

Four-Wheel Drive Systems - Vehicles With: 2-Speed Torque On Demand Transfer Case

Principles of Operation

The TCCM has a thermal hardware protection strategy which monitors the amount of energy going through the clutch. This strategy has 2 levels of protection:

- **NOTE:** *In this scenario the indicators in the instrument cluster switch between 4H and 4A, While the physical MSS remains in 4A.*

AUTOLOCK - If the system is in 4A and TCCM detects driving conditions that require greater 4X4 performance, the TCCM temporarily turns on 4H and informs the customer via the message center indicating 4x4 Temporarily Locked. The 4x4 system automatically returns to 4A after the system no longer detects these driving conditions and informs the customer via the message center indicating 4x4 Restored.

- **NOTE:** *The 4x4 Temporarily Disabled message can be dismissed by the customer however it's advisable to let the TCCM clear the message itself, which indicates that the 4x4 system has resumed normal operation.*

POWERTRAIN TORQUE PROTECTION - If the system is in 4H or 4L and TCCM detects excessive stress or high energy going through the clutch (clutch is slipping excessively while the system is commanding max clutch torque), clutch output will be turned off and the message center indicates 4x4 Temporarily Disabled. When the system has the ability to cool off, the 4x4 operation is automatically restored.

The 2-speed torque-on-demand system allows the operator to choose between 2H (4x2) and 3 different 4WD modes of operation: 4A (4X4 AUTO), 4H (4X4 HIGH) and 4L (4x4 LOW). When 4WD modes are selected the TCCM sends a duty cycle command to the transfer case coil which activates the clutch within the transfer case and transfers torque to the front driveline. When the 2H mode is selected, the TCCM duty cycle command is turned OFF and the IWEs located at each front wheel are disengaged to reduce additional drag from the front driveline.

Engagement and disengagement of the front wheels is done by the IWEs. The IWEs are normally engaged (no vacuum). Vacuum is supplied to the IWEs by actuation of the IWE solenoid commanded by the TCCM. When actuated, the IWE solenoid allows vacuum to pass through to each IWE. The IWEs disengage and allow the front wheel hubs to be turned freely from the front axle. Note: When shifting to 2H mode in order for the IWEs to completely disengage the vehicle steering wheel must be less than 90 deg and 5 seconds have elapsed since the shift to 2H has been initiated.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the range fork within the transfer case between the HIGH range (2H, 4A and 4H) and LOW range (4L) positions. The electric shift motor only moves during a shift to and from 4L and Neutral, it does not move during any other mode shift. TCCM directly controls the electric shift motor and can reverse motor polarity to reverse rotary cam/shift fork direction. The shift motor sense plate, an integral part of the shift motor assembly, informs the TCCM of the transfer case position.

This transfer case is equipped with an electronically controlled clutch which is located inside the case. This clutch is used to synchronize the speed of the front driveline with the rear driveline as well as transfer torque in either of the 3 different 4WD modes. When the MSS is switched between 2H and 4A or 4H modes, the TCCM first energizes the clutch. When the transfer case front and rear output shafts are synchronized, the front axle IWEs are engaged.

When the front and rear drivelines are synchronized the TCCM sends a duty cycle command to the transfer case clutch coil as a torque request based on combination of