GROUP 35B

ANTI-SKID BRAKE SYSTEM (ABS)

CONTENTS

GENERAL INFORMATION

M2351000100313

FEATURES

The 4ABS ensures directional stability and controllability during hard braking.
This ABS uses a 4-sensor 3-channel system that controls the right and left front wheels independently of each other and controls the rear wheels simultaneously (select low control*). The basic system is the same as that of former COLT/LANCER. 4WD models are equipped with G-sensor.

*NOTE: *Select low control: Control system that compares the speeds of the right and left wheels and performs the same fluid pressure control on both wheels according to the speed of the wheel that is likely to be locked.*

The system has the following features:

- EBD (Electronic Brake-force Distribution system) control has been added to provide the ideal braking force for the rear wheels.
- Fail-safe function which ensures that safety is maintained
- Diagnostic function which provides improved serviceability

EBD CONTROL

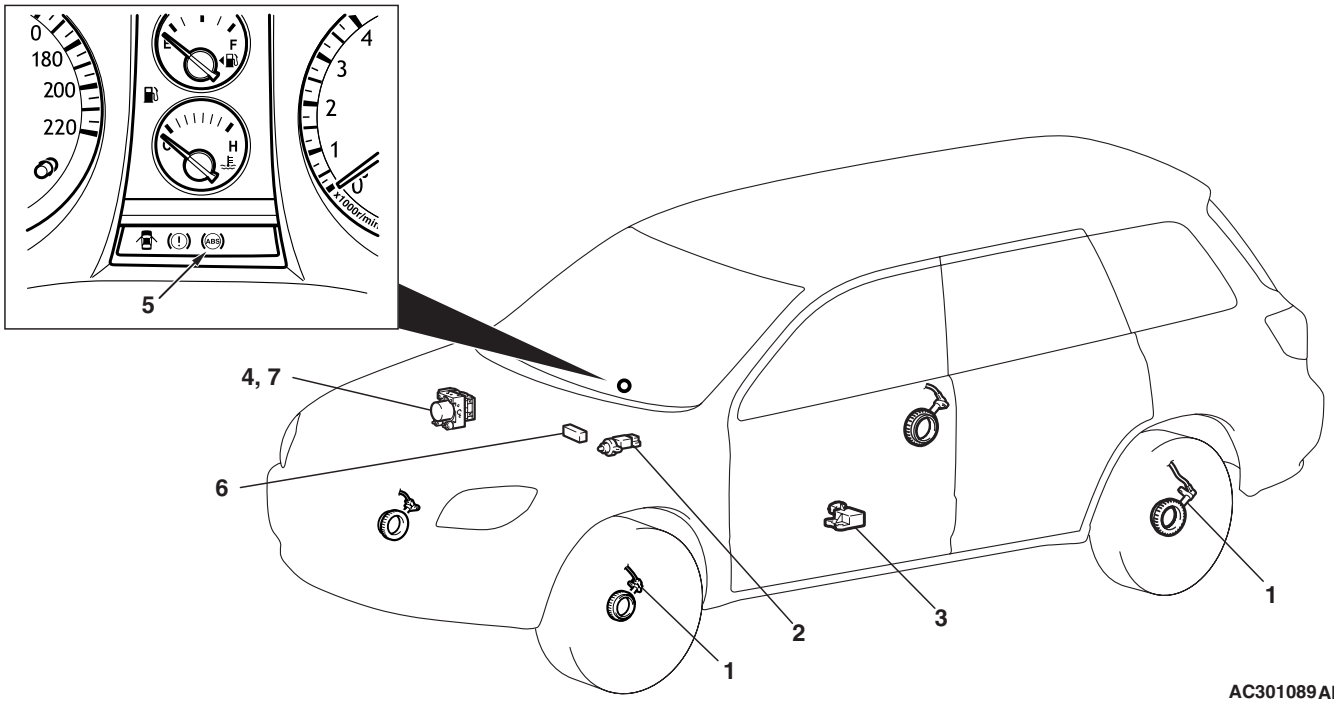
In ABS, electronic control is used so the rear wheel brake hydraulic pressure during braking is regulated by rear wheel control solenoid valves in accordance with the vehicle's rate of deceleration, and the front and rear wheel slippage which are calculated from the signals received from the various ABS sensors. EBD control is a control system which provides a high level of control for both vehicle braking force and vehicle stability. The system has the following features:

- Because the system provides the optimum rear wheel braking force regardless of vehicle load conditions and the condition of the road surface, the system reduces the required pedal depression force, particularly when the vehicle is heavily loaded or driven on road surfaces with high frictional coefficients.
- Because the duty placed on the front brakes is reduced, the increases in pad temperature can be controlled during brakes application to improve the wear resistance characteristics of the pad.
- Control valves such as the proportioning valve are no required.

SPECIFICATIONS

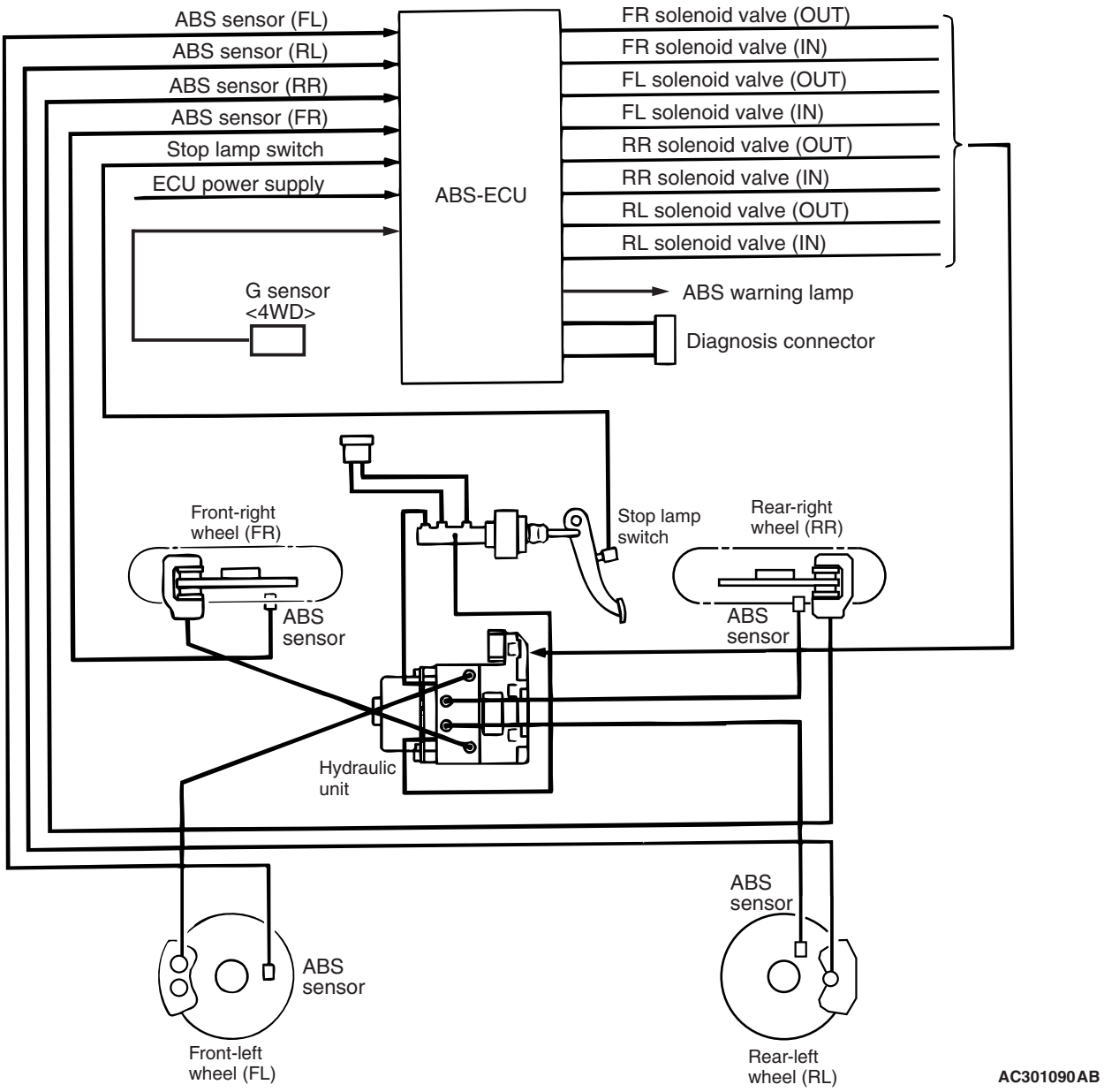
Item		Specification
ABS control method		4-sensor, 3-channel
No. of ABS rotor teeth	Front	43
	Rear	43
ABS sensor	Type	Magnet coil type
	Maximum gap between sensor and rotor mm <Non-adjustable>	0.85 <Front> 0.89 <Rear (2WD)> 0.96 <Rear (4WD)>

CONSTRUCTION DIAGRAM

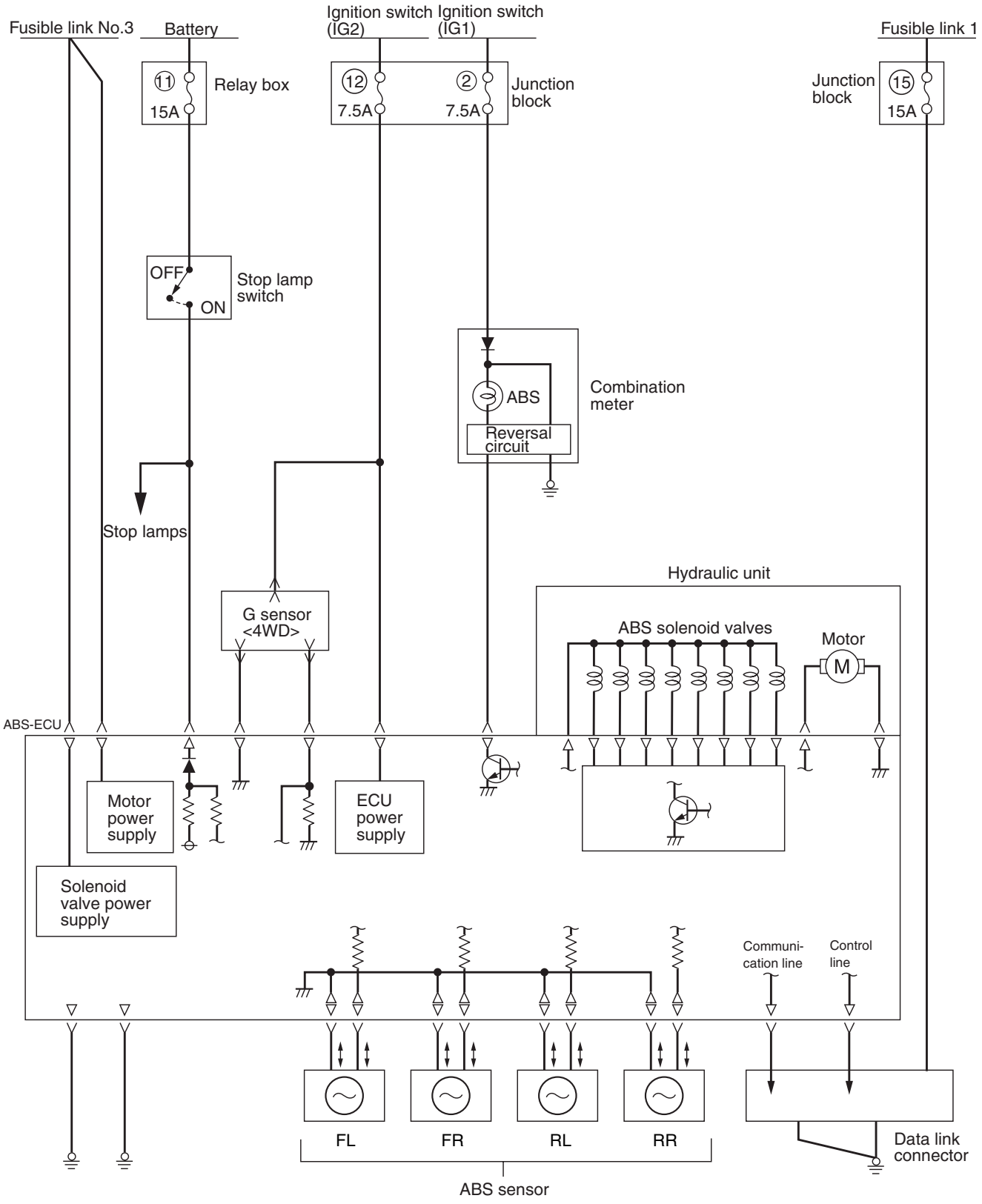


Name of part		Number	Outline of function
Sensor	ABS sensor	1	Sends alternating current signals at frequencies which are proportional to the rotation speeds of each wheel to the ABS-ECU.
	Stop lamp switch	2	Sends a signal to the ABS-ECU to indicate whether the brake pedal is depressed or not.
	G sensor <4WD>	3	Detects acceleration in the travel direction of the vehicle and sends a signal that is converted to a voltage value to the ABS-ECU.
Actuator	Hydraulic unit	4	Drives the solenoid valves according to signals from the ABS-ECU in order to control the brake hydraulic pressure for each wheel.
	ABS warning lamp	5	Illuminates in response to signals from the ABS-ECU when a problem develops in the system.
Diagnosis connector		6	Outputs the diagnosis codes and allows communication with the M.U.T.-II/III.
ABS-ECU		7	Controls actuators (described above) based on the signals coming from each sensor.
			Controls the self-diagnosis and fail-safe functions.
			Controls the diagnostic function (M.U.T.-II/III compatible).

SYSTEM CONFIGURATION DIAGRAM



ABS ELECTRICAL CIRCUIT DIAGRAM



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CONSTRUCTION DESCRIPTION

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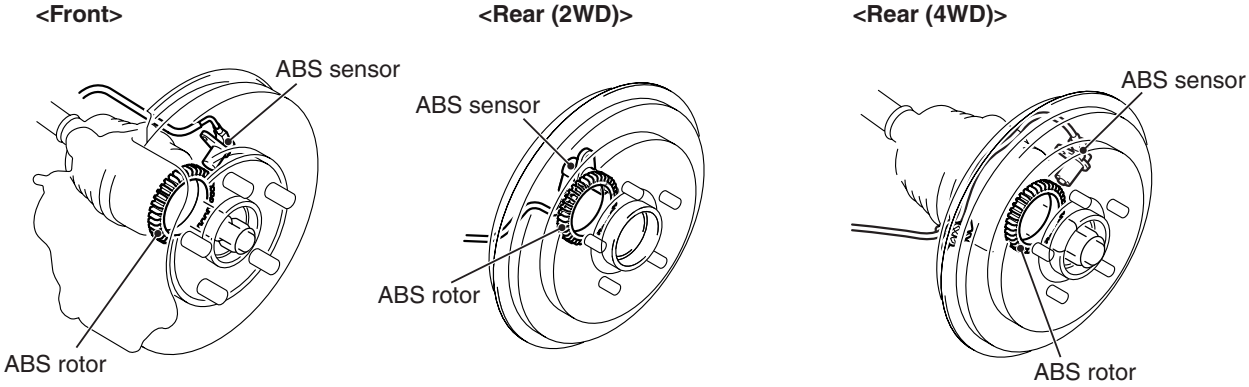
SENSORS

ABS SENSORS AND ROTORS



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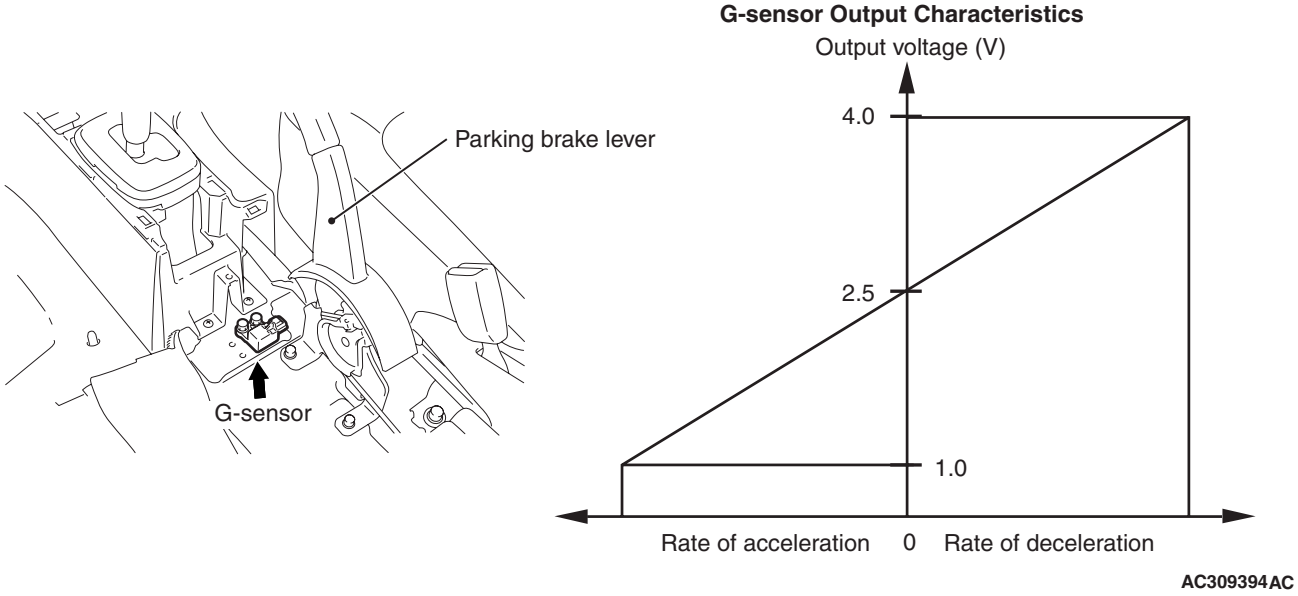
The ABS sensors consist of fixed ABS sensors and the ABS rotors that rotate at the same speed as the wheels, and output alternating current signals at frequencies which are proportional to the wheel speed.

- For front wheels, the ABS rotors (43 teeth) are installed to the drive shafts, and the ABS sensors are installed to knuckles.
- For rear wheels of 2WD models, the ABS rotors (43 teeth) are installed to the rear hub assemblies, and the ABS sensors are installed to the trailing arms.
- For rear wheels of 4WD models, the ABS rotors (43 teeth) are installed to the drive shafts, and the ABS sensors are installed to the trailing arms.
- The gap between the ABS rotor and ABS sensor is non-adjustable at both the front and rear to improve serviceability.

G-SENSOR <4WD>



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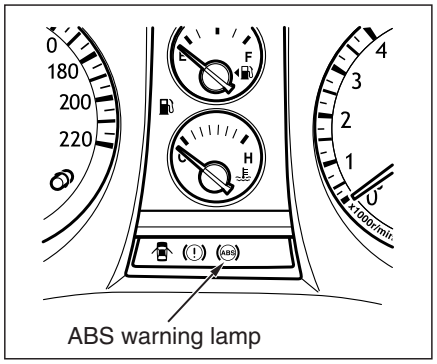
The G-sensor detects fore-and-aft accelerations of a vehicle with semiconductors, and sends signals representing voltage values to ABS-ECU. The ABS-ECU estimates the vehicle speed required for control according to the signals from the G-sensor and ABS sensor.
The G-sensor is basically the same as that of the 2000 PAJERO PININ

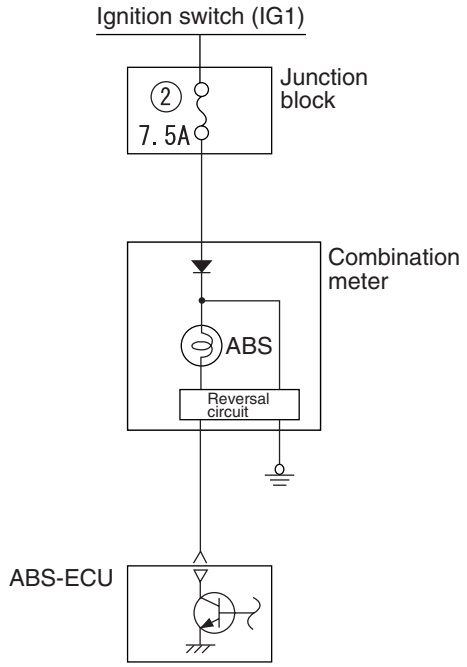
STOP LAMP SWITCH

This switch turns on when the brake pedal is depressed, and turns off when the brake pedal is released. The ABS-ECU detects whether the stop lamp switch is on or off by means of fluctuations in voltage (ON: system voltage/OFF: approximately 0V). This data is used for ABS-ECU fail-safe/diagnosis function.

ACTUATORS

ABS WARNING LAMP





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The ABS warning lamp is controlled by the ABS-ECU. The warning lamp drive circuit in the combination meter contains an reversal circuit, which turns the ABS warning lamp off when the transistor in the ABS-ECU is ON and turns the lamp on when the transistor is OFF. The ABS warning lamp illuminates in the following cases:

- During initial check when the ignition switch is at the "ON" position (for approximately 3 seconds)
- When ABS system detects a trouble
- Poor ABS-ECU connector connection

HYDRAULIC UNIT

The hydraulic unit is basically the same as that of the 2000 PAJERO PININ.

ABS-ECU

The ABS-ECU is basically the same as that of the 2000 PAJERO PININ except for the followings:

DIAGNOSTIC FUNCTIONS

The ABS-ECU includes the following functions to make system inspection easier.
All of the following operations can be carried out using the M.U.T.-II/III.

- Diagnosis code output
- Service data output
- Actuator testing

FAIL-SAFE FUNCTION

Diagnosis code No.	Item	Control during fail-safe operation		
		ABS control	EBD control	ABS warning lamp
11	Open circuit or short-circuit in ABS sensor (FR)	Control stopped if any faulty wheel detects	If faulty wheels include two rear wheels: Control stopped Other than the above: Control carried out	Illuminated
12	Open circuit or short-circuit in ABS sensor (FL)			
13	Open circuit or short-circuit in ABS sensor (RR)			
14	Open circuit or short-circuit in ABS sensor (RL)			
16	Abnormal drop or rise in ABS-ECU power supply voltage	Control stopped	Control stopped (when high voltage) Control carried out (when low voltage)	Illuminated
21	ABS sensor (FR) system	If any faulty wheel detects: Control stopped in all wheels	If faulty wheels include two rear wheels: Control stopped Other than the above: Control carried out	Illuminated
22	ABS sensor (FL) system			
23	ABS sensor (RR) system			
24	ABS sensor (RL) system			
32	G sensor system <4WD>	Control stopped	Control carried out	Illuminated
33	Stop lamp switch system	Control carried out	Control carried out	Switched off
41	Solenoid valve (FR) system	System interrupted	System interrupted	Illuminated
42	Solenoid valve (FL) system			
43	Solenoid valve (RR) system			
44	Solenoid valve (RL) system			
51	Valve relay ON problem	Control stopped	Control carried out	Illuminated
52	Valve relay OFF problem	System interrupted	System interrupted	Illuminated
53	Motor relay OFF problem	Control stopped	Control carried out	Illuminated
54	Motor relay ON problem	System interrupted	Control carried out	Illuminated
55	Motor system	Control stopped	Control carried out	Illuminated
63	ABS-ECU abnormality	System interrupted	System interrupted	Illuminated
	ABS-ECU mis-installation <2WD>	Control stopped	Control carried out	Illuminated

NOTE: Control stopped: Control is not carried out until the ignition switch is turned to the "LOCK" (OFF) position. However, if the problem returns to normal, control is carried out again.

System interrupted: Control is not carried out until the ignition switch is turned to the "LOCK" (OFF) position.

DIAGNOSIS CODE INDICATION METHOD

The diagnosis codes can be checked using the M.U.T.-II/III, and also by the flashing of the ABS warning lamp. (Refer to Service Manual.)

DIAGNOSIS CODE CLEARING PROCEDURE

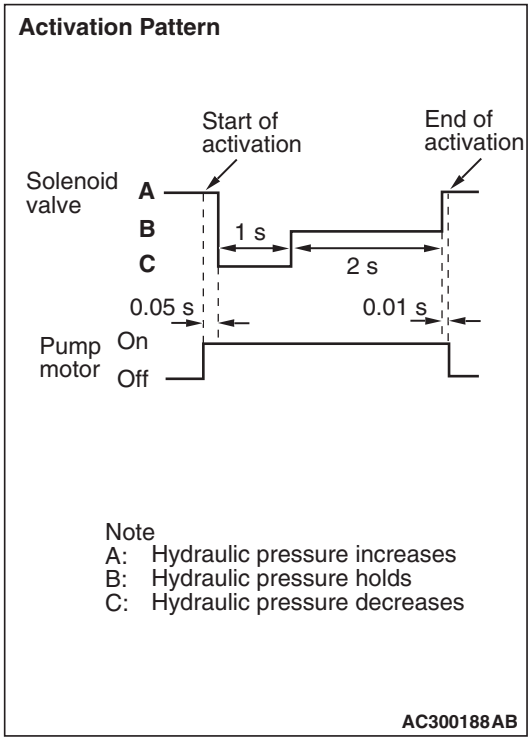
The diagnosis codes can be cleared using the M.U.T.-II/III or by special operation for the brake pedal. (Refer to Service Manual.)

SERVICE DATA OUTPUT

The data input from all sensors and switch can be read using the M.U.T.-II/III.

Item No.	Check item	Checking requirement	Normal value
11	Front-right ABS sensor	Drive the vehicle.	Vehicle speeds displayed on the speedometer and M.U.T.-II/III are identical.
12	Front-left ABS sensor		
13	Rear-right ABS sensor		
14	Rear-left ABS sensor		
21	ABS-ECU power supply voltage	Ignition switch: ON	10 – 16 V
32	G-sensor <4WD>	• Ignition switch: ON • When vehicle is parked on a level surface.	2.4 – 2.6 V
		When vehicle is accelerated	4.0 – 1.0 V
		When vehicle is decelerated	1.0 – 4.0 V
36	Stop lamp switch	Depress the brake pedal.	ON
		Release the brake pedal.	OFF

ACTUATOR TEST



The M.U.T.-II/III can be used to force-drive all solenoid valves and the pump motor.

Item No.	Check item	Drive Contents
01	Solenoid valve for front-right wheel	Solenoid valves and pump motor in the hydraulic unit (simple inspection mode)
02	Solenoid valve for front-left wheel	
03	Solenoid valve for rear-right wheel	
04	Solenoid valve for rear-left wheel	

SYSTEM OPERATION

M2351004000147

- In terms of ABS operation, the system is basically the same as that of the ’96 COLT/LANCER.
- In terms of EBD operation, the system is basically the same as that of the 2001 CARISMA.