

Anti-lock Brake System (ABS)

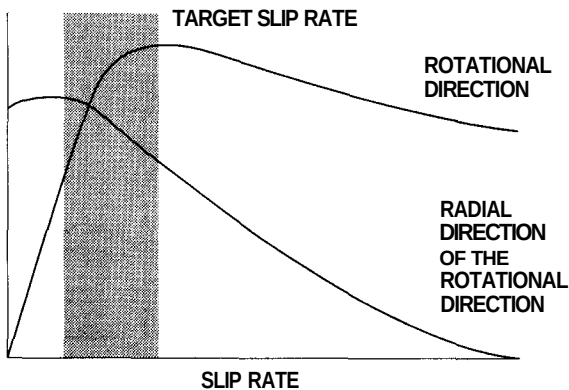
Features/Construction

When the brake pedal is pressed during driving, the wheels can lock before the vehicle comes to a stop. In such an event, the maneuverability of the vehicle is reduced if the front wheels are locked, and the stability of the vehicle is reduced if the rear wheels are locked, creating an extremely unstable condition. The ABS precisely controls the slip rate of the wheels to ensure maximum grip force from the tires, and it thereby ensures maneuverability and stability of the vehicle.

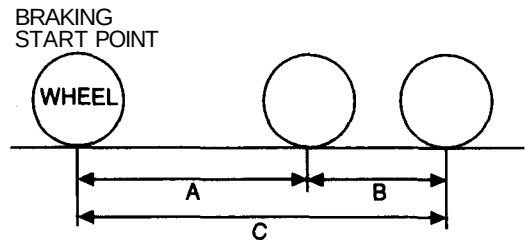
The ABS calculates the slip rate of the wheels based on the vehicle speed and the wheel speed, then it controls the brake fluid pressure to attain the target slip rate.

Grip Force of Tire and Road Surface

COEFFICIENT OF FRICTION

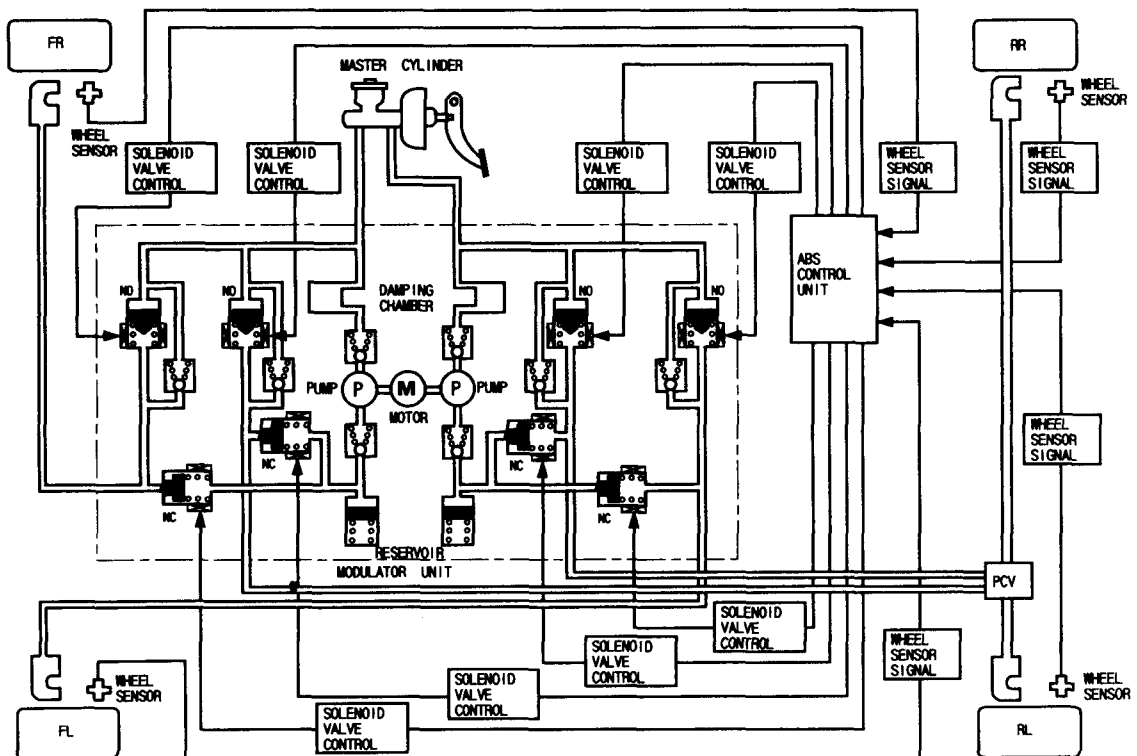


Slip Rate



A: Distance without slip
B: Slipped distance
C: Actual distance

$$\text{SLIP RATE} = \frac{B}{C} = \frac{\text{VEHICLE SPEED} - \text{WHEEL SPEED}}{\text{VEHICLE SPEED}}$$



NO: Normally Open
NC: Normally Closed

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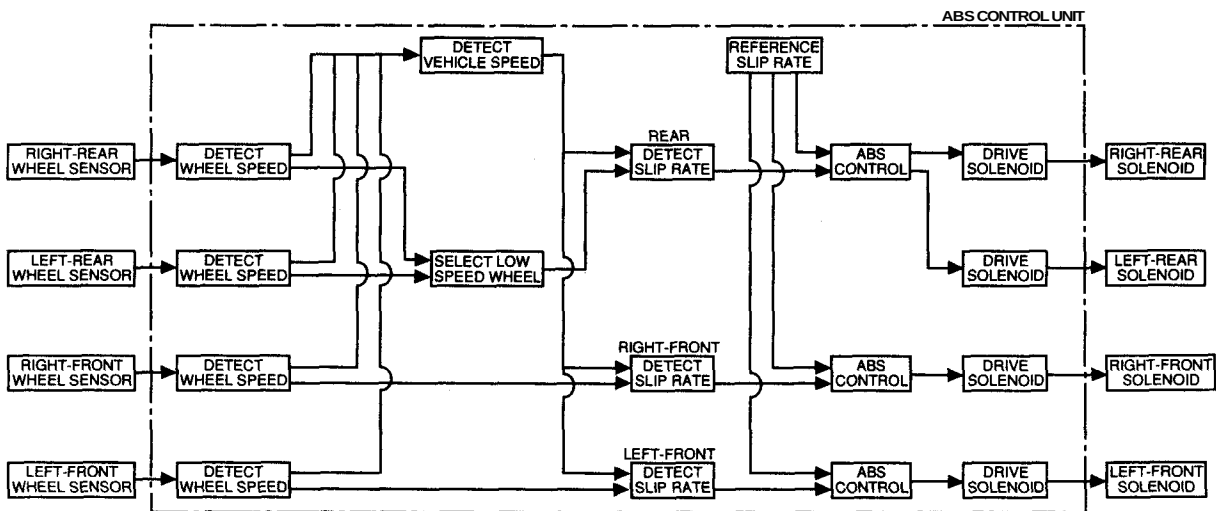
Features/Construction (cont'd)

ABS Control

The ABS control unit detects the wheel speed based on the wheel sensor signal it received, then it calculates the vehicle speed based on the detected wheel speed. The control unit detects the vehicle speed during deceleration based on the rate of deceleration.

The ABS control unit calculates the slip rate of each wheel, and it transmits the control signal to the modulator unit solenoid valve when the slip rate is high.

The pressure reduction control has 3-modes: pressure reduction, pressure retaining, and pressure intensifying.



Self-diagnosis

1. The ABS control unit is equipped with a main CPU and a sub CPU, that check each other for problems.
2. The CPUs check the circuit of the system.
3. Self-diagnosis can be classified into 2 categories.
 - Initial diagnosis: Performed right after the engine starts and until the ABS indicator goes off.
 - Regular diagnosis: Performed right after the initial diagnosis until the ignition switch is turned OFF.
4. When a problem is detected by self-diagnosis, the system:
 - Turns the fail-safe relay OFF
 - Turns the solenoid valve OFF
 - Turns the pump motor OFF
 - Turns the ABS indicator ON

Self-diagnosis Table

Diagnostic Trouble Code(DTC)	Detection Item	Detection Timing		Fail-safe Mode
		Initial Diagnosis	Regular Diagnosis	
11,13,15,17	Wheel sensor (open/short to body ground/short to power)		O	A
12,14,16,18	Wheel sensor (electrical noise/intermittent Interruption)		O	S, A and L, S and L
21-24	Pulser		O	A and L
31-38	Solenoid (short to body ground/short to wire)	O	O	S
41-44	Wheel lock		O	A and L
51	Motor lock		O	S and L
52	Motor stuck OFF		O	A and L
53	Motor stuck ON	O	O	A and L
54	Fail-safe relay	O		S
61	Low ignition voltage		O	B
62	High ignition voltage		O	B
71	Different diameter tire		O	S
81	Central Processing Unit (CPU) diagnosis, and ROM/RAM diagnosis	O	O	S

Operation Mode Table

Operation Mode	Description	ABS Indicator
Regular operation	Operation in normal condition	OFF
Fail-safe mode-S	The ABS control unit turns the system off when the control unit detects a problem.	Comes ON when a problem is detected.
Fail-safe mode-A	If the ABS control unit detects a malfunction during an emergency stop, it will turn off the malfunctioning component, and continue to modulate the rest of the ABS system until the vehicle comes to a stop. At that, the entire system will be turned off until the problem goes away.	Comes ON when a problem is detected.
Fail-safe mode-L	The ABS control unit stores a DTC in back-up memory when it detects a problem. If a problem is detected when the ignition switch is turned ON (II), the ABS control unit will turn the system off. If the problem goes away, the ABS control unit will turn the system on again.	ON
Fail-safe mode-B	The ABS control unit will turn the system off if ignition voltage drops, and will turn on again when ignition voltage returns to normal.	Comes ON when a problem is detected.

On-board Diagnosis Function

The ABS control unit is connected to the 16P Data Link Connector.

The ABS can be diagnosed with the Honda PGM Tester.

The ALB Checker cannot be used with this system. For air bleeding, and checking wheel sensor signals, use the Honda PGM Tester. See the Honda PGM Tester user's manuals for specific operating instructions.

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Features/Construction (cont'd)

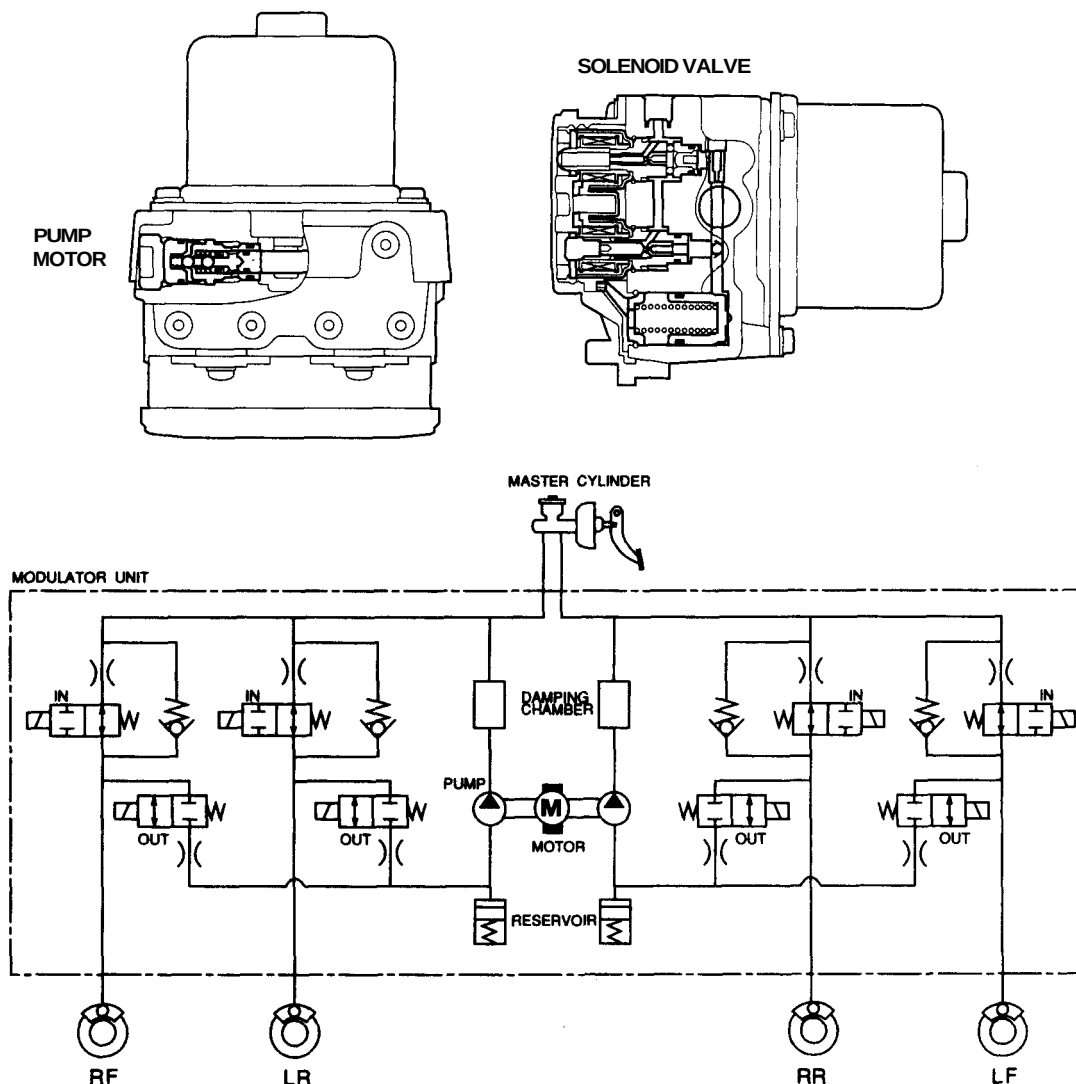
ABS Modulator

The ABS modulator consists of the inlet solenoid valve, outlet solenoid valve, reservoir, pump, pump motor and the damping chamber.

The modulator reduces the caliper fluid pressure directly. It is a circulating-type modulator because the brake fluid circulates through the caliper, reservoir and the master cylinder.

The hydraulic control has three modes: pressure reduction, pressure retaining and pressure intensifying.

The hydraulic circuit is the independent four channel-type, one channel for each wheel.



Pressure intensifying mode: Inlet valve open, outlet valve closed

Master cylinder fluid is pumped out to the caliper.

Pressure retaining mode: Inlet valve closed, outlet valve closed

Caliper fluid is retained by the inlet valve and outlet valve.

Pressure reduction mode: Inlet valve closed, outlet valve open

Caliper fluid flows through the outlet valve to the reservoir.

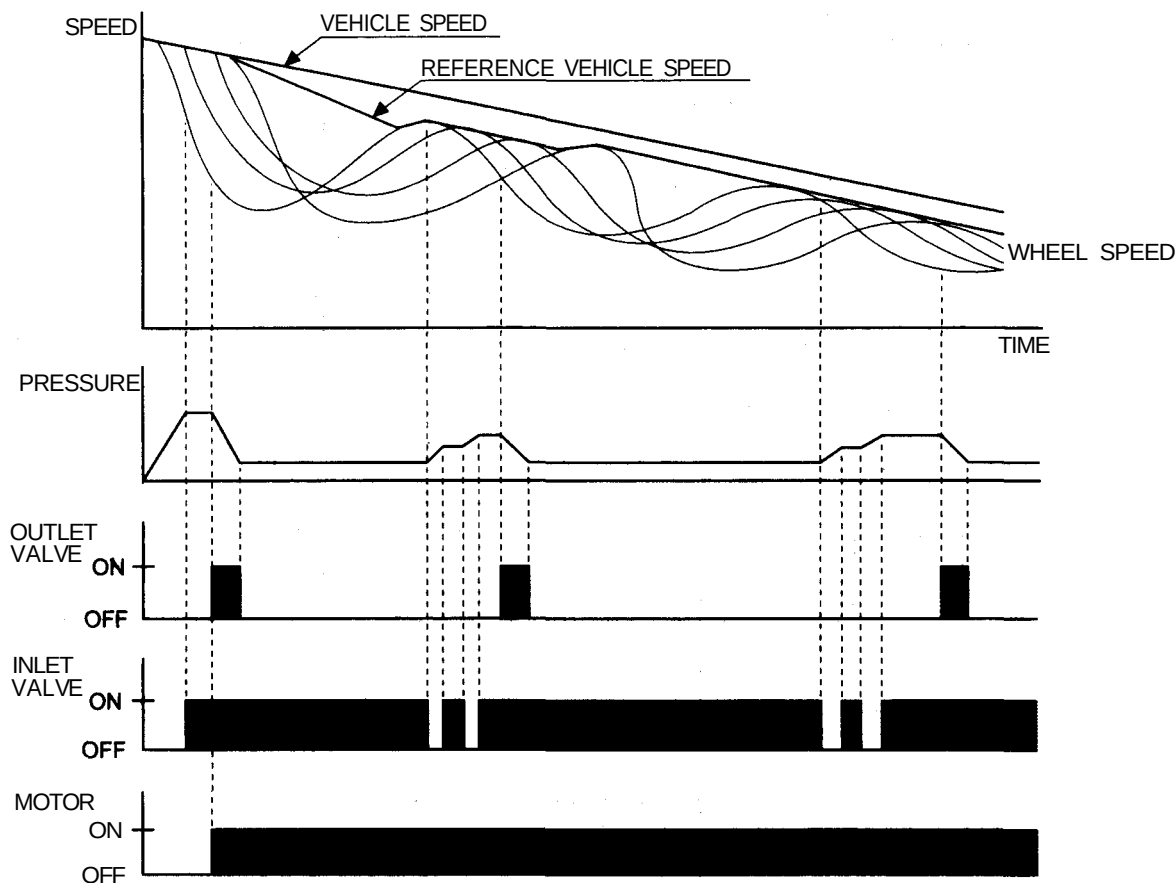
Motor operation mode: When starting the pressure reduction mode, the pump motor is ON.

When stopping ABS operation, the pump motor is OFF.

The reservoir fluid is pumped out by the pump, through the damping chamber, to the master cylinder.

IN: INLET VALVE (NORMALLY OPEN)
OUT: OUTLET VALVE (NORMALLY CLOSED)

Wheel Speed and Modulator Control



When the wheel speed drops sharply below the vehicle speed, the inlet valve closes to retain the caliper fluid pressure. When the wheel speed drops further, the outlet valve opens momentarily to reduce the caliper fluid pressure. The pump motor starts at this time.

As the wheel speed is restored, the inlet valve opens momentarily to increase the caliper fluid pressure.

Wheel Sensor

The wheel sensors are the magnetic contactless type. As the gear pulser teeth rotate past the wheel sensor's magnetic coil, AC current is generated. The AC frequency changes in accordance with the wheel speed. The ABS control unit detects the wheel sensor signal frequency and thereby detects the wheel speed.

