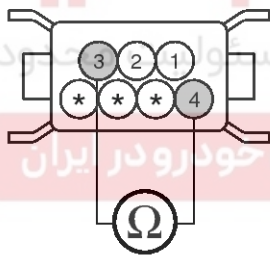
**NO**

► Check for damaged harness and poor connection between terminal "1" of the steering angle sensor harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

### CAN Circuit Inspection

1. Ignition "OFF".
2. Disconnect SAS connector.
3. Measure resistance between terminal "3, 4" of the steering angle sensor harness connector.

Specification : Approx. 60 Ω



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

SBLBR6525L

4. Is the measured resistance within specifications?

**YES**

► Go to "CAN Bus Short (to ground) Inspection" procedure.

**NO**

► Check for damaged harness and poor connection between terminal "3, 4" of the steering angle sensor harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

### CAN Bus Short (to ground) Inspection

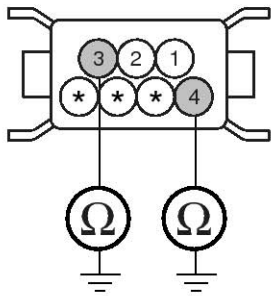
1. Ignition "OFF".
2. Disconnet the HECU harness connector.
3. Measure resistance between terminal "3, 4" of the HECU harness connector and chassis ground.

Specification : Approx. ∞ Ω



## BR-226

## Brake System



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

SBLBR6526L

4. Is the measured resistance within specifications?

**YES**

► Go to "CAN Bus Short (between HIGH and LOW) Inspection" procedure.

**NO**

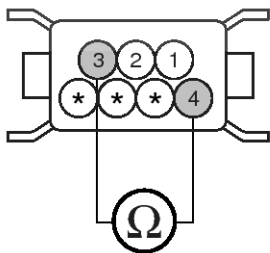
► Check for short to ground in CAN HIGH signal harness in case of abnormal resistance measured between terminal "3" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

► Check for short to ground in CAN LOW signal harness in case of abnormal resistance measured between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

### CAN Bus Short (between HIGH and LOW) Inspection

1. Ignition "OFF".
2. Disconnect all the connector related to CAN such as HECU, PCU, EPS, ECS harness connector.
3. Measure resistance between terminal "3, 4" of the HECU harness.

Specification : Approx. 120 Ω



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

SBLBR6527L

# ESP(Electronic Stability Program) System

## BR-227

4. Is the measured resistance within specifications?

**YES**

▶ Go to "Component Inspection" procedure.

**NO**

▶ Check for short in CAN signal harness between terminal "3" of the HECU harness connector and terminal "4" of the HECU harness connector. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

- 1) Substitute with a known-good steering angle sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification Of Vehicle Repair" procedure.
- 2) Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Fault is intermittent caused by poor connection in steering angle sensor harness or faulty steering angle sensor. Go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

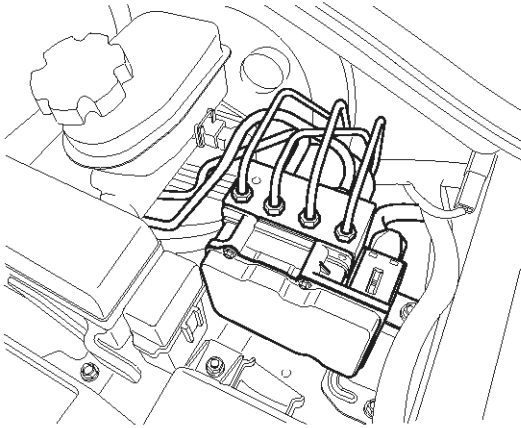
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.



**BR-228****Brake System****C1625****COMPONENT LOCATION**

SBLBR6003D

**General Description**

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the PCM(ECM & TCM) through CAN bus line. The PCM(ECM) performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The PCM(TCM) maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

**DTC Description**

The HECU checks the CAN communication lines for normal ESP control, and sets this code if a CAN message is not transmitted within predefined time.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>CAN message monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>Faults are detected if CAN message was not transmitted on time by the CAN controller of HECU.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Inhibit the ESP control and ABS/EBD control is available.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-229

### Terminal and Connector Inspection

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

**YES**

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

**NO**

▶ Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

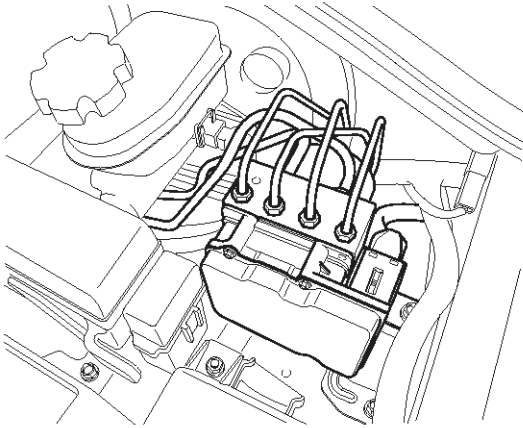
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.



**BR-230****Brake System****C1626****COMPONENT LOCATION**

SBLBR6003D

**General Description**

The ESP is a system to stabilize a car in an emergency (kine of under steering or over steering) by supplying appropriate wheel with braking pressure according to signal of yaw & G sensor, SAS, WSS, pressure sensor. ESP system help to ESPape from facing in an accident.

**DTC Description**

Under normal conditions, the inlet valves of all four wheels are not closed during control for longer than 1.28s or If the controller requests pressure-hold or pressure-decrease for longer than 1.28s, a fault is detected. The ABS/ESP warning lamp is turned ON and the EBD warning lamp is turned OFF.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Faulty HECU</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>If the controller requests pressure-hold or pressure-decrease for longer than 1.28s, a fault is stored.</li> <li>Under normal condition, the inlet valves of all four wheels are not closed during control for longer than 1.28s.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>The ABS/ESP functions are inhibited, allow the EBD control.</li> <li>The ABS/ESP warning lamps are activated.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-231

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.



دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

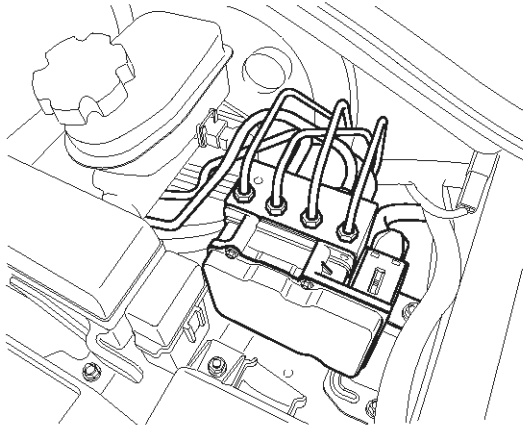
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

**BR-232**

**Brake System**

**C1627**

**COMPONENT LOCATION**



SBLBR6003D

**General Description**

The HECU interchanges requirement data with the 4WD ECU through CAN bus line for normal ABS control. For example the HECU sends a control inhibition signal to 4WD ECU for normal ABS control in case of the ABS and 4WD control requested at the same time such as wheel speed difference between front and rear wheel generated due to wheel slip.

**DTC Description**

The HECU checks absence of the 4WD message from the 4WD ECU for normal ABS control, and sets this code if an 4WD ECU message is not received within predefined time. The HECU checks the presence and specific contents of the 4WD1 message from the 4WD ECU, and sets this code if there is an error in 4WD ECU message1.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>CAN message monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Faulty 4WD ECU</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>Faults are detected if 4WD message was not received on time by the CAN controller of HECU.</li> <li>If the 4WD ECU detected an following error and informed the HECU about it via CAN, a fault is determined.                             <ul style="list-style-type: none"> <li>- 4WD1 message timeout was detected by HECU</li> <li>- 4WD1 data length code error was detected</li> <li>- a failure of the 4WD ECU shift motor or encoder was detected</li> <li>- a 4WD magnetic clutch failure was detected</li> <li>- the 4WD ECU does not receive the TCS4 message any more</li> <li>- the 4WD max cardan shaft torque contains faulty torque information</li> </ul> </li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Inhibit the ABS/ESP control and allow the EBD control.</li> <li>ABS/ESP warning lamps are activated.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-233

### Terminal and Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" procedure.

### Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes(DTCs)" mode again.
6. Are any DTCs present ?

**YES**

► Refer to the 4WD dignostic part to find a cause of fault.If there is no problem in 4WD, Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

The ECU mounted in the wrong type of car may be a cause. (2WD ECU in 4WD vehicle)

**NO**

► Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

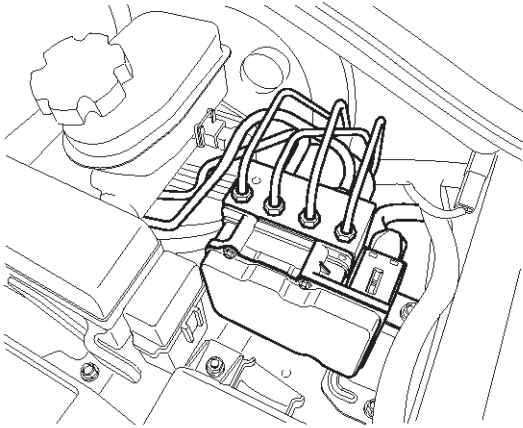
► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.





**BR-234****Brake System****C1702****COMPONENT LOCATION**

SBLBR6003D

**General Description**

There is no hardware difference of the HECU according to the vehicle's specification, just software is changed by the vehicle parameter used for ESP control. The HECU stores a classified variant code value according to the received data (a kind of engine, engine displacement, a kind of T/M). After then the HECU reads a various parameter according to the stored variant value in the memory to use for the ESP control.

**DTC Description**

The HECU checks the variant code after ignition. If an inappropriate variant code is detected or there is no variant code, a fault is detected.

**DTC Detecting Condition**

Item	Detecting Condition	Possible cause
DTC Strategy	<ul style="list-style-type: none"> <li>Internal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Replacement of PCM (ECM &amp; TCM)</li> </ul>
Monitoring Period	<ul style="list-style-type: none"> <li>Once during startup.</li> </ul>	
Enable Conditions	<ul style="list-style-type: none"> <li>After power on, the HECU does not receive a valid variant code information during the configuration time.</li> <li>HECU has no valid variant code stored in the EEPROM.</li> <li>The received CAN signals do not lead to a defined and supported variant code.</li> <li>If an ECU, which has already memorized a valid variant code information, receives a different variant code information. (at a next Power on cycle)</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>The ABS/EBD/ESP functions are inhibited.</li> <li>The ABS/EBD/ESP warning lamps are activated.</li> </ul>	

# ESP(Electronic Stability Program) System

BR-235

## Monitor Scantool Data

### Variant Coding

1. Check for improper installation of EMS/PCM(ECM & TCM)/ESP.
2. Connect scantool to Data Link Connector(DLC).
3. Ignition "ON".
4. Go in Anti-Lock brake system (figure 1).

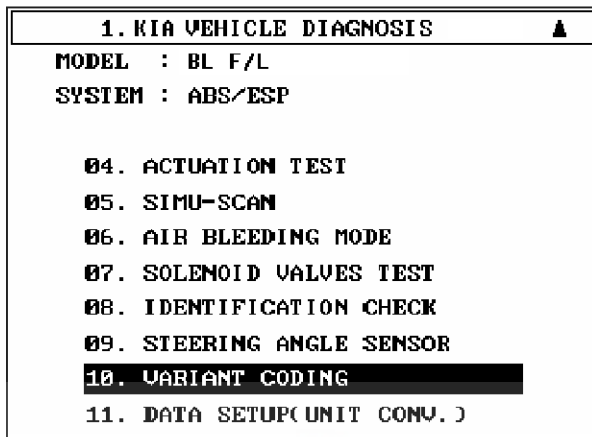


Fig1

Fig 1) Variant coding.

5. Perform variant code.
6. Disconnect scantool.
7. Ignition "OFF" and then ignition "ON". Go to "Component Inspection" Procedure.

\* For the vehicle equipped 4WD, delete the DTC(s) memorized in 4WD ECU when variant coding is completed.

## Component Inspection

1. Ignition "OFF".
2. Ignition "ON".
3. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode.
4. Using a scantool, Clear DTC.
5. Select "Diagnostic Trouble Codes (DTCs)" mode again.
6. Are any DTCs present ?

**YES**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

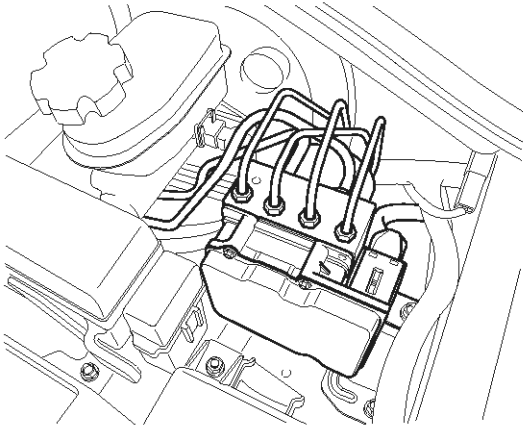
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

**BR-236****Brake System****C2112****COMPONENT LOCATION**

SBLBR6003D

**General Description**

The HECU supplies battery power to all solenoid valves with a valve relay which is controlled by the Electronic Control UNIT(ECU). The valve relay and all solenoid valves are installed inside the HECU ( Hydraulic and Electronic Control Unit ).

**DTC Description**

The HECU monitors voltage of the valve relay to check if the HECU can perform ABS control normally. When the valve relay is switched to ON, the HECU will set this code if the solenoid drive voltage is below permissible voltage ranges for a period of time. When the valve relay is switched to OFF, the HECU sets this code if the solenoid drive voltage is over the permissible voltage range for a period of time.

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# ESP(Electronic Stability Program) System

## BR-237

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Open or short in power supply circuit (IGN+)</li> <li>Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Once during startup.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Watchdog and valve relay function is tested during startup. A failure is detected if the valve relay/Enable remains in off position when it is turned on and vice versa. Reason could be short to GND or UZ, interrupted lines or a inoperative output stage etc.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>A Fault is detected if valve relay voltage <math>&lt; 0.8 * \text{battery voltage}</math> for a time 500 ms.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If valve relay malfunction and supply solenoid valve short to battery or supply solenoid valve and medium or high ohmic short of valve relay (or a valve) to valve relay voltage, solenoid valve voltage or GND are detected.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>No valve actuation possible.</li> <li>The ABS/EBD/ESP functions are inhibited.</li> <li>The ABS/EBD/ESP warning lamps are activated.</li> </ul>	

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## BR-238

## Brake System

**Monitor Actuation Test**

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

1.5 ACTUATION TEST		02/13
FRONT LEFT VALVE(IN)		
DURATION	2 SECONDS	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ?		
STRT		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF".  
Ex) Actuation Test on Front left valve(in)

5. Do all valves operate normally?

**YES**

► Fault is intermittent caused by poor connection in power harness (ABS2) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "W/Harness Inspection" procedure.

**Terminal & Connector Inspection**

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

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of all valves with Actuation Test.

Specification : It's normal if operating sound is heard.

3. Has a problem been found?

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Power Circuit Inspection" procedure.

**Power Supply Circuit Inspection**

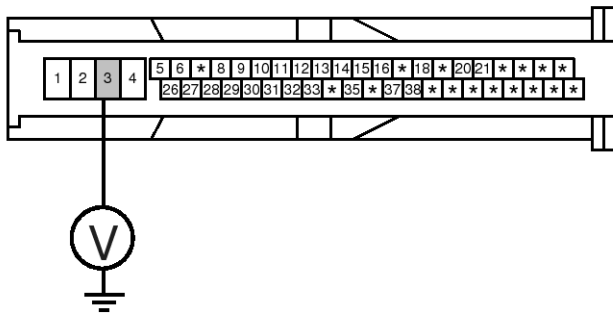
1. Ignition "OFF".
2. Disconnect HECU connector.
3. Ignition "ON".
4. Measure voltage between terminal "3" of the HECU harness connector and chassis ground.

Specification : Approx. B+

# ESP(Electronic Stability Program) System

# BR-239

<ESP HECU>



<ABS, ESP>  
3. Battery(+)

SBLBR6529L

5. Is the measured voltage within specifications?

**YES**

▶ Go to "Ground Circuit Inspection" procedure.

**NO**

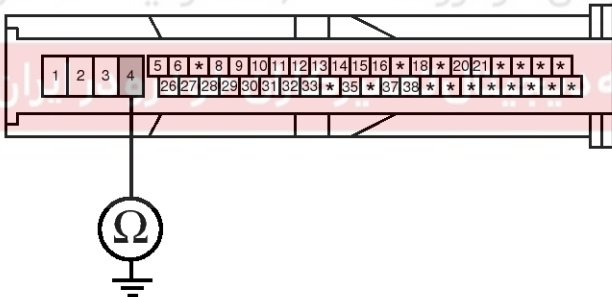
▶ Check for damaged harness and open or short to GND between the battery terminal(+) and terminal "3" of the HECU harness connector. Check for open or blown 20A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure.

## Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω

<ESP HECU>



<ABS, ESP>  
4. Ground



SBLBR6506L

## BR-240

## Brake System

4. Is the measured resistance within specifications?

### YES

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

### NO

▶ Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

### YES

▶ Go to the applicable troubleshooting procedure.

### NO

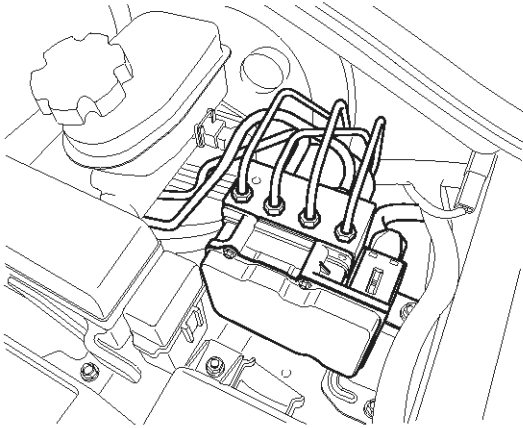
▶ System performing to specification at this time.



# ESP(Electronic Stability Program) System

**BR-241****C2308**

## COMPONENT LOCATION



SBLBR6003D

### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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## BR-242

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Immediately after power on</li> <li>every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>A Fault is found if <math>UVR</math> is not within <math>0.1 \cdot \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \cdot \text{battery voltage}</math></li> <li>A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \cdot \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30</math> km/h.</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils, almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	

# ESP(Electronic Stability Program) System

# BR-243

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.

1.4 ACTUATION TEST 02/13	
FRONT LEFT VALVE(IN)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(in)

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

EJBF504L

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

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

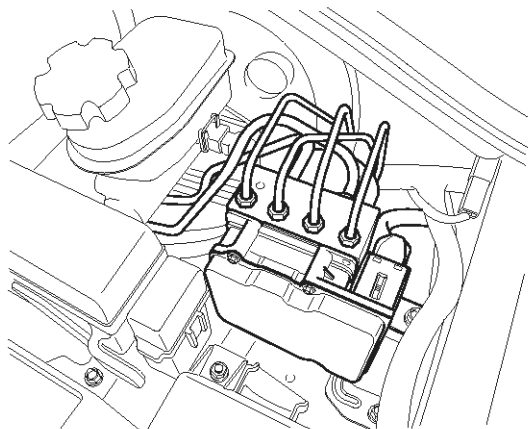
▶ System performing to specification at this time.

## BR-244

## Brake System

C2312

### COMPONENT LOCATION



SBLBR6003D

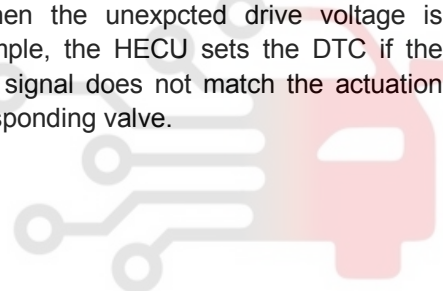
### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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# ESP(Electronic Stability Program) System

## BR-245

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Immediately after power on</li> <li>every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>A Fault is found if <math>UVR</math> is not within <math>0.1 \times \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \times \text{battery voltage}</math></li> <li>A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \times \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30</math> km/h.</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	

## BR-246

## Brake System

**Monitor Actuation Test**

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

1.4 ACTUATION TEST 06/13	
FRONT LEFT VALVE( OUT )	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(out)

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "Component Inspection" procedure.

**Terminal and Connector Inspection**

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

**YES**

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

**NO**

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of outlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

SCMBR6572L

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

**Verification of Vehicle Repair**

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

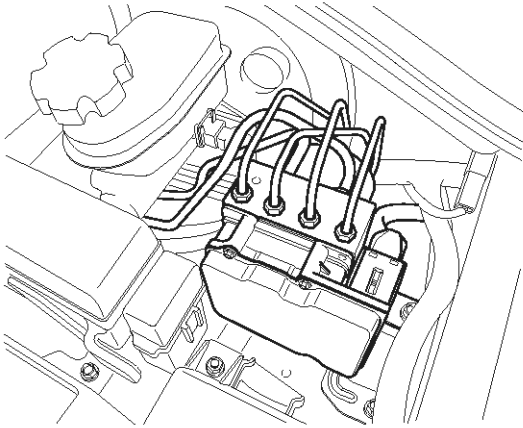
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

# ESP(Electronic Stability Program) System

**BR-247****C2316****COMPONENT LOCATION**

SBLBR6003D

**General Description**

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

**DTC Description**

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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## BR-248

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Immediately after power on</li> <li>every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>A Fault is found if <math>UVR</math> is not within <math>0.1 * \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 * \text{battery voltage}</math></li> <li>A Fault is found if <math>\text{valve relay voltage} \geq 0.2 * \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30</math> km/h.</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils, almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	

# ESP(Electronic Stability Program) System

# BR-249

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST		02/13
FRONT LEFT VALVE(IN)		
DURATION	2 SECONDS	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(in)

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

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

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

EJBF504L

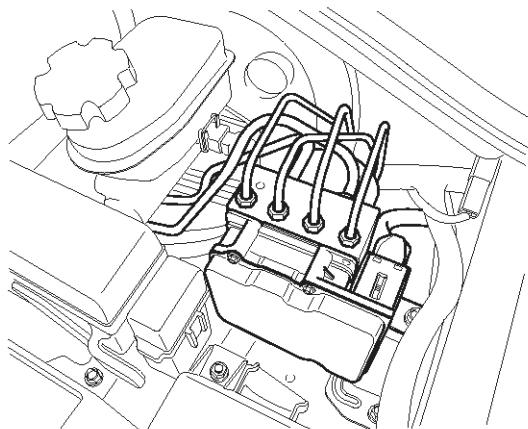


## BR-250

## Brake System

C2320

### COMPONENT LOCATION



SBLBR6003D

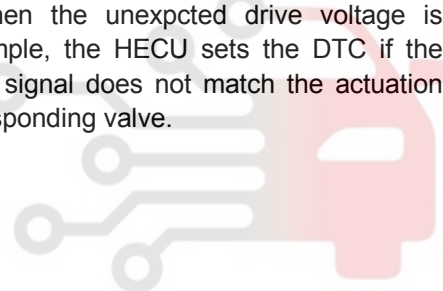
### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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# ESP(Electronic Stability Program) System

# BR-251

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Immediately after power on</li> <li>every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>A Fault is found if <math>UVR</math> is not within <math>0.1 * \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 * \text{battery voltage}</math></li> <li>A Fault is found if <math>\text{valve relay voltage} \geq 0.2 * \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30</math> km/h.</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	

## BR-252

## Brake System

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

1.4 ACTUATION TEST		06/13
FRONT LEFT VALVE( OUT )		
DURATION	2 SECONDS	
METHOD	ACTIVATION	
CONDITION	IG. KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY		
STRT		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(out)

5. Does a inlet valve operate normally?

**YES**

► Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of outlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

SCMBR6572L

**NO**

► Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

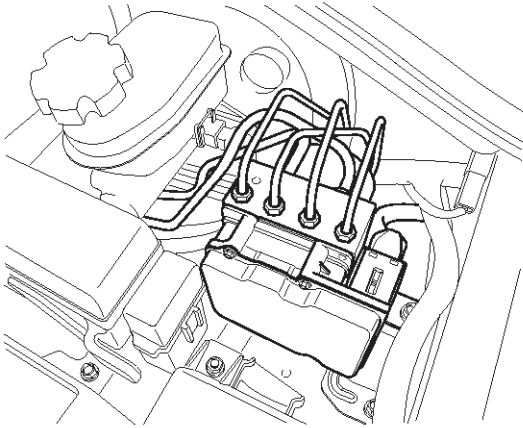
**NO**

► System performing to specification at this time.

# ESP(Electronic Stability Program) System

**BR-253****C2324**

## COMPONENT LOCATION



SBLBR6003D

### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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## BR-254

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Immediately after power on</li> <li>every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>A Fault is found if <math>UVR</math> is not within <math>0.1 \cdot \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \cdot \text{battery voltage}</math></li> <li>A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \cdot \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30</math> km/h.</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils, almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	

# ESP(Electronic Stability Program) System

# BR-255

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 02/13	
FRONT LEFT VALVE(IN)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(in)

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

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

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

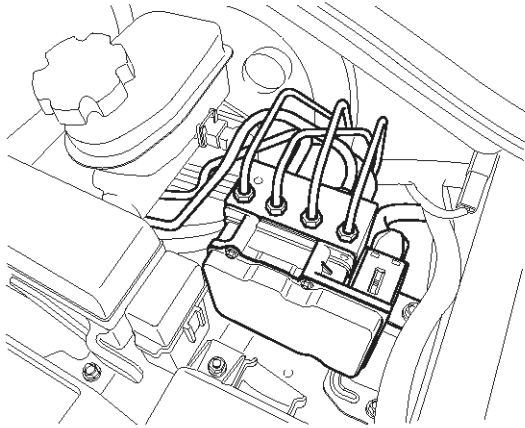
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

EJBF504L

**BR-256****Brake System****C2328****COMPONENT LOCATION**

SBLBR6003D

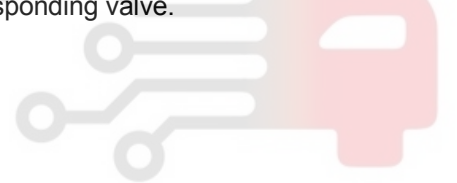
**General Description**

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

**DTC Description**

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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# ESP(Electronic Stability Program) System

## BR-257

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Immediately after power on</li> <li>every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>A Fault is found if <math>UVR</math> is not within <math>0.1 \cdot \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 \cdot \text{battery voltage}</math></li> <li>A Fault is found if <math>\text{valve relay voltage} \geq 0.2 \cdot \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30</math> km/h.</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils, almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	



## BR-258

## Brake System

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

1.4 ACTUATION TEST 06/13	
FRONT LEFT VALVE( OUT )	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG. KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(out)

5. Does a inlet valve operate normally?

**YES**

► Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Component Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of outlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

**NO**

► Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

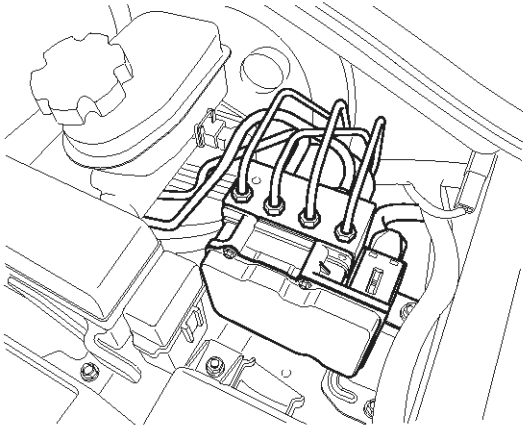
► System performing to specification at this time.

SCMBR6572L

# ESP(Electronic Stability Program) System

**BR-259****C2332**

## COMPONENT LOCATION



SBLBR6003D

### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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## BR-260

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Immediately after power on</li> <li>every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>A Fault is found if <math>UVR</math> is not within <math>0.1 * \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 * \text{battery voltage}</math></li> <li>A Fault is found if <math>\text{valve relay voltage} \geq 0.2 * \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30</math> km/h.</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils, almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	

# ESP(Electronic Stability Program) System

# BR-261

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

1.4 ACTUATION TEST 02/13	
FRONT LEFT VALVE(IN)	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY	
STRT	

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(in)

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

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

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

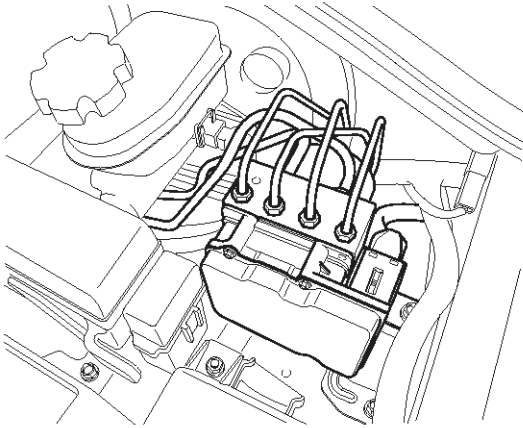
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

**BR-262****Brake System****C2336****COMPONENT LOCATION**

SBLBR6003D

**General Description**

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

**DTC Description**

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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# ESP(Electronic Stability Program) System

## BR-263

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Continuous</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms.</li> <li>- Current controlled valves and under voltage conditions :detection time is 80 ms</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>Immediately after power on</li> <li>every 20 s</li> <li>- The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>A Fault is found if <math>UVR</math> is not within <math>0.1 * \text{battery voltage} &lt; \text{valve relay voltage} &lt; 0.8 * \text{battery voltage}</math></li> <li>A Fault is found if <math>\text{valve relay voltage} \geq 0.2 * \text{battery voltage}</math>.</li> <li>- After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.</li> </ul>	
Case 3	Monitoring Period	<ul style="list-style-type: none"> <li>The Valve and Pump motor Test is performed once after ignition on if vehicle speed is <math>\geq 30</math> km/h.</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
	Enable C-conditions	<ul style="list-style-type: none"> <li>The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.</li> </ul>	
Case 4	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control</li> <li>1. No BLS is applied</li> <li>2. Brake pressure is <math>&lt; 10</math> bar</li> <li>3. Vehicle speed <math>&gt; 15</math> km/h</li> <li>4. Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>5. Supply voltage <math>&gt; 11</math> volts.</li> </ul>	
	Enable C-conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	

# BR-264

# Brake System

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

<b>1.4 ACTUATION TEST</b>		<b>06/13</b>
<b>FRONT LEFT VALVE( OUT )</b>		
<b>DURATION</b>	<b>2 SECONDS</b>	
<b>METHOD</b>	<b>ACTIVATION</b>	
<b>CONDITION</b>	<b>IG. KEY ON ENGINE OFF</b>	
<b>PRESS [STRT], IF YOU ARE READY ? SELECT TEST ITEM USING UP/DOWN KEY</b>		
<b>STRT</b>		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on Front left valve(out)

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to "Verification Of Vehicle Repair" procedure.

**NO**

▶ Go to "Component Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

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

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of outlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

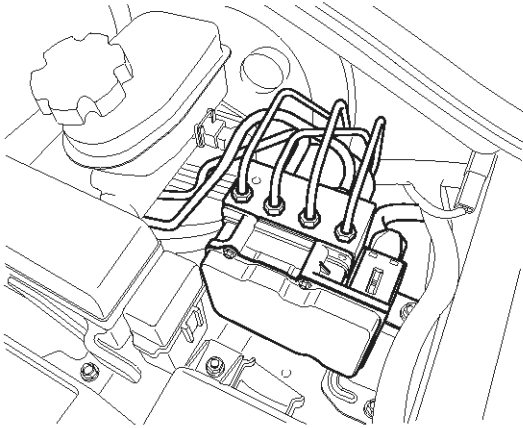
▶ System performing to specification at this time.

SCMBR6572L

# ESP(Electronic Stability Program) System

**BR-265****C2366**

## COMPONENT LOCATION



SBLBR6003D

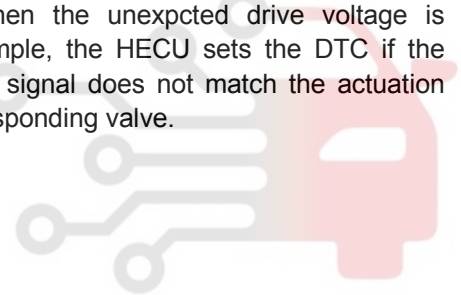
### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

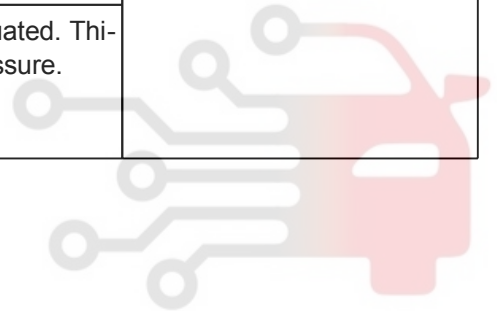
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**BR-266****Brake System****DTC Detecting Condition**

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after ignition on at standstill if the BLS is off</li> <li>At vehicle speed <math>\geq 15</math> km/h if the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control               <ol style="list-style-type: none"> <li>No BLS is applied</li> <li>Brake pressure is <math>&lt; 10</math> bar</li> <li>Vehicle speed <math>&gt; 15</math> km/h</li> <li>Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>Supply voltage <math>&gt; 11</math> volts.</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils, almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	



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# ESP(Electronic Stability Program) System

# BR-267

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

1.4 ACTUATION TEST		10/13
TCS VALUE(USU1)		
DURATION	2 SECONDS	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on TCS(USV) valve #1

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by inoperative valve or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

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

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

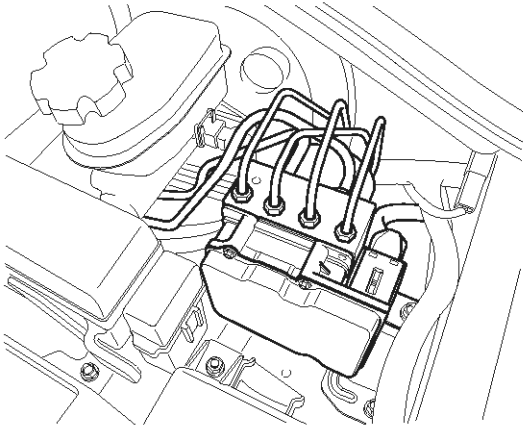
**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

SCMBR6573L

**BR-268****Brake System****C2370****COMPONENT LOCATION**

SBLBR6003D

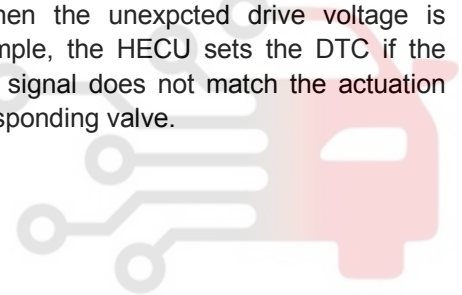
**General Description**

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

**DTC Description**

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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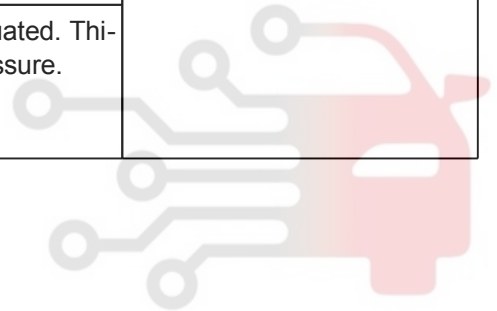


# ESP(Electronic Stability Program) System

## BR-269

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after ignition on at standstill if the BLS is off</li> <li>At vehicle speed <math>\geq 15</math> km/h if the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control               <ol style="list-style-type: none"> <li>No BLS is applied</li> <li>Brake pressure is <math>&lt; 10</math> bar</li> <li>Vehicle speed <math>&gt; 15</math> km/h</li> <li>Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>Supply voltage <math>&gt; 11</math> volts.</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	



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# BR-270

# Brake System

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

<b>1.4 ACTUATION TEST</b>		<b>10/13</b>
<b>TCS VALUE(USU1)</b>		
<b>DURATION</b>	<b>2 SECONDS</b>	
<b>METHOD</b>	<b>ACTIVATION</b>	
<b>CONDITION</b>	<b>IG.KEY ON ENGINE OFF</b>	
<b>PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY</b>		
<b>STRT</b>		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on TCS(USV) valve #1

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by inoperative valve or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

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

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

▶ Go to the applicable troubleshooting procedure.

**NO**

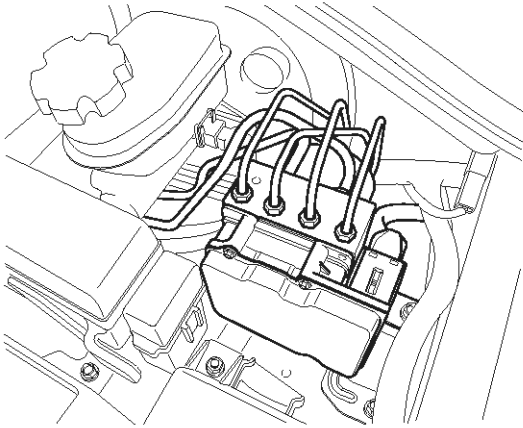
▶ System performing to specification at this time.

SCMBR6573L

# ESP(Electronic Stability Program) System

**BR-271****C2372**

## COMPONENT LOCATION



SBLBR6003D

### General Description

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

### DTC Description

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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## BR-272

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after ignition on at standstill if the BLS is off</li> <li>At vehicle speed <math>\geq 15</math> km/h if the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control               <ol style="list-style-type: none"> <li>No BLS is applied</li> <li>Brake pressure is <math>&lt; 10</math> bar</li> <li>Vehicle speed <math>&gt; 15</math> km/h</li> <li>Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>Supply voltage <math>&gt; 11</math> volts.</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle. If it detects partly shorted valve coils, almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	

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# ESP(Electronic Stability Program) System

# BR-273

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

1.4 ACTUATION TEST		10/13
TCS VALUE(USU1)		
DURATION	2 SECONDS	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on TCS(USV) valve #1

5. Does a inlet valve operate normally?

**YES**

▶ Fault is intermittent caused by inoperative valve or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

**NO**

▶ Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

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

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

**NO**

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

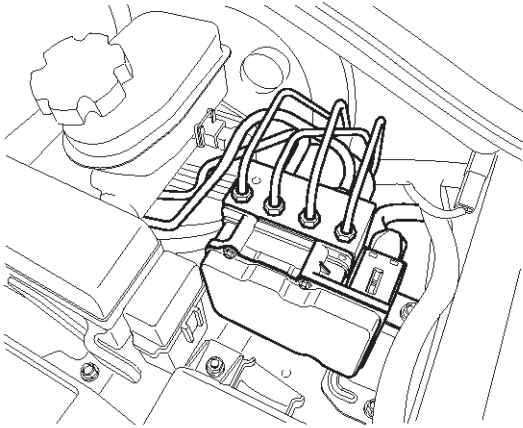
▶ Go to the applicable troubleshooting procedure.

**NO**

▶ System performing to specification at this time.

SCMBR6573L



**BR-274****Brake System****C2374****COMPONENT LOCATION**

SBLBR6003D

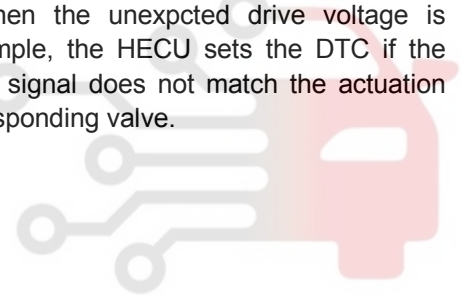
**General Description**

The HECU is composed of an ECU (Electronic Control Unit ) and an HCU( Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydraulic pressure supplied to a brake caliper.

**DTC Description**

The HECU monitors the operation of the valves by checking the drive circuit of the solenoid valves, and then sets this code when the unexpected drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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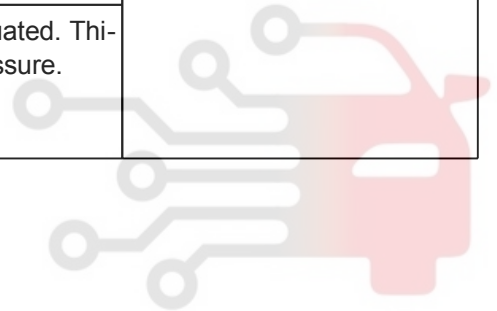


# ESP(Electronic Stability Program) System

## BR-275

### DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Inoperative HECU</li> </ul>
Case 1	Monitoring Period	<ul style="list-style-type: none"> <li>Once after ignition on at standstill if the BLS is off</li> <li>At vehicle speed <math>\geq 15</math> km/h if the BLS is on.</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.</li> </ul>	
Case 2	Monitoring Period	<ul style="list-style-type: none"> <li>The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control               <ol style="list-style-type: none"> <li>No BLS is applied</li> <li>Brake pressure is <math>&lt; 10</math> bar</li> <li>Vehicle speed <math>&gt; 15</math> km/h</li> <li>Vehicle acceleration <math>&gt; 0.5</math> m/s<sup>2</sup></li> <li>Supply voltage <math>&gt; 11</math> volts.</li> </ol> </li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost inoperative coils or malfunction of the valve driver, a failure is recognized.</li> </ul>	
Fail Safe		<ul style="list-style-type: none"> <li>Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure.</li> <li>ABS/EBD/ESP function is prohibited.</li> <li>ABS/EBD/ESP warning lamp is turned ON.</li> </ul>	



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## BR-276

## Brake System

## Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

1.4 ACTUATION TEST		10/13
TCS VALUE(USV1)		
DURATION	2 SECONDS	
METHOD	ACTIVATION	
CONDITION	IG.KEY ON ENGINE OFF	
PRESS [STRT], IF YOU ARE READY ! SELECT TEST ITEM USING UP/DOWN KEY		
STRT		

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on TCS(USV) valve #1

5. Does a inlet valve operate normally?

**YES**

► Fault is intermittent caused by inoperative valve or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

**NO**

► Go to "W/Harness Inspection" procedure.

## Terminal and Connector Inspection

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

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

SCMBR6573L

**NO**

► Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

## Verification of Vehicle Repair

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

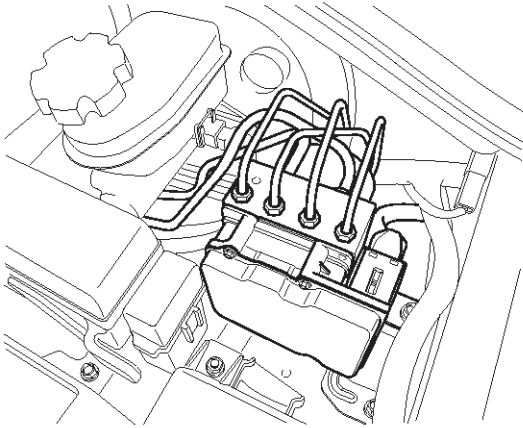
1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

**YES**

► Go to the applicable troubleshooting procedure.

**NO**

► System performing to specification at this time.

**ESP(Electronic Stability Program) System****BR-277****C2402****COMPONENT LOCATION**

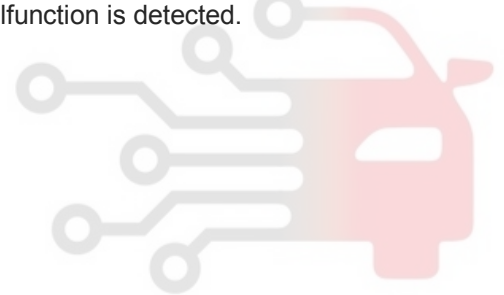
SBLBR6003D

**General Description**

The HECU supplies battery power to the electric motor with a motor relay which is controlled by the Electronic Control Unit(ECU). The electric motor pump supplies hydraulic pressure to all wheel brake calipers by operating the piston inside the pump.

**DTC Description**

The ABS ECU monitors the pump motor relay or fuse open, open or short in motor or motor lock and then sets this code if a malfunction is detected.



شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

## BR-278

## Brake System

## DTC Detecting Condition

Item		Detecting Condition	Possible cause
DTC Strategy		<ul style="list-style-type: none"> <li>Voltage Monitoring</li> </ul>	
Case1 (Motor Relay continuous off, Open, Fuse blown)	Detect Mode	<ul style="list-style-type: none"> <li>Continuous (If the pump is switched on (FET on))</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>If the motor relay is switched ON and motor voltage &lt; (IGN voltage – 4.0V) continued for 100msec, the failure is detected.</li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>Pressure decrease is no longer possible. (wheels block)</li> <li>The ABS/ESP functions are inhibited and the EBD function is reduced.</li> <li>The ABS/EBD/ESP warning lamps are activated.</li> </ul>	
Case2 (Motor Lock)	Detect Mode	<ul style="list-style-type: none"> <li>Continuous (If the pump is in the transition "on → off")</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>After the end of the actuation of the motor relay, the pump motor is still in motion and is generating a voltage during its slowdown. The generated motor voltage is monitored for a certain time on high level. The time depends on the supply voltage and is in the range of 300ms to 125ms. If the slow down condition isn't met, the pump is activated again and the slowdown time is measured again. This is repeated for maximum 3 times. If, after the last pump activation, the pump motor slowdown time is still too short, a failure is detected.</li> </ul> <p>1st actuation : 200ms 2nd actuation : 1000ms 3rd actuation : 3000ms</p>	<ul style="list-style-type: none"> <li>Open or short of power supply circuit (ESP2)</li> <li>Faulty HECU</li> </ul>
	Fail Safe	<ul style="list-style-type: none"> <li>Pressure decrease is no longer possible. (wheels block)</li> <li>The ABS/ESP functions are inhibited and the EBD function is reduced.</li> <li>The ABS/EBD/ESP warning lamps are activated.</li> </ul>	
Case3 (Ground loss, Motor relay continuous on, Motor Short to BATT)	Detect Mode	<ul style="list-style-type: none"> <li>Continuous (If the pump is switched off i.e. not actuation and no slowdown)</li> </ul>	
	Enable Conditions	<ul style="list-style-type: none"> <li>Motor relay is switched OFF, VMR &gt; 2.0V continued for 1sec, the failure is detected.</li> </ul>	
	Fail Safe	<ul style="list-style-type: none"> <li>The return pump does not work correct.</li> <li>The ABS/ESP functions are inhibited and the EBD function is reduced.</li> <li>The ABS/EBD/ESP warning lamps are activated.</li> </ul>	

# ESP(Electronic Stability Program) System

## BR-279

### Monitor Actuation Test

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".

1.5 ACTUATION TEST 01/13	
<b>MOTOR</b>	
DURATION	2 SECONDS
METHOD	ACTIVATION
CONDITION	IG.KEY ON ENGINE OFF
PRESS [STRT], IF YOU ARE READY ?	
[STRT]	

Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"  
Ex) Actuation Test on motor

5. Does a inlet valve operate normally?

**YES**

► Fault is intermittent caused by poor connection in motor circuit or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "W/Harness Inspection" procedure.

### Terminal & Connector Inspection

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

3. Select the "Actuation Test" mode on the scantool.
4. Inspect operating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

3. Has a problem been found?

**YES**

► Repair as necessary and then go to "Verification Of Vehicle Repair" procedure.

**NO**

► Go to "Power Circuit Inspection" procedure.

### Power Supply Circuit Inspection

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Ignition "ON".

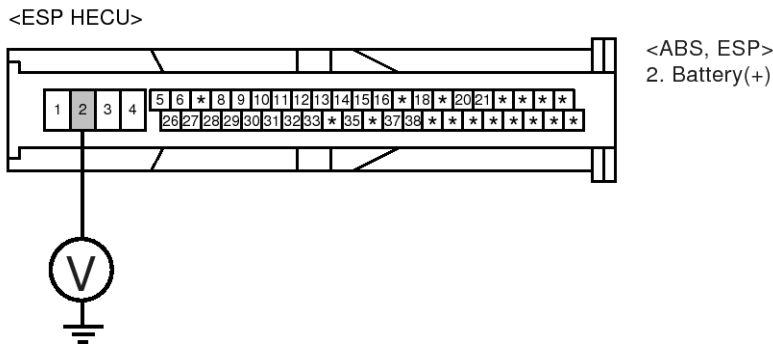
SCMBR6574L

# BR-280

# Brake System

4. Measure voltage between terminal "2" of the HECU harness connector and chassis ground.

Specification : Approx. B+



SBLBR6530L

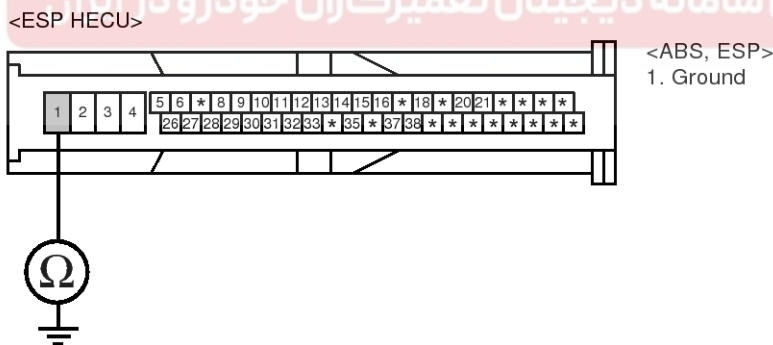
5. Is the measured voltage within specifications?

**YES**

▶ Go to "Ground Circuit Inspection" procedure.

**NO**

▶ Check for damaged harness and open or short to GND between the battery terminal(+) and terminal "2" of the HECU harness connector. Check for open or blown 40A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification Of vehicle Repair" procedure.



## Ground Circuit Inspection

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω

SBLBR6531L

# ESP(Electronic Stability Program) System

## BR-281

4. Is the measured resistance within specifications?

### YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification Of Vehicle Repair" procedure.

### NO

▶ Check for damaged harness and poor connection between terminal "1" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification Of vehicle Repair" procedure.

### Verification of Vehicle Repair

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

1. Connect scantool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information. (Start and drive vehicle in gear and maintain vehicle speed at or above 30kmh. (18mph)
4. Are any DTCs present?

### YES

▶ Go to the applicable troubleshooting procedure.

### NO

▶ System performing to specification at this time.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

