Bendix®

Service Data

SD-13-4746

Bendix® Gen 4™ and Gen 5™ ABS for Trucks, Tractors, and Buses

Cab-Mounted Models

Frame-Mounted Model

FIGURE 1 - Bendix® ABS Controller Assemblies

GEN 4™ AND GEN 5™ ABS INTRODUCTION

This manual describes both the cab mount and the frame mount versions of the Bendix® Gen 4™ and Gen 5™ Antilock Brake System/Automatic Traction Control (ABS/ATC) systems.

Both cab and frame mount versions are designed for:

- Tractors
- Trucks
- Buses and
- Motor Coaches and
- RVs.

This manual covers:

- ABS/ATC Operation
- System Components
- Service Procedures
- Diagnosis and
- Troubleshooting Procedures.

For information on disassembly, installation, and service of related axle and brake components, refer to their individual Bendix Service Manuals.

For assistance in your area call Bendix at 1-800-247-2725 or RoadRanger® at 1-800-826-4357.

These ABS controllers and systems were originally marketed by Eaton Corporation under the Eaton® brand name. For more information contact Bendix, your local authorized Bendix dealer, or RoadRanger®.

Document Revision Level

This document is subject to revision.
For updates, please visit www.bendix.com.

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ANTILOCK BRAKING SYSTEM (ABS)

ABS-controlled braking ensures optimum vehicle stability while minimizing the stopping distance. During vehicle operation, the ABS Electronic Control Unit (ECU) continuously monitors all wheel speed sensors. Data input from the wheel speed sensors allows the ECU to:

- Detect impending wheel lock.
- Maintain optimum wheel slip during braking.
- Maximize vehicle stability while maintaining braking effectiveness.

ABS Operation

The ABS controls braking by operating the Pressure Modulator Valves. The ECU makes a new assessment of conditions and updates the control signal to the pressure modulator valves at the rate of 100 times per second.

When inactive, the pressure modulator valves provide straight-through-passages for supply air to the brake chambers. During ABS operation (an ABS "event"), the control unit operates the valves to override the supply of air to the chambers. During an ABS release, supply air is held off while the chambers are vented to the atmosphere. In hold mode, supply air is held off and chamber air is held constant. When required, air is applied to the chamber at a controlled rate by modulating the hold side of the modulator valve.

The ABS system itself does not apply additional braking power. Rather, the purpose of ABS is to limit brake torque to prevent locking that results in loss of lateral stability and increased stopping distances. Cautious driving practices such as maintaining adequate distances from the vehicle ahead are still essential to safe vehicle operation.

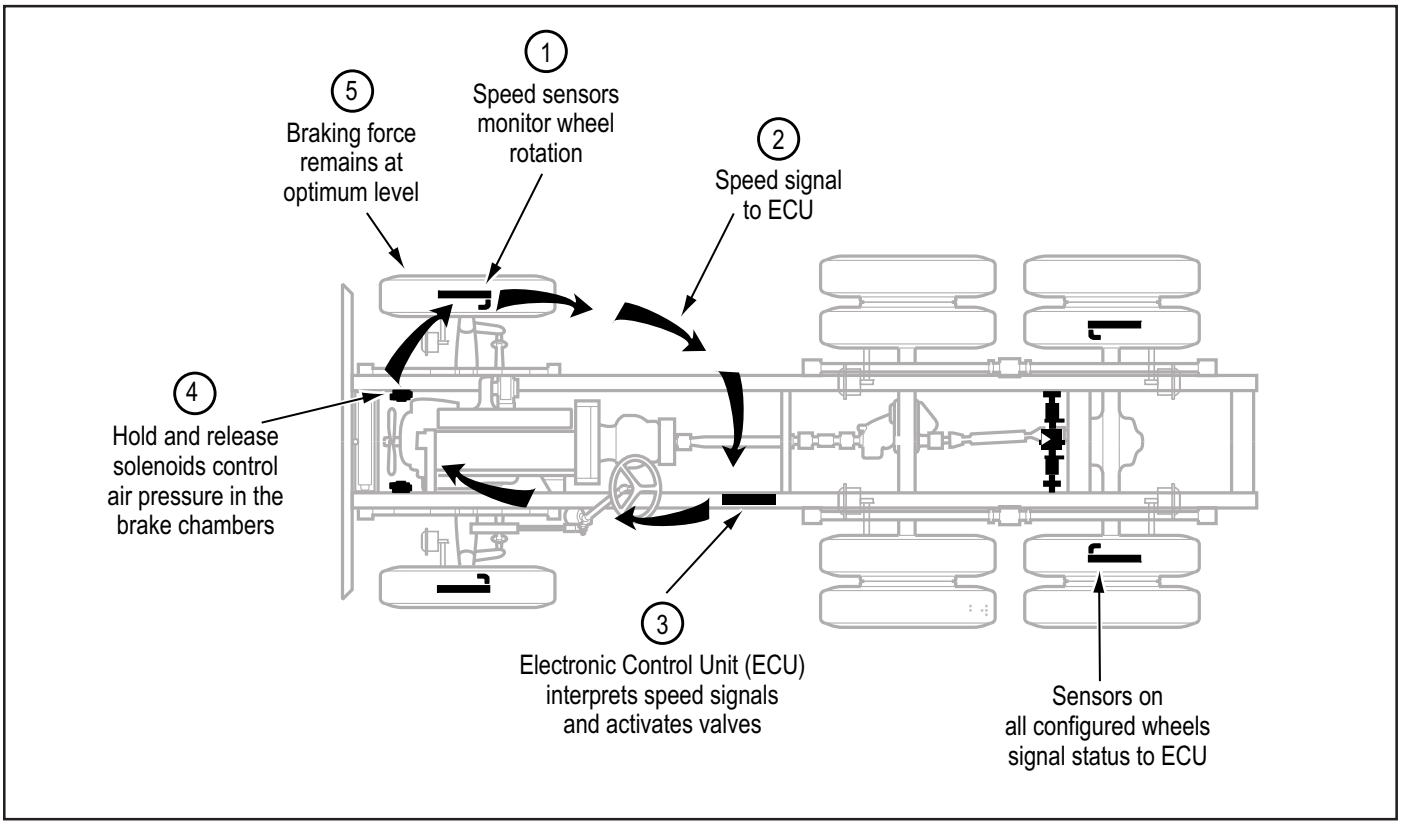

FIGURE 2 - Overview of ABS Operation

ABS Component Function

The ABS system operates as follows (see Figure 2).

1. Speed sensors on each wheel monitor wheel rotation.
2. Each speed sensor communicates wheel rotation pulses to the central Electronic Control Unit (ECU).
3. The ECU receives speed sensor input, interprets the signal pulses, and calculates speed and acceleration rates for the wheels and the vehicle.
4. Based on speed sensor input with the brakes applied, the ECU detects impending wheel lock and operates the ABS modulator valves as required for proper control. The modulator valves can be operated in either a release or a hold mode to regulate air pressure in the brake chambers.
5. Braking force is applied at a level which minimizes stopping distance while maintaining as much lateral stability as possible.

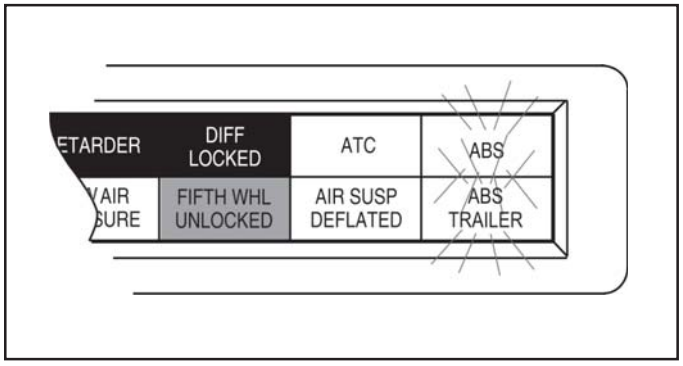

FIGURE 3 - ABS Indicator Lamps

ABS Indicator Lamp

This lamp is the primary indicator of the ABS status.

- The ABS lamp illuminates steadily for a two second bulb-check whenever the switched ignition is ON. The ABS lamp turns OFF after the bulb-check if there are no ABS malfunctions present.
- The ABS lamp flashes on and off continuously when the off-highway mode is selected. (Special option for military and off-highway vehicles.)
- If the Indicator Lamp remains ON, after the bulb-check, there is an ABS diagnostic trouble code that requires service.

NOTE: In the case of a speed sensor failure which has been corrected, the indicator lamp will remain on until sensor output has been verified by the control unit. In this case it is necessary to move the vehicle above 5 mph before the indicator lamp will turn off.

ABS Trailer Indicator Lamp

Tractor/Towing vehicles manufactured on or after March 1, 2001 are equipped with a cab mounted “ABS Trailer” indicator lamp.

When an ABS equipped trailer with Power Line Carrier (PLC) communications capability is connected to the tractor, the ABS Trailer indicator lamp will illuminate for a two second bulb check after the ignition is switched on. The ABS lamp turns OFF after the bulb-check if there are no ABS malfunctions present on the trailer ABS.

If the trailer is NOT equipped with ABS or ABS with PLC capability, the ABS trailer indicator lamp in the cab will not illuminate.

Automatic Traction Control (ATC) System

The ATC system is available on all Standard ABS ECU's. ATC is not available on Basic ECU's. It helps improve traction on slippery or unstable driving surfaces by preventing excessive wheel spin. ATC also enhances vehicle stability by prevention of power spin-out.

ATC requires:

1. ATC valve - Either a stand alone valve or a Rear Axle Valve Assembly with integral ATC solenoid may be used.
2. SAE J1922 or J1939 engine interface (the ABS ECU serial data interface must match the engine controller interface).
3. Brake Light Switch input.
4. ATC Indicator Lamp.

The Electronic Control Unit (ECU) must be configured for ATC operation either by using the diagnostic switch, an MPSI ProLink® hand-held tester or Eaton's ServiceRanger PC software.

ATC Operation

During periods of wheel slip, the Electronic Control Unit enters an Automatic Traction Control mode. There are various modes of Automatic Traction Control.

System operation:

- At speeds above 25 mph, the engine is throttled back via the SAE J1922 or SAE J1939 data link to control spin out.
- At speeds below 25 mph, both engine control and differential brake control are activated as required to control wheel slip. Once triggered, differential braking mode remains active regardless of vehicle speed.
- An optional mud and snow switch allows greater wheel spin (more torque) when activated. It is intended for adverse conditions, usually off-highway. Except for special cases, the switch is programmed for momentary operation. ATC reverts to normal operation when the switch is cycled a second time and whenever the system goes through a power-up cycle.

Component Function

When brake control is utilized, the ATC valve is activated, diverting supply tank air to the Modulator Valves on the drive axle(s). The Electronic Control Unit then activates the appropriate solenoids in order to apply a brake force to the spinning wheel. The Automatic Traction Control System cannot increase traction to a particular wheel; it can only utilize the available traction.

Thermal (Brake Heat) Protection

To prevent excessive brake and drum temperature resulting from brake activity, ATC incorporates a brake temperature estimation algorithm to determine when differential braking mode should be suspended. The differential braking function is re-enabled after a cool-down period.

ATC Indicator Lamp

The ATC indicator lamp operates when a vehicle is equipped with the optional Automatic Traction System.

- Gen 4™ ABS – Lights at key-ON and remains lit with ATC inactive until the driver presses the brake pedal.
- Gen 5™ ABS – Lights at key-ON and turns off after a 2 second lamp check. ATC is active after the lamp check.
- Flashes *rapidly* to indicate that ATC is active.
- Flashes *slowly* when the "mud-and-snow" mode is selected and then flashes more *rapidly* when the automatic traction control system operates.
- Remains ON if an engine data link failure occurs.

NOTE: Some non-ATC equipped vehicles have an ATC lamp that is labeled as a spin light. It indicates when a low traction condition has been encountered. No control action is taken.

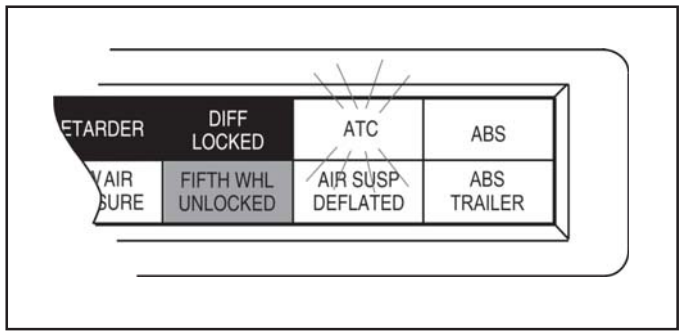

FIGURE 4 - ATC Indicator Lamp