

Automatic Four Wheel Drive (A4WD)

Features and Operation

The A4WD system is an electronic shift 4x4 system that allows the operator to choose between three different 4x4 modes as well as 2-wheel drive. The operator can switch between 2WD, A4WD, and 4WD HIGH modes at speed. To engage or disengage LOW Range, the vehicle speed must be less than 5 kph, the brake depressed, and the transmission must be in NEUTRAL.

A4WD

In A4WD, the generic electronic module (GEM) varies the torque split between front and rear drivelines by controlling the transfer case clutch. Under most conditions, the GEM activates the transfer case clutch at a minimum duty cycle (percentage of time the clutch is turned on) which allows for slight speed differences between the front and rear driveshafts which normally occurs when negotiating a corner on dry pavement. When the rear wheels are overpowered, the GEM detects this slip condition, and the duty cycle to the transfer case clutch is increased until the speed difference between driveshafts is reduced. In this manner, the GEM can redirect up to 50% of engine torque to the front wheels when the rear wheels lose traction, yet still allow operation in the A4WD mode on dry pavement without driveline wind-up.

NOTE: When the ABS system is active, the GEM will default to a minimum duty cycle for the transfer case clutch.

Feature Inputs:

- 4WD mode switch (various resistances).
- Front/rear driveshaft speed sensors (Hall effect sensor output: 26.67 Hz/mph).
- ABS active input (battery voltage when ABS is active, grounded when inactive).
- Contact plate position inputs A, B, C, D (grounded when closed, open circuit when open).

Feature Outputs:

- Solid state clutch relay output (pulse width modulated signal: grounded when relay is on, battery potential when relay is off).
- 4x2/4x4 vacuum solenoid (ground when activated, open circuit when deactivated).
- A4WD indicator (ground when activated, open circuit when deactivated).

Shifting Between 2WD, A4WD, and 4WD HIGH

Shifts between 2WD, A4WD, and 4WD HIGH can be made at any speed. Listed below are the inputs and outputs needed by the GEM to execute a change between any of these modes.

Feature Inputs:

- 4WD mode switch (various resistances).
- Contact plate position inputs A, B, C, D (grounded when closed, open circuit when open:).

Feature Outputs:

- 4x4 shift motor relay outputs.
- Solid state clutch relay (pulse width modulated signal; grounded when relay is on, battery potential when relay is off).
- 4x2/4x4 vacuum solenoid (ground when activated, open circuit when deactivated).
- Cluster indicators (ground when activated, open circuit when deactivated).

Shifting Into/Out of LOW RANGE

When shifting into or out of LOW RANGE, the GEM requires that the vehicle speed is less than 5 kph, the brake is applied, and the transmission is in NEUTRAL.

Feature Inputs:

- 4WD mode switch (various resistances).
- Contact plate position inputs A, B, C, D (grounded when closed, open circuit when open:).
- VSS Sensor (sinusoid signal: 0.7V-20V, 2.2 Hz/mph).
- Brake input (battery voltage when brake is depressed, open circuit when not activated).
- Digital transmission range (DTR) sensor (ground when transmission is in neutral, open circuit otherwise).
- Start/clutch depressed input.

Feature Outputs:

- 4x4 shift motor relay outputs.
- 4x2/4x4 vacuum solenoid (ground when activated, open circuit when deactivated).
- Cluster indicators (ground when activated, open circuit when deactivated).

4WD Mode Switch

The 4WD mode switch is a rotary switch which allows the vehicle operator to choose between 2WD, A4WD, 4WD HIGH, and LOW range positions.

GEM Module

The generic electronic module (GEM) controls the operation of the 4x4 system. (See A4WD Features and Operations Section for details.)

Vehicle Speed Sensor

The vehicle speed sensor (VSS), mounted on the rear of the transfer case, informs the GEM of vehicle speed.

Front/Rear Driveshaft Speed Sensors

The hall effect sensor, mounted to the transfer case, is used to detect the speed of the front and rear driveshafts. These inputs are used by the GEM primarily to control A4WD operation.

Transfer Case Shift Motor Sense Plates

The shift motor sense plate, an integral part of the electric shift motor, informs the GEM to the position of the transfer case.

Transmission Range (TR) Sensor

Located on the left side of the transmission, this sensor informs the GEM of the transmission gear position.

Electric Shift Motor

The electric shift motor, mounted externally at the rear of the transfer case, drives a rotary cam which moves the mode fork and range fork within the transfer case to select between the 2H/A4WD, 4WD HIGH, and LOW RANGE positions.

4x4/4x2 Vacuum Solenoids

These two solenoids are attached to the upper RH side of the engine compartment dash panel, they alternately route vacuum to the vacuum motor which engages/disengages the center axle disconnect collar in the front axle assembly.

4x4 Shift Motor Relay

The 4x4 shift motor relay is a module containing two relays which, under the control of the GEM, shift the transfer case shift motor between the 2WD and the three, 4WD modes.

Solid State Clutch Relay

The solid state clutch relay is used to activate the A4WD clutch within the transfer case.
