



by Pete Huscher

The NVG246 Transfer Case, Part 1: Description and Operation

In previous *GEARS* articles we've discussed the operation and diagnosis of the Borg-Warner 1354, 1356 and the 4405 transfer cases, used mainly in Ford vehicles. In this article we'll look at the NVG246 transfer case, found mainly in General Motors Blazers, Sonomas and Silverados, starting in 1998 and continuing through 2004. In part two, we'll follow that up with diagnostic and repair procedures for the NVG246 transfer case control system.

About the NVG246 Transfer Case

The NVG246 transfer case is a 2-speed unit. It uses a planetary set

for gear reduction in low range and is capable of adjusting the amount of torque being delivered to the front drive axle automatically (figure 1).

The NVG246 transfer case is manufactured by New Process Gear, located in Syracuse, NY, and is referred to as an Automatic Transfer Case or Active Transfer Case.

The transfer case system is controlled by an Automatic Transfer Case Control Module (ATCM), which automatically controls the amount of torque being transmitted to the front differential when placed in Auto mode or when the operator chooses to select a specific mode of operation.

NVG246 Transfer Case System Operation

The NVG246 transfer case system features a 4-button control switch located on the instrument panel. When the vehicle is running, the ATCM monitors inputs from the transfer case system to determine which mode the transfer case will operate in. Unless the driver selects a specific mode, the ATCM will automatically select 2HI.

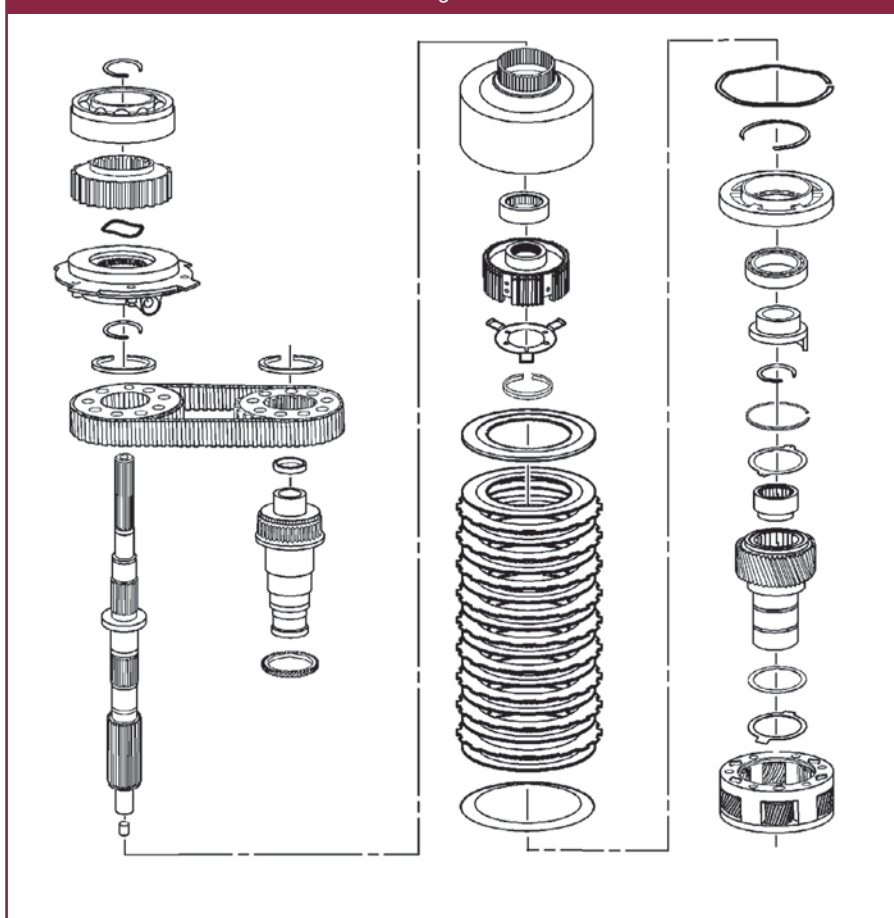
The ATCM monitors the input from the transfer case shift control switch to determine which range the driver has selected. With a simple press of the transfer case control switch, the driver has the option of selecting Auto 4WD, 2HI, 4HI, 4LO or Neutral.

The ATCM monitors inputs from the transfer case control switch, front and rear driveshaft speed sensors (propeller shaft sensors), the vehicle speed sensor, and the transfer case encoder to determine what the transfer case is doing (figures 2 and 3).

Auto 4WD Mode — When the driver selects Auto 4WD mode, the ATCM monitors rear wheel speed, based on the inputs from the front and rear driveshaft speed sensors. When the ATCM senses a rear wheel slip, the ATCM sends a pulse-width modulated signal to the electric motor located in the encoder motor assembly.

The motor rotates the transfer case sector shaft to apply a mechanical clutch pack located in the transfer case. This clutch pack delivers a variable amount of torque — normally transmitted to the rear wheels — to the front differential as needed. The ATCM then ramps up to the PWM signal to increase the torque split between the front and rear differentials, until the front driveshaft speed is the same as the rear driveshaft speed. Then the ATCM varies the PWM signal up and down to bring the rear wheel slip into specifications.

Figure 1



Once the ATCM no longer detects a rear wheel slip, the ATCM shuts off the PWM signal to the encoder motor assembly and disconnects the front differential, until it detects rear wheel slip again; then the process repeats itself as long as Auto 4WD mode is selected.

2HI Mode — When you select 2HI mode, the ATCM receives the command for 2HI mode from the transfer case control switch. The ATCM then disables 4WD operation and disengages the front axle. Automatic transfer case functions are totally disabled in 2HI mode.

4HI Mode — When you select 4HI mode, the ATCM receives a signal from the transfer case control switch. The ATCM then sends a signal to the encoder motor assembly, fully engaging the transfer case clutch assembly, which provides torque application to the front drive axle. The ATCM also engages the front differential to allow 4X4 operation.

4LO Mode — When you select 4LO mode, the ATCM receives a signal from the transfer case control switch. Again, the ATCM sends a signal to the encoder motor assembly to engage the

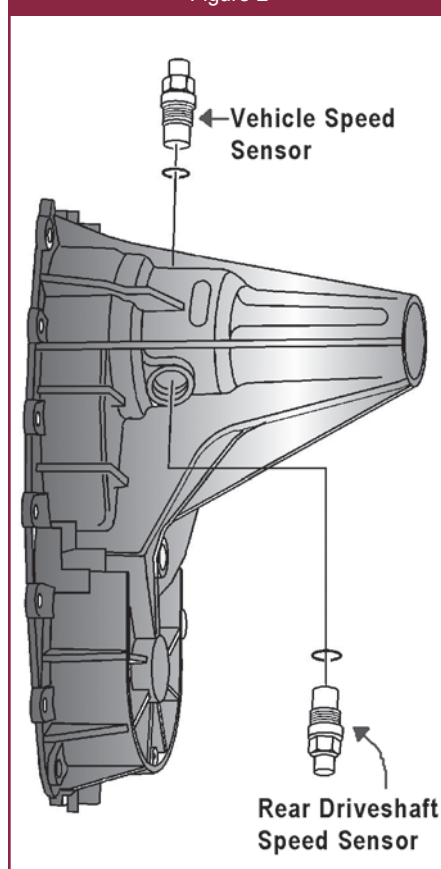
transfer case clutch fully. The ATCM will also engage the front differential to allow 4X4 operation. The only difference between 4HI and 4LO modes is that, in 4LO, the transfer case delivers torque to both output shafts through a planetary gear set, which provides gear reduction for 4X4 low operation.

Neutral Mode — Neutral mode is available on the NVG246 transfer case even though there's no neutral button on the transfer case control switch. Neutral mode allows the vehicle to be towed without a dolly. The ATCM only allows the Neutral command under these circumstances:

- VSS must indicate vehicle speed is less than 3 MPH.
- Transfer case must have previously been in 2HI mode.
- Transmission must be in neutral or the clutch pedal must be depressed.
- Engine RPM signal must be present.

To select Neutral mode, press and hold the 2HI and 4HI buttons at the same time for 10 seconds. The ATCM will

Figure 2



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The NVG246 Transfer Case

command the encoder motor into neutral position. The red, Neutral Indicator Light will light once the unit goes into neutral. To re-engage the transfer case system, select any of the 4 modes and the transfer case system will go into the range commanded.

NVG246 Transfer Case Control System Components

- NVG246 transfer case assembly
- Automatic Transfer Case Control Module (ATCM)
- Transfer Case Encoder Motor assembly
- Transfer Case Encoder
- Transfer Case Motor Lock
- Transfer case control switch
- Front Driveshaft (propeller shaft) Speed Sensor
- Rear Driveshaft (propeller shaft) Speed Sensor
- Vehicle Speed Sensor
- Service 4WD Indicator
- Front Differential Control System
- Misc. harnesses and connectors

Component System Operation

NVG246 TRANSFER CASE ASSEMBLY — This is the backbone of the transfer case system. The transfer case assembly provides a mechanical link between the rear differential and the front differential under certain circumstances. The transfer case also provides a gear reduction planetary set for low range operation.

AUTOMATIC TRANSFER CASE CONTROL MODULE (ATCM) — The ATCM controls the NVG246 transfer case system by monitoring the inputs from the transfer case control switch, the encoder, front and rear driveshaft speed sensors, and the vehicle speed sensor. The ATCM then commands the transfer case to engage into the specific mode requested by the transfer case control switch. The ATCM can perform self-diagnosis on its systems and provide a list of complaint codes for diagnosis.

TRANSFER CASE ENCODER MOTOR ASSEMBLY — A permanent magnet DC motor with a gear reduction unit. The encoder motor is a bidirectional motor which allows the motor to turn in either direction. The encoder motor assembly is located on the left side of the transfer case assembly. When activated by the ATCM, the encoder motor rotates

the transfer case sector shaft to shift the transfer case mode and engage the transfer case clutch, which engages the front driveshaft. The ATCM provides a pulse width modulated signal to control the encoder motor operation. This circuit consists of a Motor Control A and Motor Control B circuit.

TRANSFER CASE ENCODER — Located on the encoder motor assembly and usually replaced with the transfer case encoder motor as an assembly. The encoder converts the sector shaft position into an electrical signal, which the ATCM can monitor. The ATCM monitors the 4 encoder channel combinations to determine what position the encoder motor is in. The four encoder channels are P, A, B, and C. These combinations of inputs translate into Auto 4WD, 2HI, 4HI, 4LO or Neutral to the ATCM.

TRANSFER CASE MOTOR LOCK — This prevents the encoder motor from rotating once the transfer case is in the selected mode. When the lock circuit is energized, the transfer case encoder motor is allowed to rotate. When the lock circuit is de-energized, the encoder motor is locked and can't rotate.

TRANSFER CASE CONTROL SWITCH — Consists of a set of resistors inside a switch. Each mode button has a specific resistance value and, when depressed, sends a momentary signal to the ATCM indicating a requested mode or range change. The ATCM then commands the encoder motor assembly to engage the selected mode or range.

FRONT DRIVESHAFT (Propeller Shaft) SPEED SENSOR — Provides an AC signal to the ATCM, indicating the front driveshaft speed. The ATCM uses this signal to calculate the amount of rear axle slip during Auto 4WD mode.

This sensor is also used to determine the percentage of torque to be applied to the front differential during Auto 4WD mode.

REAR DRIVESHAFT (Propeller Shaft) SPEED SENSOR — Provides an AC signal to the ATCM indicating the rear driveshaft speed. The rear driveshaft speed sensor is used to calculate rear axle slip during AUTO 4WD mode.

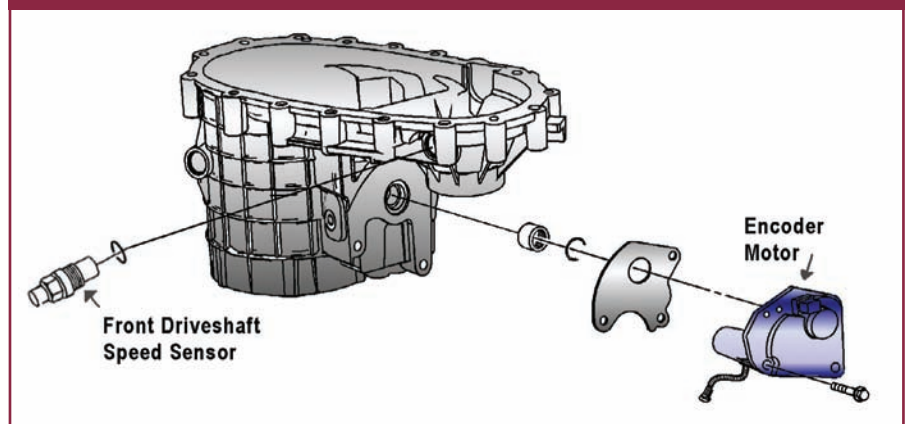
VEHICLE SPEED SENSOR — Located on the transfer case output shaft, the PCM uses the vehicle speed sensor signal to determine vehicle speed. The PCM then shares this information with the ATCM via the Class 2 serial data lines.

SERVICE 4WD INDICATOR — Located on the driver's information center, the Service 4WD indicator is an integral part of the instrument cluster and can't be serviced separately. The Service 4WD indicator is designed to inform the driver of any problems within the transfer case control system. The Service 4WD indicator is controlled by the ATCM via the class 2 serial data lines.

FRONT DIFFERENTIAL CONTROL SYSTEM — Consists of the ATCM, the transfer case control switch, and a thermally-actuated solenoid to engage the front axle for 4X4 operation. The ATCM controls the front differential actuator to engage and disengage the front differential as needed.

Each of these components plays an integral part in the NVG246 transfer case system operation. Now that you have a better understanding of how the NVG246 transfer case system works, you're ready to learn how to diagnose the system, which we'll cover in the next issue of *GEARS*. Until then, make it a great day, and keep those trannys rolling. 

Figure 3



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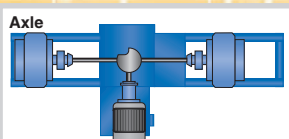
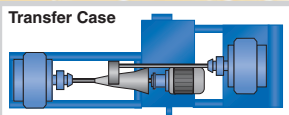
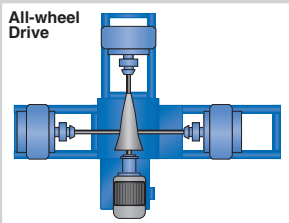
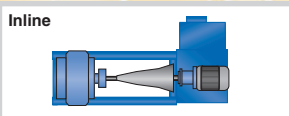
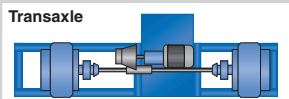
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