



## Up To Standards

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Contributing Editor

One of the most-common tech calls we get concerns the NV233 electronic-shift transfer case in the 1993-and-up GM "T" trucks. The 233 transfer case is very similar to the manually shifted 231 transfer case but is equipped with an electronic shift motor and a position sensor called an encoder. The transfer case has three positions: 2WD, 4W high and 4W low.

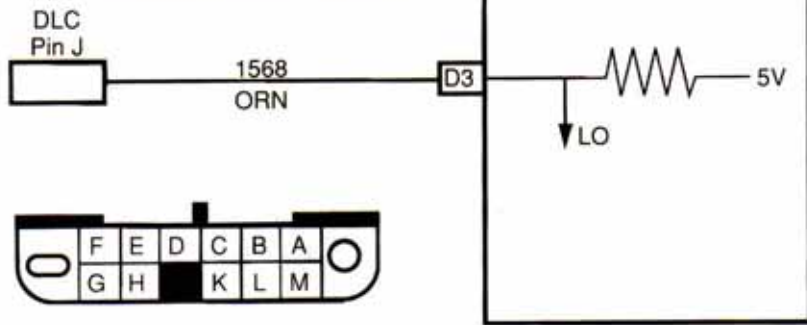
The transfer-case control module (TCCM) operates the transfer-case shift motor. The TCCM gets input information from the encoder switch on the shift motor, the digital ratio adapter controller (DRAC) that provides vehicle speed signal, the neutral-safety switch (NSS), pin J on the diagnostic link connector (See Figure 1), and the transfer-case selector switch. The TCCM sends signals to the electric shift motor, the 4WD status lights on the selector switch and diagnostic trouble codes to blink the status lights (See Figure 2).

The schematic diagram and voltage chart in Figure 3 show the neutral-safety-switch circuit. When making voltage checks on the NSS or TCCM, back-probe the pins with the ignition in the run position. Range shifts (4W High to 4W low) can be made only in neutral. If the NSS is out of adjustment, a turn/backup fuse is blown or there is an open in circuit 75, there will be no range shift in neutral. A backup-switch connector that is plugged in upside down can cause a range shift in park as well as neutral (See Figure 3). *continues page 28*

# Troubleshooting The GM 233 Electronic Transfer Case

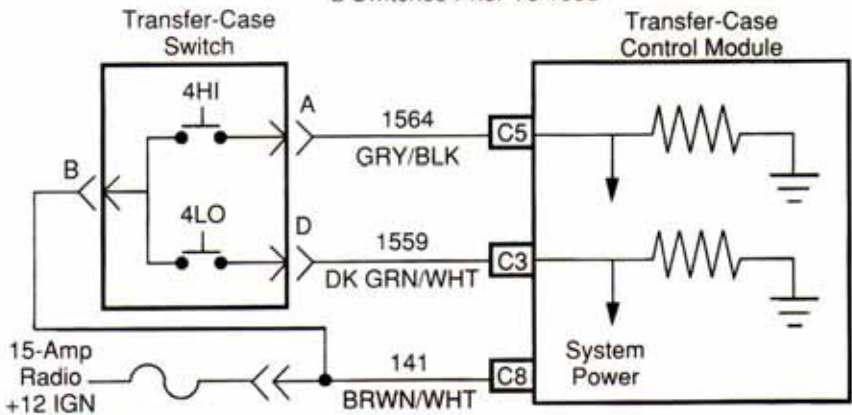
**Figure 1**

DLC Connector Pin J Schematic (Diagnostic Enable Terminal)

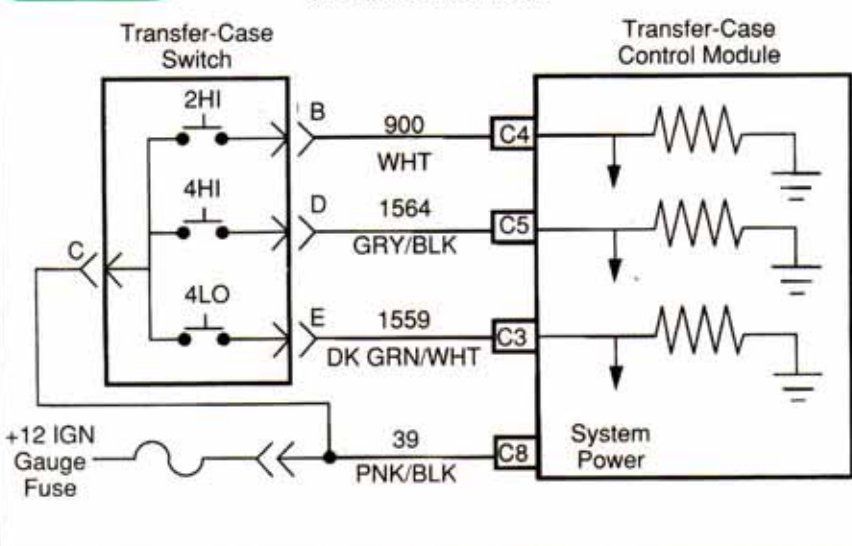


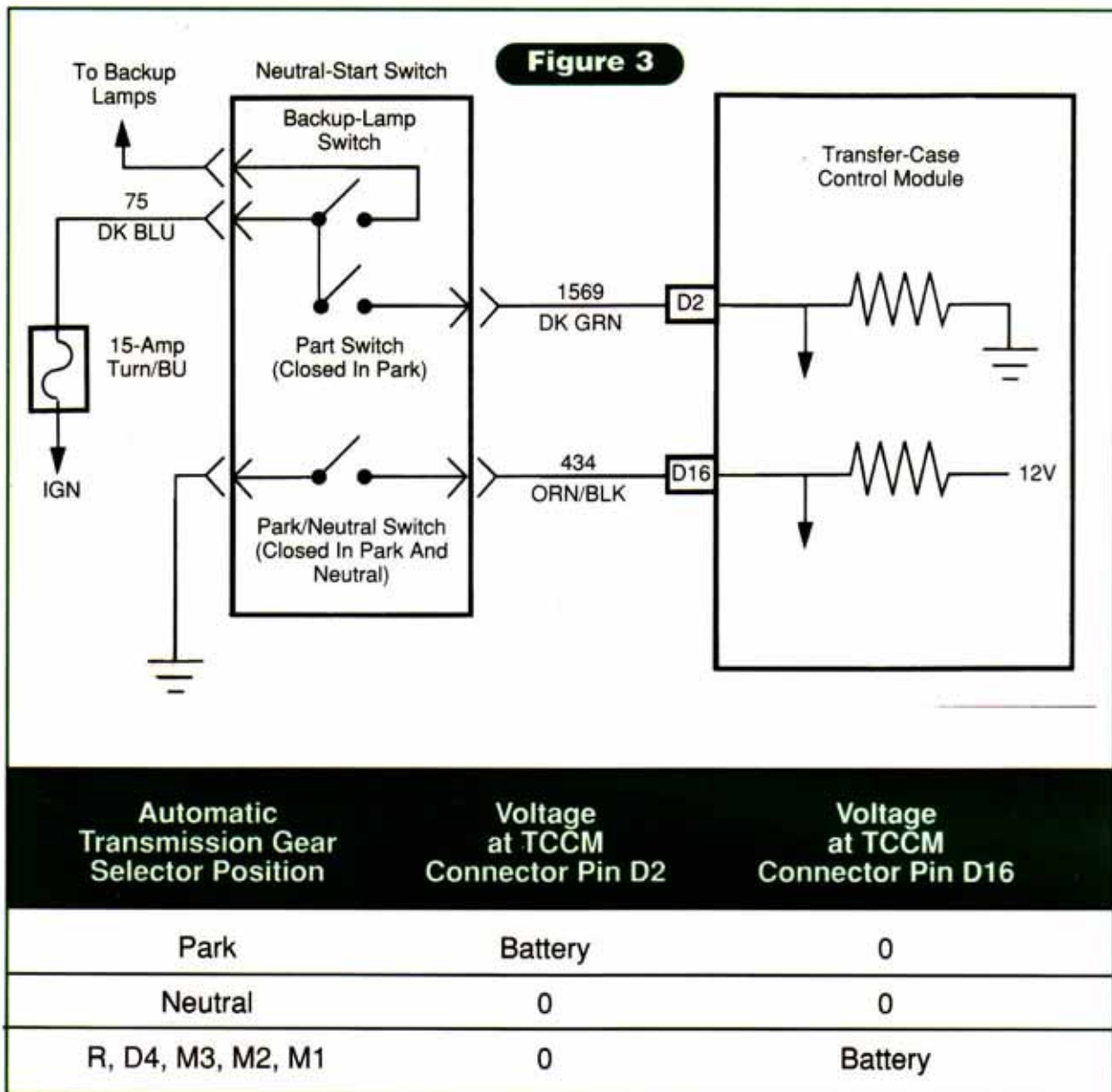
**Figure 2**

Transfer-Case 4WD Selector Switch Schematic  
2 Switches Prior To 1993



3 Switches After 1993





### VSS/DRAC Input

The DRAC circuit shown in Figure 4 provides a vehicle-speed signal to the TCCM, which will not permit range shifts above 3 mph.

The encoder switch, mounted on the shift motor, is a rotary switch with four channels: A, B, C and P. There is a 3-leg wiper arm with legs 120° apart. The legs contact an outer ring that is broken up into four channels, and the inner ring is the ground. When one of the legs contacts a channel, it completes the ground path to the inner ring. The schematic in

Figure 5 shows the encoder circuitry and the correct voltage readings between channels.

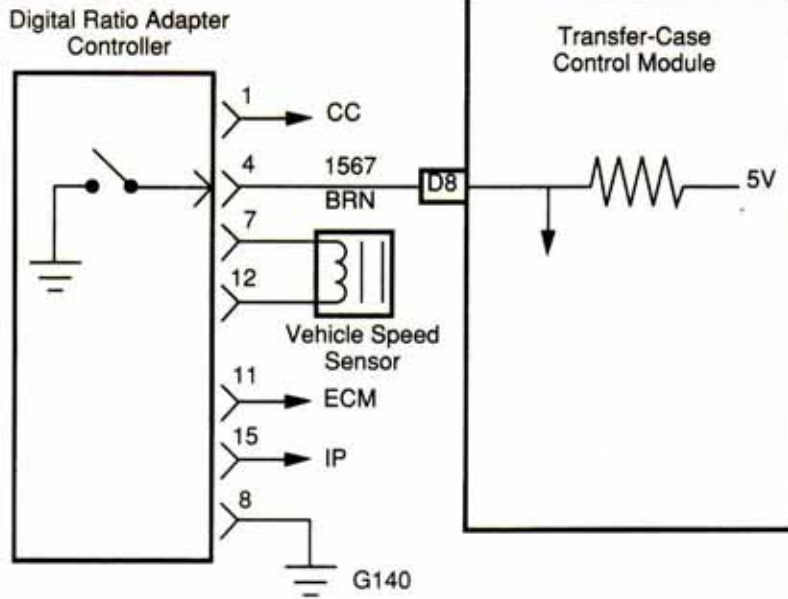
### Electric Circuitry For The Shift Motor

Power flows from the ignition circuit through a 30-amp power-accessory circuit breaker to the TCCM. There are two motor-control relays. The TCCM powers one relay for clockwise rotation and the other for counterclockwise movement. The TCCM is grounded through pins D12 and D13, as shown in Figure 6, page 32.

### Understanding Fault Codes And TCCM Operation

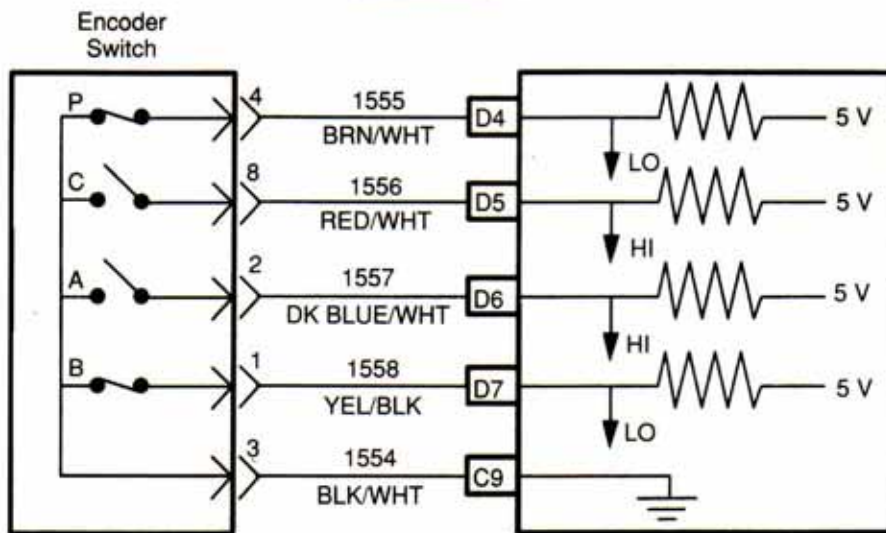
The TCCM is capable of storing 4 trouble codes (See Figure 6). Knowing how the TCCM "thinks" may help you in future diagnosis of problem units. When the driver turns the key and ignition voltage (12 volts) goes to the TCCM, the control module then runs a check on internal program memory and compares it with a checklist stored in the program. If the TCCM picks up a fault in the internal program, it will set code 4 for RAM/ROM failure. If you get a consistent code 4, TCCM replacement is necessary.

**Model 233 Transfer-Case DRAC Schematic**



**Figure 4**

**Figure 5**



| Transfer-Case Gearing | Encoder Channel Voltage |    |    |    |
|-----------------------|-------------------------|----|----|----|
|                       | Encoder Channel         |    |    |    |
|                       | P                       | C  | A  | B  |
|                       | TCCM Connector Pin      |    |    |    |
|                       | D4                      | D5 | D6 | D7 |
| 4LO                   | 0                       | 0  | 5  | 5  |
| Between Gears         | 5                       | 0  | 5  | 5  |
| Between Gears         | 5                       | 0  | 5  | 0  |
| Between Gears         | 0                       | 0  | 5  | 0  |
| Between Gears         | 5                       | 0  | 5  | 0  |
| Between Gears         | 5                       | 5  | 5  | 0  |
| 4HI                   | 0                       | 5  | 5  | 0  |
| Between Gears         | 5                       | 5  | 5  | 0  |
| Between Gears         | 5                       | 5  | 0  | 0  |
| 2 HI                  | 0                       | 5  | 0  | 0  |

*continues page 32*

After the internal program checks are complete and valid, the TCCM checks its data memory to make sure RAM standby power to the TCCM has not failed or been intermittent. If the memory count does not match what the TCCM had before the ignition was turned off, stored trouble codes will be lost. If the RAM standby power was interrupted, the TCCM will set a code 1 for RAM Standby Failure. This code will clear automatically after the ignition has been cycled 5 consecutive times.

The TCCM also monitors the position encoder for the shift motor. Anytime the encoder registers a position other than the next possible shift detent, the TCCM adds a count of 4 to an internal error counter. Each time the TCCM sees a correct encoder signal it reduces the fault count by 1. If the fault count hits 32, a code 2 will set for Encoder Fault. Codes to the TCCM can be cleared by removing the 5-amp TCCM fuse for 2 minutes and 30 seconds.

As you can see, these computer-

controlled transfer cases are extremely sophisticated, and if you don't have access to a good manual, you will be in trouble trying to diagnose them. GM has produced an excellent training manual called ALL WHEEL/FOUR WHEEL DRIVE, #14003.04-2, which you can order by calling 800-468-6657 for General Motors training materials. The price of good books will be paid off quickly by the hours you will save making repairs. **TD**

### IMPORTANT

Remove the 5-amp TCCM fuse for 2 minutes and 30 seconds to clear TCCM DTCs.

#### System Power

The ignition switch controls, and a 15-amp radio fuse protects, operating power. Circuit 141 supplies system power to TCCM connector pin C8. This fuse also supplies voltage to pin B of the transfer-case switch.

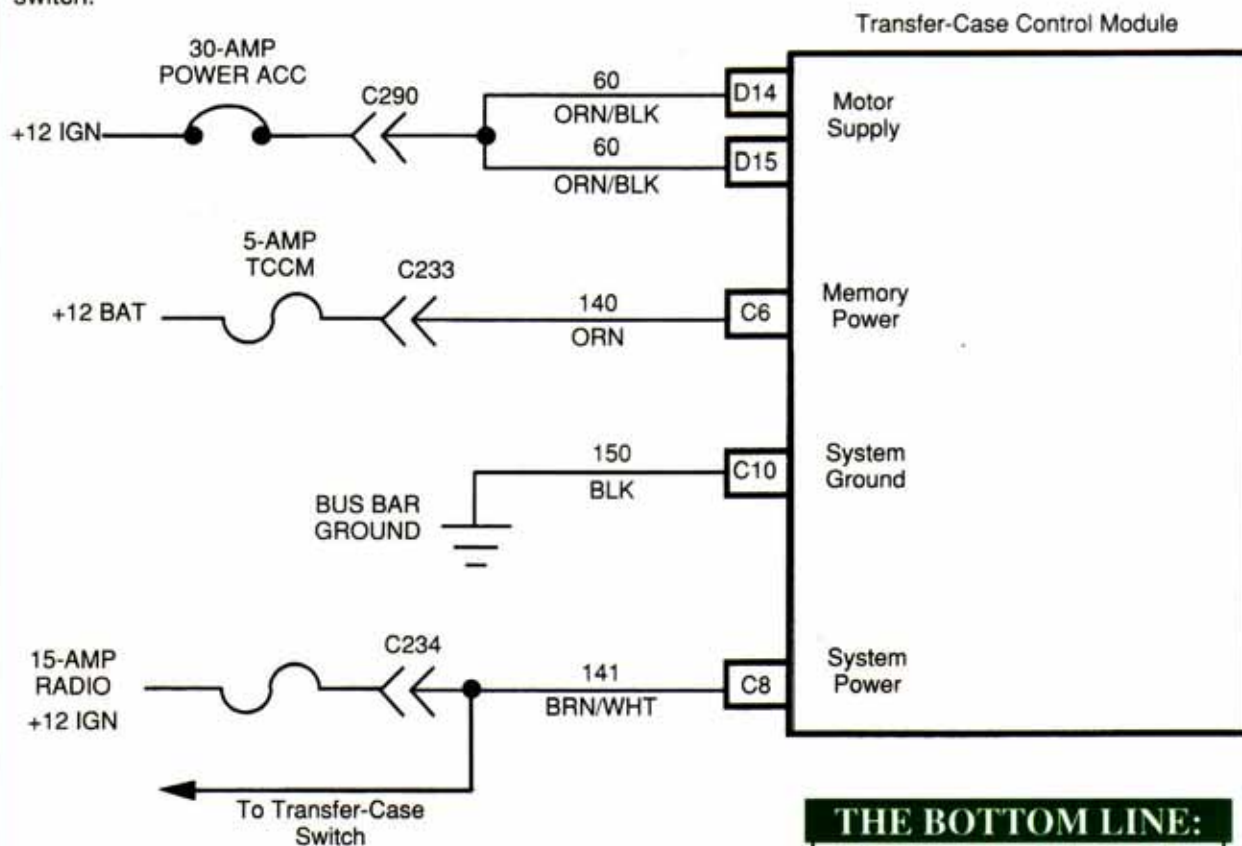


Figure 6

### THE BOTTOM LINE:

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