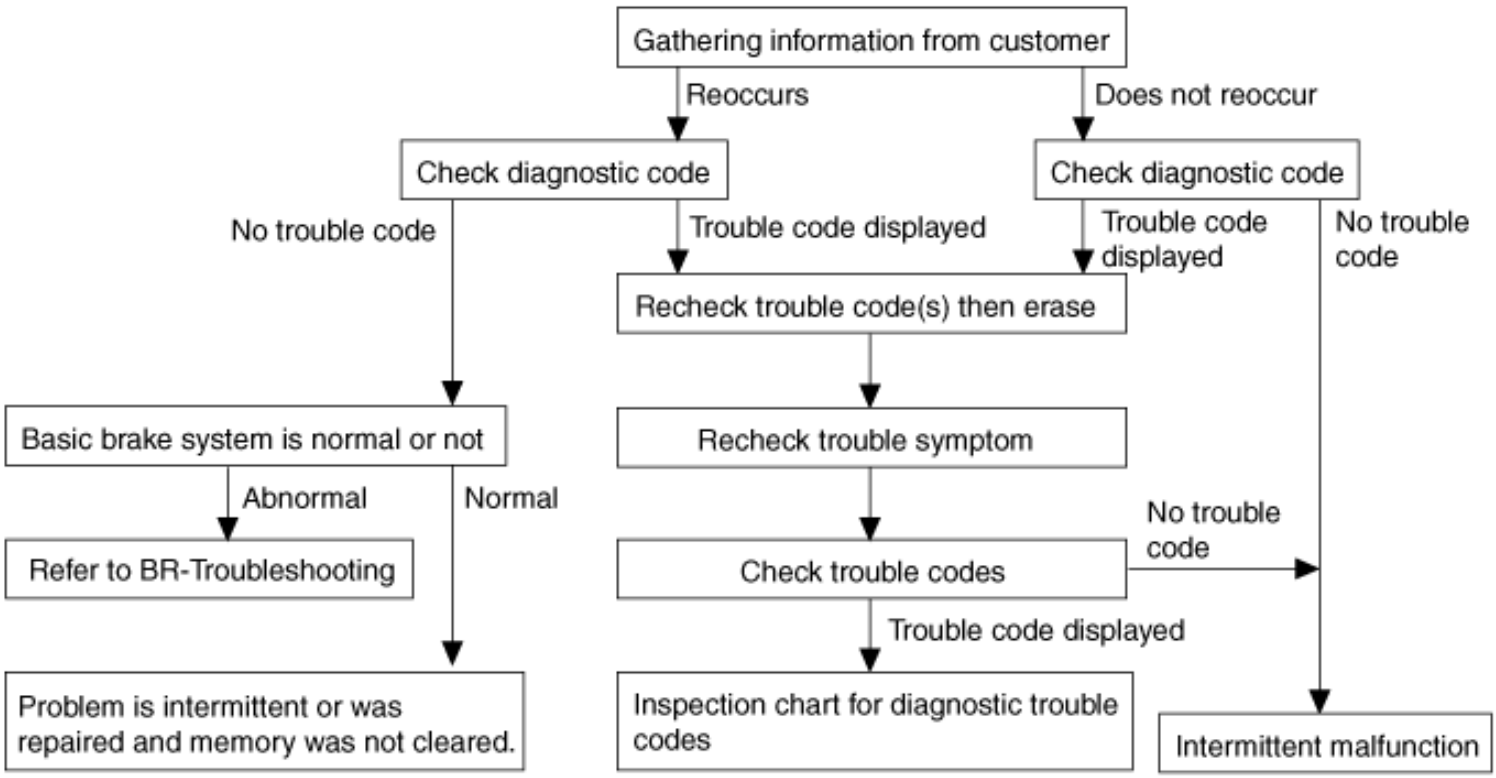
TROUBLESHOOTING

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

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	1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due torepeated brake application and release (Thump : suspension; squeak: tires)
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.

Pedal kick back	Pedal kick back is normal operation.

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 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 Occurence of Problem	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	☐ Intermittent (times a day)
	ABS Warning Light Abnormal	☐ Remains ON ☐ Does not light up

Diagnostic Trouble Code Check	**1st Time**	☐ Normal Code	☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code	☐ Malfunction Code (Code)

PROBLEM SYMPTOMS TABLE

Symptom	Suspect Area	See page

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.	BR - 59
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 normal code is output. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.	BR - 61
Communication with Hi-scan (pro) is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line	BR - 63
Communication with Hi-scan (pro) is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU	BR - 64
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU	BR - 66
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU	BR - 68
Brake warning lamp is abnormal.	1. Brake oil level sensor 2. Parking brake switch 3. Brake warning lamp circuit	BR - 70

CAUTION

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.

DIAGNOSTIC TROUBLE CODE CHART

DTC No.	Detection Item	MIL*	Memory	See page
C1101	Battery voltage over volt: 18V or more	○	○	BR-
C1102	Battery voltage low volt: 9.5V or less	○	○	BR-

C1200	FL wheel sensor: open or short to ground	○	○	BR-
C1201	- Range/Performance: speed jump or damaged exciter	○	○	BR-
C1202	- No signal: air-gap error or wrong excite	○	○	BR-
C1203	FR wheel sensor: open or short to ground	○	○	BR-
C1204	- Range/Performance: speed jump or damaged exciter	○	○	BR-
C1205	- No signal excite: air-gap error or wrong excite	○	○	BR-
C1206	RL wheel sensor: open or short to ground	○	○	BR-
C1207	- Range/Performance: speed jump or damaged exciter	○	○	BR-
C1208	- No signal excite: air-gap error or wrong excite	○	○	BR-
C1209	RR wheel sensor: open or short to ground	○	○	BR-
C1210	- Range/Performance: speed jump or damaged exciter	○	○	BR-
C1211	- No signal: air-gap error or wrong excite	○	○	BR-
C1604	ECU hardware: ECU internal or valve failure	○	○	BR-
C2112	Valve relay: valve relay or fuse failure	○	○	BR-
C2402	Motor-Electrical: open or short to battery, motor relay, fuse or motor lock fail	○	○	BR-
C1503	TCS switch failure	×	○	BR-
C1605	CAN Hardware failure	Δ	○	BR-
C1610	CAN Bus off failure	Δ	○	BR-
C1611	EMS Time-out failure	Δ	○	BR-
C1612	TCM Time-out failure	Δ	○	BR-
C1613	TCM Un-matching failure	Δ	○	BR-
C2227	Brake disc overheat	Δ	○	BR-

NOTE

*MIL: Malfunction Indication Lamp
○: ABS warning lamp
Δ: TCS warning lamp

ABS Does Not Operate

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.	-Faulty power source circuit -Faulty wheel speed sensor circuit -Faulty hydraulic circuit for leakage -Faulty HECU

INSPECTION PROCEDURES

1. CHECK THE DTC RECONFIRMING THAT THE NORMAL CODE IS OUTPUT.

1. Connect the Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.

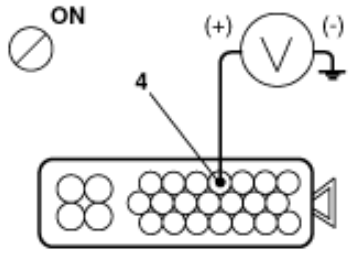
Is the normal code output?

Yes		
	No	Erase the DTC and recheck using Hi-Scan (pro).

2. 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 4 of the ABS control module harness side connector (E37) and body ground.

- **Specification: approximately B+**

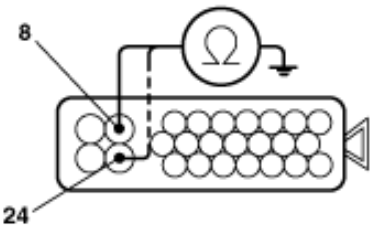


Is the voltage within specification?

Yes		
	No	Check the harness or connector between the No.11 fuse (10A) in the passenger compartment junction block and the ABS control module. Repair if necessary.

3. CHECK THE GROUND CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 8,24 of the ABS control module harness side connector (E37) and ground point (G17).



Is there continuity?

Yes		
	No	Repair an open in the wire and ground point (G17).

4. CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.(see page BR- 75)

OK	
NG	Repair or replace the wheel speed sensor.

5. CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines. (see page BR- 44)

OK	
NG	Repair the hydraulic lines for leakage.

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

ABS Does Not Operate Intermittently

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.	-Faulty wheel speed sensor circuit -Faulty stop lamp switch circuit -Faulty hydraulic circuit for leakage -Faulty HECU

INSPECTION PROCEDURES

1. CHECK THE DTC RECONFIRMING THAT THE NORMAL CODE IS OUTPUT.

1. Connect the Hi-Scan (pro) to the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.

Is the normal code output?

Yes	
No	Erase the DTC and recheck using Hi-Scan (pro).

2. CHECK THE WHEEL SPEED SENSOR CIRCUIT.

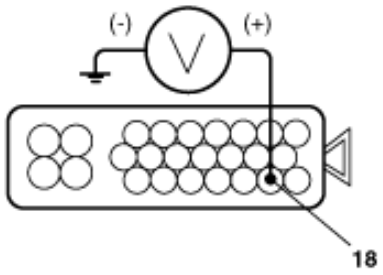
Refer to the DTC troubleshooting procedures. (see page BR- 75)

OK	
NG	Repair or replace the wheel speed sensor.

3. 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 18 of the ABS control module harness side connector (E37) and body ground when brake pedal is depressed.

- **Specification: approximately B+**



Is the voltage within specification?

Yes	
No	Repair the stop lamp switch. Repair an open in the wire between the ABS control module and the stop lamp switch.

4. CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines. (see page BR- 44)

OK	
NG	Repair the hydraulic lines for leakage.

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

Communication With Hi-Scan (pro) Is Not Possible.
(Communication With Any System Is Not Possible)

DETECTING CONDITION

Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	-An open in the wire -Poor ground (G14)

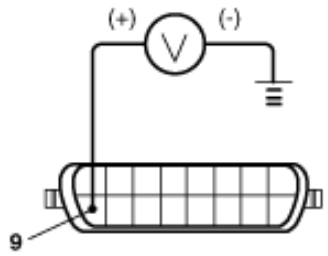
INSPECTION PROCEDURES

1. CHECK THE POWER SUPPLY CIRCUIT FOR THE DIAGNOSIS

Measure the voltage between terminal 9 of the data link connector (M07) and body ground.

- **Specification: approximately B+**

Is voltage within specification?

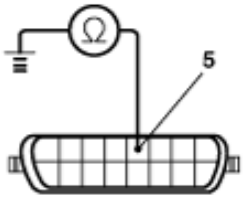


Yes	
No	Repair an open in the wire. Check and replace fuse (15A) from the passenger compartment junction block

2 . CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

Check for continuity between terminal 5 of the data link connector (M07) and body ground.

Is there continuity?



No	Repair an open in the wire between terminal 5 of the data link connector (M07) and ground point (G14).

Communication With Hi-Scan (pro) Is Not Possible.
(Communication With ABS Only Is Not Possible)

DETECTING CONDITION

Trouble Symptoms	Possible Cause
When communication with Hi-Scan (pro) is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Blown No.11 fuse (10A) in the passenger compartment junction block - Faulty HECU

INSPECTION PROCEDURES

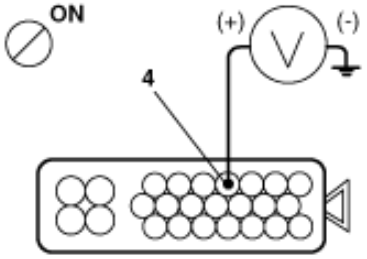
1. CHECK FOR CONTINUITY IN THE DIAGNOSIS LINE

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 7 of the ABS control module connector (E37) and 1 of the data link connector (M07).

Is there continuity?

Yes	
No	Repair an open in the wire.

2. CHECK THE POWER SOURCE OF ABS CONTROL MODULE



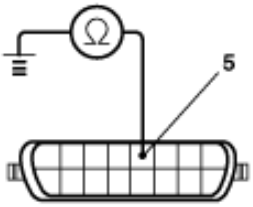
1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 4 of the ABS control module harness side connector (E37) and body ground.

- **Specification: approximately B+**

Is voltage within specification?

Yes	No	Check the harness or connector between the No.11 fuse (10A) in the passenger compartment junction block and the ABS control module. Repair if necessary.

3 . CHECK FOR POOR GROUND



Check for continuity between terminal 5 of the data link connector (M07) and ground point (G14).

Is there continuity?

Yes	No	Repair an open in the wire or poor ground.

Replace the ABS control module and recheck.

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

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 HECU, and the faulty HECU.	- Blown No.2 fuse (10A) in the passenger compartment junction block - An open in the wire - Faulty ABS warning lamp bulb - Faulty ABS warning lamp module - Faulty HECU

INSPECTION PROCEDURES

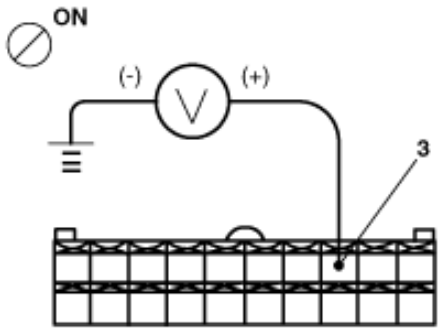
1 . PROBLEM VERIFICATION

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

Does the ABS warning lamp light up?

No	Yes	Check for short circuit in the ABS control module connector.

2 . CHECK THE POWER SOURCE FOR THE ABS WARNING LAMP



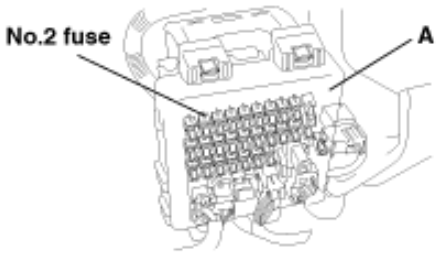
1. Disconnect the instrument cluster connector (M10-1) and turn the ignition switch ON.
2. Measure the voltage between terminal 3 of the cluster harness side connector (M10-1) and body ground.

- **Specification: approximately B+**

Is voltage within specification?

No	Yes	Repair bulb or instrument cluster assembly.

3 . CHECK FOR BLOWN FUSE



Check continuity of No.2 fuse (10A) from the passenger compartment junction block (A).

Is there continuity?

Yes	No	Replace the blown fuse.

Repair an open in the wire between terminals 12 of I/P-H connector and 3 of cluster connector (M10-1).

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

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.	-An open in the wire -Faulty instrument cluster assembly -Faulty HECU

INSPECTION PROCEDURES

1 . CHECK DTC OUTPUT.

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

Is DTC output?

No	Yes	Repair circuit indicated by code output.

2 . CHECK INSTRUMENT CLUSTER

Disconnect the cluster connector (M10-1) and turn the ignition switch ON.

Does the ABS warning lamp remains ON?

No	Yes	Replace the instrument cluster.

3 . CHECK FOR OPEN IN THE WIRE

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

Is there continuity?

Yes	No	Repair an open in the wire between cluster and ABS control module.

Replace the ABS control module and recheck.

Brake Warning Lamp Is Abnormal

DETECTING CONDITION

Trouble Symptoms	Possible Cause
The brake warning lamp lights up when the brake oil is insufficient, parking brake is applied or EBD is defective.	- Faulty brake oil level sensor - Faulty parking brake switch - Faulty instrument cluster - Faulty HECU

INSPECTION PROCEDURES

1. CHECK PARKING BRAKE SWITCH CIRCUIT

OK

NG	Repair or replace parking brake switch circuit.

2. CHECK BRAKE OIL LEVEL WARNING SWITCH CIRCUIT

OK

NG	Repair or replace brake oil level warning switch circuit.

3. CHECK BRAKE WARNING LAMP CIRCUIT IN CLUSTER

OK

NG	Repair or replace the instrument cluster.

4. CHECK FOR OPEN OR SHORT CIRCUIT IN HARNESS AND CONNECTOR

OK

NG	Repair or replace the harness and connector.

Replace the ABS control module and recheck.

DTC	**C1101 (Over Voltage) C1102 (Low Voltage)**	**Battery Voltage out of Range (Low or Over Voltage)**

DESCRIPTION

The voltage of the HECU power supply drops lower than or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.

CAUTION

If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to the standard value, the code is no longer output. Before carrying out the following inspection, check the battery level, and refill if necessary.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1101 (Over Voltage) C1102 (Low Voltage)	**Detecting Condition for Over Voltage:** 1. When Vign>17V is continued for 500msec. 2. When Vign>19V is continued for 49msec. 3. If the voltage recover normal operating range, the controller is reset. **Detecting Condition for Low Voltage:** 1. When Vign<9.4V is continued for 500msec. 2. When Vign>9.6V is continued for 500msec, the controller recovers to normal state. 3. During ABS control or standstill, detection voltage = 8.4V, recovery voltage = 8.6V. 4. When Vign<7.2V is continued for 28msec. 5. When Vign>7.5V is continued for 28msec, the controller recovers to state 1).	- An open or short in the wire - Faulty power supply circuit - Faulty HECU

FAILSAFE FUNCTION

Over voltage failure:

System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

Low voltage failure:

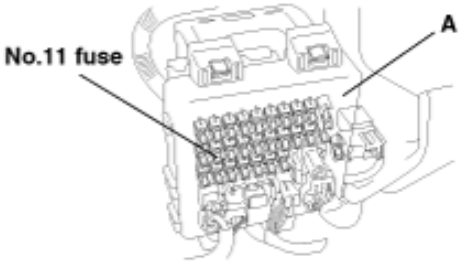
1. Outside the ABS control cycle : inhibit the ABS(,TCS) control of front wheels and allow the ABS control of rear wheels, deactivating the motor, and the ABS(,TCS) warning lamp is switched on. When the voltage recover to the normal operating range, enable ABS function and ABS(,TCS) warning lamp is switched off and erase the error code.
2. Inside the ABS control cycle : inhibit ABS control of the front wheels and allow ABS control of the rear wheels, deactivating the motor. the ABS(,TCS) warning lamp is directly switched on and the state keeps continuously. the error code is always stored.

INSPECTION PROCEDURES

1 . CHECK NO.11 FUSE (10A) FROM JUNCTION BLOCK.

Check continuity of No.11 fuse (10A) from passenger compartment junction block (A).

Is there continuity?



Yes	
No	Check for short circuit in all the harness and components connected to No.11 fuse

2 . CHECK BATTERY POSITIVE VOLTAGE.

Is battery voltage within 10~14V?

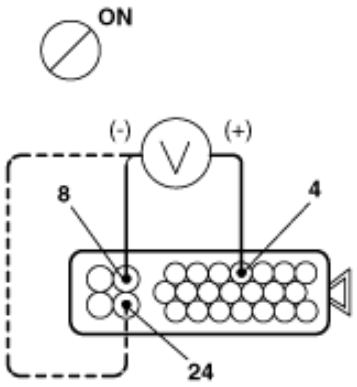
Yes	
No	Check and repair the charging system.

3 . CHECK FOR VOLTAGE BETWEEN TERMINALS OF HECU HARNESS SIDE CONNECTOR.

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON.
3. Measure the voltage between terminals 4 and 8, 24 of the ABS control module harness side connector.

- **Specification: approximately B+**

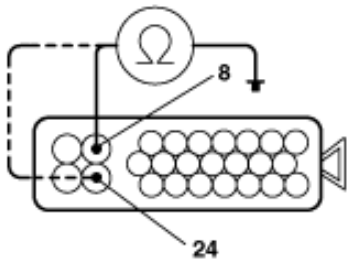
Is the voltage within specification?



No	
Yes	Check and replace the ABS control module.

4 . CHECK FOR CONTINUITY BETWEEN TERMINALS OF HECU CONNECTOR AND BODY GROUND.

Measure the resistance between terminals 8, 24 of ABS control module harness side connector and body ground.



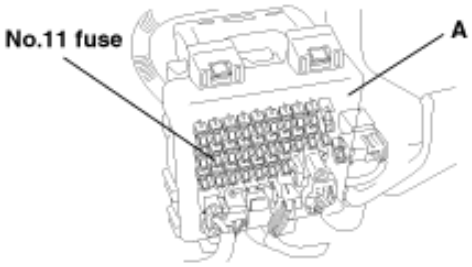
- **Specification: 1□ or less**

Is the resistance within specification?

Yes		
	No	Repair an open in the wire or faulty ground point.

5 . CHECK FOR OPEN CIRCUIT BETWEEN TERMINAL OF HECU CONNECTOR AND NO. 11 FUSE.

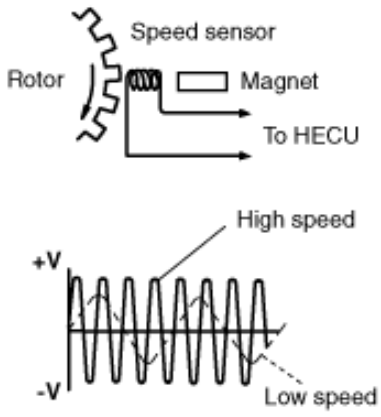
Check for open circuit in harness and connector between terminal 4 of ABS control module harness side connector and No.11 fuse (10A) in the passenger compartment junction block (A).



DTC	**C1200 (FL) C1203 (FR) C1206 (RL) C1209 (RR)**	**Wheel Speed Sensor Open or Short to Ground**

DESCRIPTION

The wheel speed sensor detects wheel speed and sends the appropriate signals to the HECU. These signals are used to control of the ABS system. The front and rear rotors each have 44 serrations.
When the rotors rotate, the magnetic field emitted by the permanent magnet in the speed sensor generates an AC voltage.
Since the frequency of this AC voltage changes in direct proportion to the speed of the rotor, the frequency is used by HECU to detect the speed of each wheel.



DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1200 (FL) C1203 (FR) C1206 (RL) C1209 (RR)	The wheel velocity is below 7km/h and the offset voltage of the sensor is outside the permitted range. if this condition is continued for more than 140msec.	- An open or short in the wire - Faulty wheel speed sensor - Faulty HECU

FAILSAFE FUNCTION

Sensor failure outside the ABS control cycle:

1. Only one wheel failure
   Only the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
2. More than two wheels failure
   System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

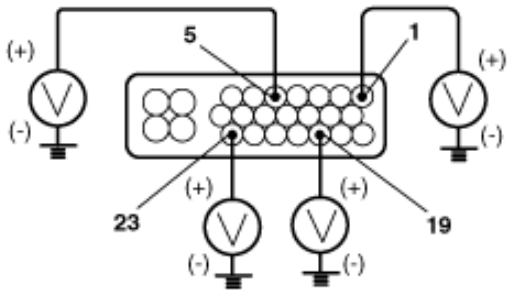
Sensor failure inside the ABS control cycle:

1. One front wheel failure
   Inhibit the ABS control of the failed-wheel and maintain the ABS control of normal wheel.
   After the controller completes the ABS control, the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
2. One rear wheel failure
   Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
   After the controller completes the ABS control, Only the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
3. More than two wheels failure.
   System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

INSPECTION PROCEDURES

1. PROBLEM VERIFICATION

1. Disconnect the ABS control module connector (E37).
2. Start the engine.
3. Measure the voltage between the appropriate wheel sensor(+) circuit terminal and body ground (see table).



DTC	Terminal
C1200 (Front - left)	1
C1203 (Front - right)	19
C1206 (Rear - left)	5
C1209 (Rear - right)	23

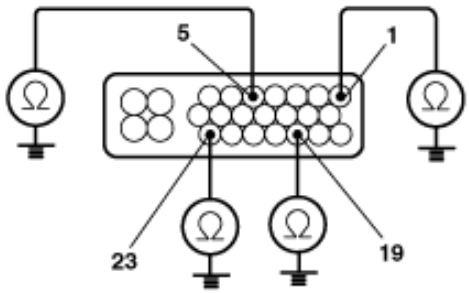
Is there 2V or more?

No	Yes — Repair short to power in the (+) circuit wire between the ABS control module and the appropriate wheel sensor.

2. CHECK CIRCUIT FOR SHORT TO GROUND.

Check for continuity between the appropriate wheel sensor(+) circuit terminal and body ground (see table).

DTC	Terminal
C1200 (Front - left)	1
C1203 (Front - right)	19
C1206 (Rear - left)	5
C1209 (Rear - right)	23



Is there continuity?

Yes	Disconnect the harness 2P connector from the appropriate wheel sensor, then check for continuity between the (+) and (-) terminals of the harness and body ground. **Is there continuity?**

Yes

No	Replace the wheel sensor.

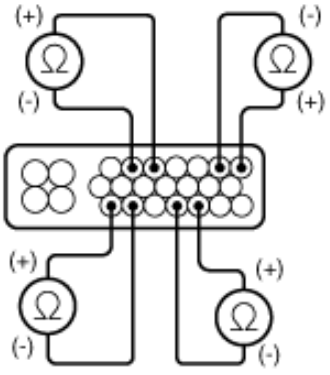
No

Repair short to body ground in the (+) or (-) circuit wire between the ABS control module and the wheel sensor.

3. CHECK THE RESISTANCE BETWEEN TERMINALS OF HECU.

Check the resistance between the appropriate wheel sensor (+) and (-) circuit terminals. (see table)

DTC	Terminal	
	(+) side	(-) side
C1200 (Front - left)	1	2
C1203 (Front - right)	19	20
C1206 (Rear - left)	5	6
C1209 (Rear - right)	23	22



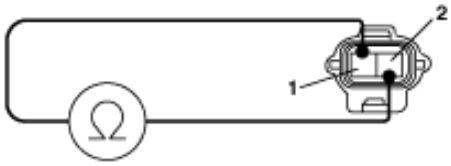
Is the resistance within 1,275~1,495□ ?

No

Yes	Check for loose ABS control module connectors. If necessary, substitute a known-good ABS control module and recheck.

4 . CHECK THE RESISTANCE BETWEEN TERMINALS OF WHEEL SENSOR

Disconnect the harness 2P connector from the appropriate wheel sensor, and check the resistance between the (+) and (-) terminals of the wheel sensor.



Is the resistance within 1,275~1,495□ ?

Yes	No	Replace the wheel sensor.

5 . REPAIR AN OPEN OR SHORT IN THE WIRE.

Repair open in the (+) or (-) circuit wire, or short between the (+) circuit wire and the (-) circuit wire between the ABS control module and the wheel sensor.

DTC	C1201 (FL) C1204 (FR) C1207 (RL) C1210 (RR)	Wheel Speed Sensor Signal Malfunction (Speed jump or damaged exciter)

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1201 (FL) C1204 (FR) C1207 (RL) C1210 (RR)	**Detecting Condition for Speed Jump:** This monitoring is performed for the period that the velocity of each wheel exceeds 2km/h. 1. Controller counts the number of the wheel acceleration of 100g [(25km/h) for 7ms]. When the numbers at one wheel exceed 56 times, or When the numbers at more two wheels exceed 5 times, controller recognize the failure. 2. Controller counts the number of the wheel acceleration of 40g [(10km/h) for 7ms]. When the numbers at one wheel exceed 126 times, or When the numbers at more two wheels exceed 20 times, controller recognize the failure. 3. Controller counts the number of the wheel deceleration of -100g[(-25km/h) for 7ms]. When the numbers at each wheel exceed 56 times, controller recognize the failure. 4. The wheel deceleration of –100g[(-25km/h) for 7ms] causes the controller to start monitoring this failure and to compare the wheel velocity with the vehicle velocity from next cycle. When its difference of -100g is continued for more than 140msec, controller recognize the failure.	- Improper installation of wheel speed sensor - An open or short in the wire - Faulty wheel speed sensor - Faulty rotor or wheel bearing - Faulty HECU

	5. In case that any sensor failure at other wheel was already detected, When the numbers of 100g at each wheel exceed 5 times, or When the numbers of 40g at each wheel exceed 20 times, controller recognize the failure. **Detecting Condition for Damaged Exciter:** 1. Max. wheel velocity exceeds 20km/h and the wheel velocity is 40% of max. wheel velocity. if this condition is lasted for 2 minutes. 2. Max. wheel velocity exceeds 40km/h and the wheel velocity is 60% of max. wheel velocity. if this condition is lasted for 2 minutes.	

FAILSAFE FUNCTION

Sensor failure outside the ABS control cycle:

1. Only one wheel failure
   Only the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
2. More than two wheels failure
   System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

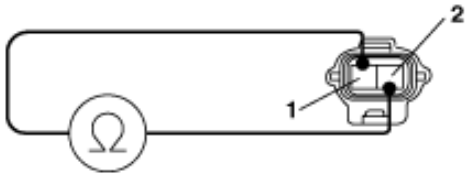
Sensor failure inside the ABS control cycle:

1. One front wheel failure
   Inhibit the ABS control of the failed-wheel and maintain the ABS control of normal wheel.
   After the controller completes the ABS control, the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
2. One rear wheel failure
   Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
   After the controller completes the ABS control, Only the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
3. More than two wheels failure.
   System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

INSPECTION PROCEDURES

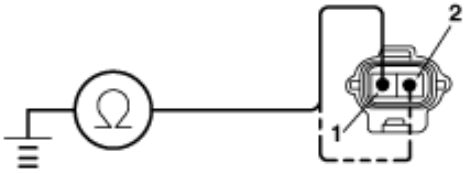
1 . CHECK WHEEL SPEED SENSOR

1. Disconnect the wheel speed sensor connector (2P).
2. Measure the resistance between terminals 1 and 2 of the wheel speed sensor connector.



- **Specification: 1,275~1,495Ω**

3. Measure the resistance between terminals 1 and 2 of the wheel speed sensor connector and body ground.



- **Specification: 1MΩ or higher**

Is the resistance within specification?

Yes	No	Replace the wheel speed sensor.

2 . CHECK FOR OPEN AND SHORT CIRCUIT

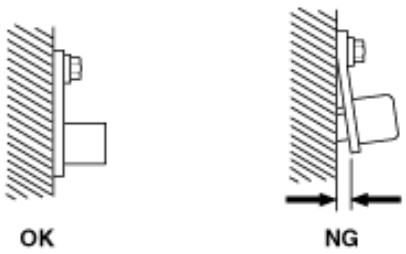
Check for open and short circuit in the harness and connector between each wheel speed sensor and ABS control module.

OK	NG	Repair or replace harness or connector.

3 . CHECK WHEEL SPEED SENSOR INSTALLATION

Visually check for appropriate wheel speed sensor and rotor installation.

Note)
The mounting bolt shall be tightened properly and there is no clearance is allowed between the sensor and front steering knuckle or rear axle carrier.

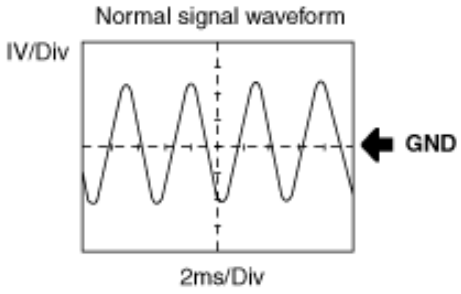


OK	NG	Repair or replace the wheel speed sensor.

4 . CHECK WHEEL SPEED SENSOR AND SENSOR ROTOR

1. Disconnect the connector from the ABS control module.
2. Rotate the wheel to be measured approximately 1/2 to 1 rotation per second, and check the output voltage and the signal waveform using oscilloscope.

- **Specification: 130mVp-p or more.**

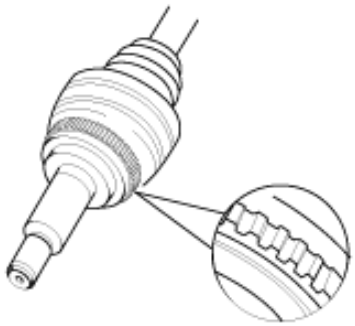


NG

OK	Check and replace the ABS control module.

5 . CHECK SENSOR ROTOR AND SENSOR TIP

1. Remove the front drive shaft and the rear axle hub.
2. Check the sensor rotor serrations.
   Check if there are no scratches, missing teeth or foreign objects.
3. Remove the front and rear wheel speed sensors.
4. Check if there are no scratches or foreign objects on the sensor tip.



OK

NG	Replace the sensor rotor or wheel speed sensor.

Erase the DTC, and test-drive the vehicle.
If the ABS warning lamp comes on and the same DTC is indicated, replace the ABS control module.

DTC	**C1202 (FL) C1205 (FR) C1208 (RL) C1211 (RR)**	**Wheel Speed Sensor Signal Malfunction (Air-gap error or wrong excite)**

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause

C1202 (FL) C1205 (FR) C1208 (RL) C1211 (RR)	**Detecting Condition for Large Air-Gap:** This monitoring is performed for the period that the minimum velocity rises from 2km/h to 10km/h. 1. When the minimum wheel velocity is 2km/h and the velocity of other wheels exceed 10km/h with the acceleration of < 0.4g, the controller start comparing the velocity of other wheels except the min. wheel. if their difference below 4km/h is continued for 140msec, Otherwise, if their difference beyond 4km/h or > 0.4g is continued for 2 minutes. 2. In < 0.4g, when the velocity of more two wheels is 2km/h and the max. wheel velocity exceeds 10km/h, the condition is continued for 20 sec. Otherwise, In >0.4g, the condition is 2 minutes. 3. After velocity of 4 wheel exceeds 10km/h, when velocity of 1 wheel or 2 wheel is 2km/h and difference of other 2 wheel velocity is less than 4km/h under that those velocity is more than 10km/h, if that conditions are continued for 12 seconds. **Detecting Condition for Long Term ABS mode:** 1. During the ABS control cycle, if the wheel velocity of 2km/h is lasted for more than 12sec. 2. If the ABS control cycle is continued for more than 36sec.	- Improper installation of wheel speed sensor - An open or short in the wire - Faulty wheel speed sensor - Faulty rotor or wheel bearing - Faulty HECU

FAILSAFE FUNCTION

Sensor failure outside the ABS control cycle:

1. Only one wheel failure
   Only the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
2. More than two wheels failure
   System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

Sensor failure inside the ABS control cycle:

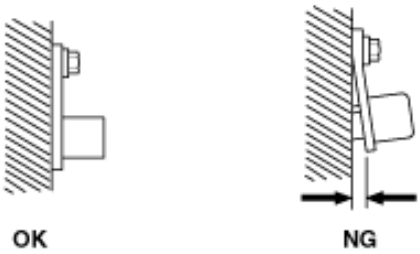
1. One front wheel failure
   Inhibit the ABS control of the failed-wheel and maintain the ABS control of normal wheel.
   After the controller completes the ABS control, the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
2. One rear wheel failure
   Inhibit ABS control of both front wheels and the pressure of both rear wheels is decreased.
   After the controller completes the ABS control, Only the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
3. More than two wheels failure.
   System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

INSPECTION PROCEDURES

1. CHECK WHEEL SPEED SENSOR INSTALLATION

Visually check for appropriate wheel speed sensor and rotor installation (see table).

DTC	Appropriate wheel sensor
C1202	Front - left wheel sensor
C1205	Front - right wheel sensor
C1208	Rear- left wheel sensor
C1211	Rear- right wheel sensor



Are they installed correctly?

Yes

No	Reinstall or replace the appropriate wheel speed sensor.

2. CHECK AIR GAP BETWEEN WHEEL SPEED SENSOR AND TONE WHEEL.

- **Specification**
  - Front: 0.2~1.3 mm
  - Rear: 0.2~1.3 mm

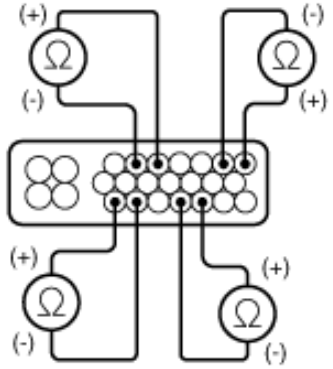
Is the air gap within specification?

Yes

No	Reinstall or replace the appropriate wheel speed sensor.

3. CHECK THE RESISTANCE BETWEEN TERMINALS OF HECU.

1. Disconnect the ABS control module connector (E37).
2. Measure the resistance between the appropriate wheel speed sensor(+) and (-) circuit terminals (see table).



DTC	Appropriate Terminal	
	(+) side	(-) side
C1202 (Front - left)	1	2
C1205 (Front - right)	19	20
C1208 (Rear - left)	5	6
C1211 (Rear - right)	23	22

Is the resistance within 1,275~1,495Ω ?

Yes

No	Repair an open or short in the wire between the ABS control module and the wheel speed sensor.

Erase the DTC, and test-drive the vehicle.
If the ABS warning lamp comes on and the same DTC is indicated, replace the ABS control module.

DTC	C1604	ECU Hardware Failure (ECU Internal or Solenoid Valve Failure)

DESCRIPTION

The HECU always monitors the solenoid valve drive circuit.
It determines that there is an open or short-circuit in the solenoid coil or in a harness even if no current flows in the solenoid or through the HECU.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1604	**Detecting Condition for Solenoid Valve Open or Short:** 1. When the valve relay is switched off, the drain voltage of the solenoid drive MOSFET is over the criterion, which is continued for 56msec. 2. When the valve relay is switched on and a solenoid off, the drain voltage of the solenoid drive MOSFET is under the criterion, which is continued for 56msec. 3. When the valve relay and a solenoid are switched on, the drain voltage of the solenoid drive MOSFET is over the criterion, which is continued for 56msec. **Detecting Condition for EEPROM Failure of ECU:** When the MCU can't erase or write a data of the EEPROM.	- An open or short in the solenoid valve circuit. - Leakage current in the solenoid valve. - Faulty HECU.

	Detecting Condition for MCU Failure of ECU: If the master/slave processor detects abnormal operation in RAM, status register, interrupt, timer, A/D converter and cycle time.	

FAILSAFE FUNCTION

System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

INSPECTION PROCEDURES

1 . CHECK THE DTC ONCE MORE

1. Clear the DTC using the Hi-scan (Pro).
2. Turn the ignition switch OFF.
3. Turn the ignition switch ON, and check if the same DTC is stored in the memory.

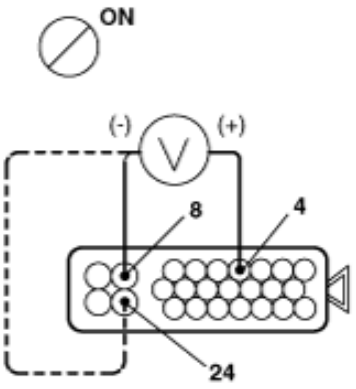
Yes	
No	Problem is intermittent and the ABS control module memory was not cleared.

2 . CHECK VOLTAGE BETWEEN TERMINALS OF HECU CONNECTOR

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON.
3. Measure the voltage between terminals 4 and 8, 24 of ABS control module harness side connector.

- **Specification: approximately B+**

Is the voltage within specification?



Yes	
NO	Check for open or short in the wire.

3 . CHECK CONNECTION OF HECU

Check the connection of ABS control module connector

OK	
NG	Repair or replace harness or connector.

Check and replace the ABS control module.

DTC	C2112	Valve Relay Failure (Valve Relay or Fuse Failure)

DESCRIPTION

When the ignition switch is turned ON, the HECU switches the valve relay on and off during its initial check. During this time, voltage sent to the valve relay is compared to the voltage in the valve power monitor line. If no current is detected in the valve power monitor line, the HECU determines that there is an open circuit and DTC C2112 is recorded.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C2112	**Detecting Condition for Valve Relay Open:** When the valve relay is switched on, the reference voltage of valve relay is under the permitted range, which is continued for 56msec. **Detecting Condition for Valve Relay Short:** When the valve relay is switched off, the reference voltage of valve relay is over the criterion, which is continued for 56msec.	-An open or short in the valve relay circuit. -Faulty HECU

FAILSAFE FUNCTION

System down. both the ABS(,TCS) and the EBD function are inhibited and the ABS(,TCS) and the EBD warning lamps is activated. In this failure, the valve relay and all solenoids are prevented from being switched on.

INSPECTION PROCEDURES

1 . CHECK THE DTC ONCE MORE

1. Clear the DTC using the Hi-scan (Pro).
2. Turn the ignition switch OFF.
3. Turn the ignition switch ON, and check if the same DTC is stored in the memory.

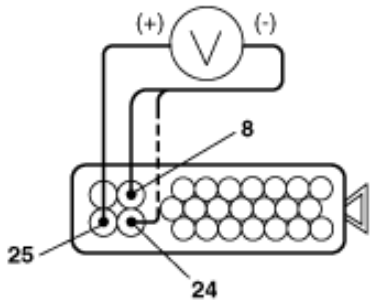
Yes	
No	Problem is intermittent and the ABS control module memory was not cleared.

2 . CHECK THE POWER SOURCE OF VALVE RELAY

1. Disconnect the connector from the ABS control module.
2. Measure the voltage between the terminals 25 and 8, 24 of the ABS control module harness side connector.

- **Specification: approximately B+**

Is the voltage within specification?



Yes	NO	Check and replace fuse (10A) and fusible link (30A). Check and repair harness or connector.

If the same code is still output after the DTC is deleted, check the contact condition of each connection.
If the connections are normal, the ABS control module may be defective.

DTC	C2402	Motor Relay or Motor Electrical Failure

DESCRIPTION

The ABS motor relay supplies power to the ABS pump motor. While the ABS is activated, the HECU switches the ABS motor relay ON and operates the ABS pump motor.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C2402	**Detecting Condition for Motor Relay Open or Motor Short to Battery:** When the motor relay is switched on, the reference voltage of motor is over the criterion, which is continued for 49msec. **Detecting Condition for Motor Lock:** The controller starts monitoring the motor voltage for 84msec from the time when the motor relay is switched off. if the motor voltage is over the criterion for 49msec after shutting off the motor, the motor is reactivated for 500msec after shutting off the motor 84msec and the above check is performed again for a maximum of two times. When the motor voltage is not normal even on the second check, the controller recognizes it as failure. **Detecting Condition for Fuse Open, Motor Open or Short to Ground:** The controller starts monitoring the motor after 1.8sec from the time when the motor relay is switched off. if the motor voltage is under the criterion for 0.2 sec.	- An open or short in the motor relay or motor circuit. - Motor lock - Faulty HECU.

FAILSAFE FUNCTION

1. Only the ABS(,TCS) function is inhibited. the ABS(,TCS) warning lamp is activated and the EBD warning lamp not activated.
2. Motor error during the ABS control cycle : inhibit the ABS control of front wheels, allow ABS control of the rear wheels, and ABS(,TCS) warning lamp is switched ON at the end of ABS control.

INSPECTION PROCEDURES

1. TEST MOTOR ACTUATION USING HI-SCAN (PRO).

Is the operating sound of motor heard?

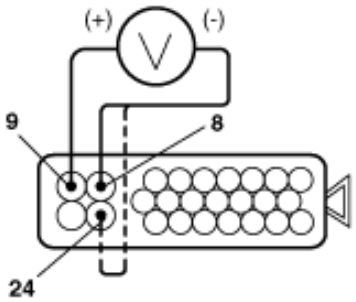
No	Yes	Check the harness and repair if necessary.

2. CHECK THE POWER SOURCE OF MOTOR.

1. Disconnect the connector from the ABS control module.
2. Measure the voltage between the terminals 9 and 8, 24 of the ABS control module harness side connector.

- **Specification: approximately B+**

Is the voltage within specification?



Yes	No	Check and replace fuses. Check and repair harness or connector.

If the same code is still output after the DTC is deleted, check the contact condition of each connection.
If the connections are normal, the ABS control module may be defective.

DTC	C1503	TCS Switch Failure (only System with TCS)

DESCRIPTION

When the TCS switch is pressed, TCS control is deactivated and the TCS OFF indicator lights up.
The TCS OFF indicator turns "ON" when the HECU prohibit TCS controls.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1503	The condition that the level of TCS switch is high is continued for 60 sec.	- An open or short in the TCS switch circuit. - Faulty TCS switch - Faulty HECU.

FAILSAFE FUNCTION

Inhibit the TCS control and allow the ABS/EBD control.
Meanwhile, stop checking the TCS switch failure under the TCS control.

INSPECTION PROCEDURES

1. CHECK THE DTC ONCE MORE.

1. Clear the DTC using hi-scan (pro).
2. Turn the ignition switch OFF.
3. Turn the ignition switch ON, and check if the same DTC is stored in the memory.

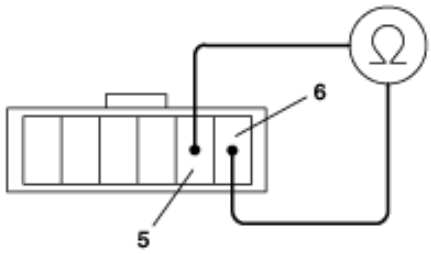
Yes	No	Problem is intermittent and the ABS control module memory was not cleared.

2. CHECK THE TCS SWITCH.

1. Remove the TCS switch.
2. Check for continuity between the terminals while operating the TCS switch.

Is there continuity between terminals 5 and 6 of TCS switch side connector (I47) with TCS switch ON?

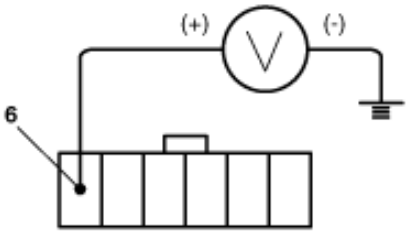
Position \ Terminal	1	2	5	6
ON				
OFF				



Yes	No	Replace the TCS switch with new one and recheck.

3. CHECK THE POWER SUPPLY CIRCUIT.

1. Disconnect the connector from the TCS switch.
2. Turn the ignition switch ON.
3. Measure the power supply voltage between terminal 6 of TCS switch harness side connector (I47) and body ground.



- **Specification: approximately B+**

Is the voltage within specification?

Yes	No	Check and replace No.10 fuse (10A). Check and repair harness or connector.

4. CHECK FOR OPEN IN THE WIRE.

Check for continuity in the wire between terminal 5 of TCS switch harness side connector (I47) and terminal 14 of HECU harness side connector (E37).

Is there continuity?

Yes	No	Check and repair harness or connector.

Erase the DTC, and test-drive the vehicle.
If the same DTC is indicated, replace the ABS control module.

DTC	C1605	CAN Hardware Failure (only System with TCS)

DESCRIPTION

The CAN circuit is used to send TCS control information from the HECU to the engine ECM and TCM, and engine and transmission control information from the engine ECM and TCM to the HECU.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1605	In case that CAN has hardware failure.	-Faulty CAN or bus

FAILSAFE FUNCTION

Inhibit the TCS control and allow the ABS/EBD control.

DTC	C1610	CAN Bus Off Failure (only System with TCS)

DESCRIPTION

The CAN circuit is used to send TCS control information from the HECU to the engine ECM and TCM, and engine and transmission control information from the engine ECM and TCM to the HECU.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1610	In case CAN BUS off state continued for more than 0.1sec.	-An open or short in the CAN bus circuit. -Faulty CAN bus -Faulty HECU

FAILSAFE FUNCTION

Inhibit the TCS control and allow the ABS/EBD control.

INSPECTION PROCEDURES

1. CHECK FOR OPEN IN THE CAN LINE.

1. Check for continuity in the wire between terminal 10 of HECU harness side connector (E37) and terminal 6 of PCM harness side connector (C183-1).
2. Check for continuity in the wire between terminal 11 of HECU harness side connector (E37) and terminal 7 of PCM harness side connector (C183-1).

Is there continuity?

Yes	No	Check and repair harness or connector.

Check the PCM according to the instructions of engine or T/M group.

DTC	C1611	EMS Time-out Failure (only System with TCS)

DESCRIPTION

HECU will compare signals from front (driving) and rear wheel speed sensors to detect driving wheels slip.
Upon detecting driving wheels slip, HECU will perform TCS control.
The HECU will transmit engine torque reduction request, fuel cut cylinder number, and TCS control request signals in accordance with slip level to engine ECM and TCM through BUS line which will provide CAN communication for TCS control.
Engine ECM will perform fuel cut as requested by HECU and retard ignition timing as per engine torque reduction request signal.
TCM will hold shift position by TCS control time according to TCS operation signal. Then enhanced acceleration by kick-down will not occur.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1611	1. In case that EMS1 or EMS2 message was not received for more than 0.5 sec. within normal voltage condition. 2. The monitoring starts 2 sec. after power up.	- An open or short in the CAN bus circuit. - Faulty CAN bus - Faulty EMS - Faulty HECU

FAILSAFE FUNCTION

Inhibit the TCS control and allow the ABS/EBD control.

INSPECTION PROCEDURES

1. CHECK FOR OPEN IN THE CAN LINE.

1. Check for continuity in the wire between terminal 10 of HECU harness side connector (E37) and terminal 6 of PCM harness side connector (C183-1).
2. Check for continuity in the wire between terminal 11 of HECU harness side connector (E37) and terminal 7 of PCM harness side connector (C183-1).

Is there continuity?

Yes	No	Check and repair harness or connector.

Check the PCM according to the instructions of engine or T/M group.

DTC	C1612	TCM Time-out Failure (only System with TCS)

DESCRIPTION

HECU will compare signals from front (driving) and rear wheel speed sensors to detect driving wheels slip.
Upon detecting driving wheels slip, HECU will perform TCS control.
The HECU will transmit engine torque reduction request, fuel cut cylinder number, and TCS control request signals in accordance with slip level to engine ECM and TCM through BUS line which will provide CAN communication for TCS control.
Engine ECM will perform fuel cut as requested by HECU and retard ignition timing as per engine torque reduction request signal.
TCM will hold shift position by TCS control time according to TCS operation signal. Then enhanced acceleration by kick-down will not occur.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1612	1. In case that TCM message was not received for more than 0.5 sec. within normal voltage condition. 2. The monitoring starts 2 sec. after power up.	- An open or short in the CAN bus circuit. - Faulty CAN bus - Faulty TCM - Faulty HECU

FAILSAFE FUNCTION

Inhibit the TCS control and allow the ABS/EBD control.

INSPECTION PROCEDURES

1. CHECK FOR OPEN IN THE CAN LINE.

1. Check for continuity in the wire between terminal 10 of HECU harness side connector (E37) and terminal 6 of PCM harness side connector (C183-1).
2. Check for continuity in the wire between terminal 11 of HECU harness side connector (E37) and terminal 7 of PCM harness side connector (C183-1).

Is there continuity?

Yes	No	Check and repair harness or connector.

Check the PCM according to the instructions of engine or T/M group.

DTC	C1613	TCM Wrong-Matched Transmission Failure (only System with TCS)

DESCRIPTION

HECU will compare signals from front (driving) and rear wheel speed sensors to detect driving wheels slip.
Upon detecting driving wheels slip, HECU will perform TCS control.
The HECU will transmit engine torque reduction request, fuel cut cylinder number, and TCS control request signals in accordance with slip level to engine ECM and TCM through BUS line which will provide CAN communication for TCS control.
Engine ECM will perform fuel cut as requested by HECU and retard ignition timing as per engine torque reduction request signal.
TCM will hold shift position by TCS control time according to TCS operation signal. Then enhanced acceleration by kick-down will not occur.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C1613	1. In case that the information about transmission is different in the EMS message and TCM message within normal voltage condition. 2. The monitoring starts 2 sec. after power up.	- Faulty CAN bus - Faulty EMS or TCM

FAILSAFE FUNCTION

Inhibit the TCS control and allow the ABS/EBD control.

DTC	C2227	Brake Disc Overheat (only System with TCS)

DESCRIPTION

On TCS control, brake control will be performed by motor pump output pressure.
This brake traction control cause the brake disc to overheat.

DTC DETECTING CONDITION

DTC No	Detecting Condition	Possible Cause
C2227	1. When the calculated temperature of disc is higher than predefined value. 2. If the calculated temperature reach to predefined value, the controller recovers to normal state.	- Brake disc is overheating

FAILSAFE FUNCTION

Inhibit the TCS control and allow the ABS/EBD control.