Understanding The New Venture 243 Transfer Case

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Contributing Editor

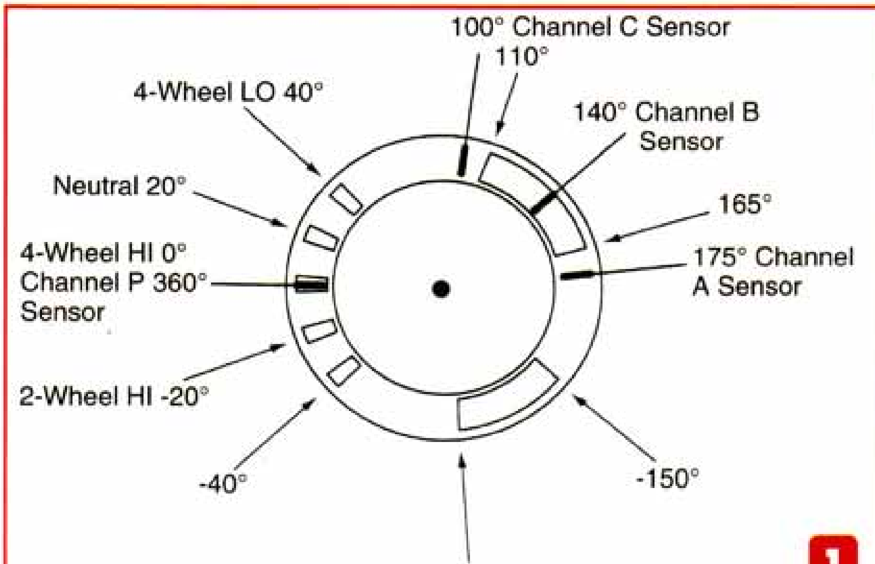

Illustration Courtesy GM Powertrain

The full-size GM truck line equipped with four-wheel drive (K-series trucks) includes the Yukon, Tahoe, Sierra, Cheyenne, Silverado, Suburban and Blazer models. Depending on the GVW and differential used, they use one of four different transfer cases. The New Venture 241 Transfer case is a manual-shift unit that has an 8¼-inch ring gear and is used in vehicles with an 8,600-lb. GVW. The New Venture 243 uses the same size diff and is used in vehicles with the same GVW.

Internally, these two units are very similar, with the 243 being electrically controlled. This article is devoted to understanding the diagnostics and control systems that enable the computer-controlled transfer case to function. Because of the complexity of the system, we will do this in two parts. This issue concentrates on the theory of operation, and next month we will cover the diagnostics in depth.

As I mentioned before, two other transfer cases also are used in the K series. The BorgWarner 4401, which is manually controlled, uses the 8¼-inch diff and can handle a GVW of 10,000 lbs. The heavyweight of the group is the BorgWarner 4470, which also is manually shifted, uses a 9¼-inch diff and can handle a GVW of up to 12,000 lbs.

In operation, the driver pushes a selector-switch button to obtain the desired shift. Status lights on the switch tell the driver which of three ranges is selected – 2-wheel drive, 4-wheel high or 4-wheel low. The status lights on the selector switch also are used to blink out diagnostic codes, which will be reviewed in the next issue. The selector switch signals the transfer-case control module (TCCM) to make the shift. The TCCM is mounted to a support bracket above the steering column under the dash. The TCCM receives inputs from the transfer-case selector switch on the dash; manual-lever-position switch on automatic models or clutch-safety switch on manual-gearbox units; the ground for the module; the shift motor and encoder; a Digital Ratio Adapter Controller (DRAC), which inputs a vehicle-speed signal; Diagnostic Link connector Pin #3, which activates the diagnostic protocol; the encoder switch on the electric shift motor, which relays signals as to actual motor position; the front-axle signal, which tells the TCCM the status of the front axle (locked or freewheeling), and a 12-volt power supply for the motor and the TCCM.

The TCCM interprets the input signals and sends output signals to the selector switch to provide the status lights to inform the driver of transfer-case position. The TCCM sends voltage to the electric shift motor to enable mode and range shifts. The TCCM provides diagnostic trouble codes that are flashed out on the status lights and also provides an 8-volt power supply for the encoder.

The shift sequence is controlled by the TCCM to protect the NV 243 transfer-case mechanicals. Mode shifts from 2-wheel high to 4-wheel high and vice versa can be made at any speed in any gear. Because range shifts are not internally synchronized, they must be limited by the TCCM. To prevent transfer-case damage, range shifts are blocked unless certain parameters are met. No range shifts should occur unless the transmission is in Neutral on automatic units or the clutch is fully depressed on vehicles with manual gearboxes, and no range shift should actuate if the vehicle is traveling at speeds greater than 3 mph.

The DRAC is misunderstood by many technicians and therefore hard to diagnose. Understanding its function really isn't difficult if

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Encoder Channel "P"	Encoder Channel "B"	Encoder Channel "C"	Encoder Channel "A"	Transfer Case Gearing
0 Volts	5 Volts	0 Volts	5 Volts	4 Low
5 Volts	5 Volts	0 Volts	5 Volts	Between Gears
5 Volts	0 Volts	0 Volts	5 Volts	Between Gears
0 Volts	0 Volts	0 Volts	5 Volts	Between Gears
5 Volts	0 Volts	0 Volts	5 Volts	Between Gears
5 Volts	0 Volts	5 Volts	5 Volts	Between Gears
0 Volts	0 Volts	5 Volts	5 Volts	4 HI
5 Volts	0 Volts	5 Volts	5 Volts	Between Gears
5 Volts	0 Volts	5 Volts	0 Volts	Between Gears
0 Volts	0 Volts	5 Volts	0 Volts	2 HI

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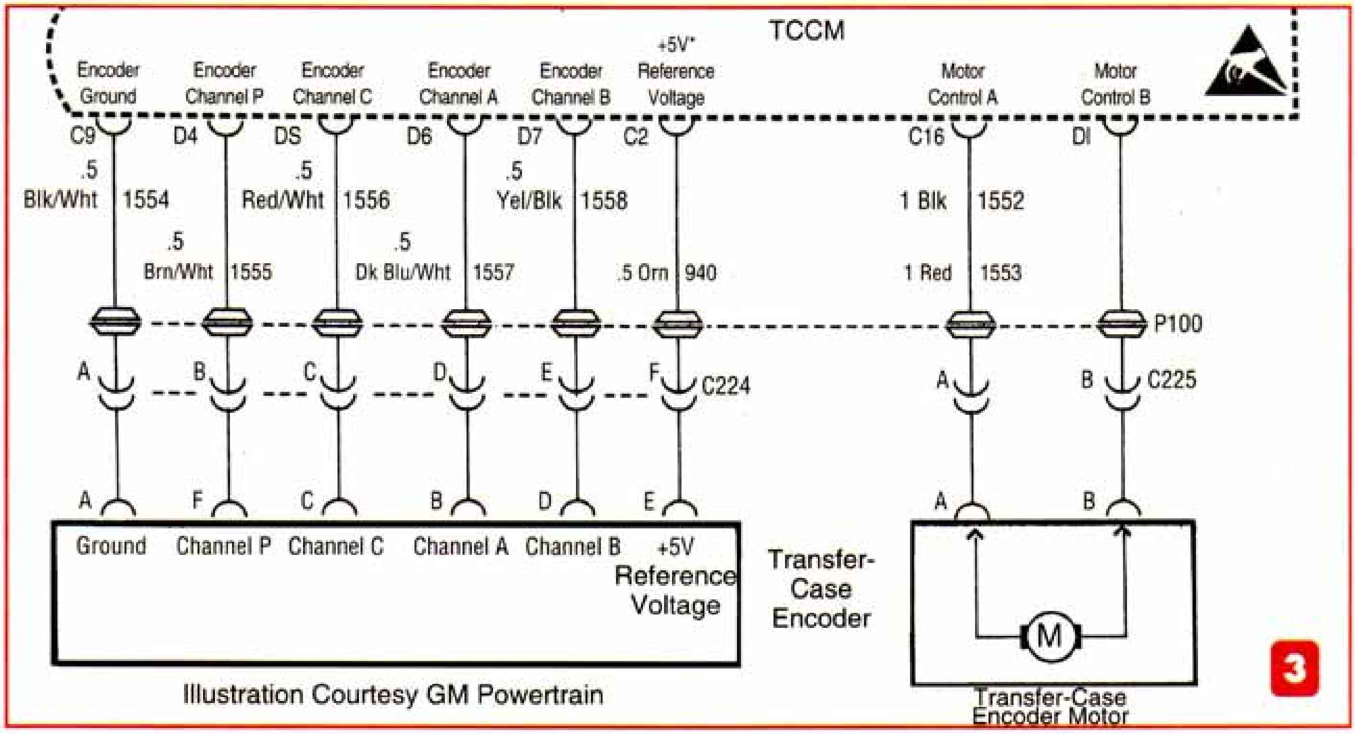

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you realize that a computer can understand only digital information. The vehicle-speed sensor is an AC-voltage generator that sends an analog signal that needs to be processed into a digital signal. The DRAC reads the VSS signal and turns it into a pulsed signal at 1.1 Hertz or 4,000 pulses per mile. We will go deeper into the DRAC operation and diagnosis next month.

The encoder is a four-channel switch that connects to the electric shift motor (See Figure 1). The TCCM interprets each of those channels as the position of the motor. Figure 2 shows the various positions and the ranges that the computer reads. Figure 3 shows the voltage combinations that the computer reads and gives you the necessary information to test the encoder. You can read voltage by back-probing the connector pins on the transfer case or on the TCCM.

In the next issue we will go over the diagnostic circuits and the electrical schematics of the NV 243 control system. Most of the general-repair manuals don't have a lot of clear diagnostics on this system, and next month's article will show you how to cut the waste out of doing these repairs. Stay tuned, same channel, next month. TD

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