Diagnosis of the Electronic Shift 4x4 Transfer Case

1. Nothing happens (dead system).
2. No range shift.
3. Attempt to shift into 4H from 2H or 4L results in the module clicking and chattering and the system stops in 2H.
4. At start up, the vehicle shifts on its own.
5. Indicator lights don't register the correct information.
6. Shifting on the fly isn't smooth and may require stopping in order to complete the shift.

All these conditions can be best understood by taking a close look at a schematic of the electrical system.

Electronic Shift Transfer Case Schematic

Power In

Power is supplied to the system at three points (P1, P2 and P3 in schematic).

P1. This is a direct connection to the battery. This power drives the electric shift control motor and provides current to the instrument cluster lamps. This circuit goes to ground G1.

P2. The electronic shift control module is tied into the ignition circuit. This circuit provides power to the computer and goes to ground G2.

P3. Nighttime illumination is provided by a connection to the vehicle's nighttime illumination circuit, which goes to ground G3.

The electronic shift control module directs power depending on the position of the control switches. In the schematic, you will notice that inputs and outputs to and from the shift module are labeled A, B or C. A circuits are power circuits, B circuits are data circuits from sensors and C circuits are activating switch and related lamp circuits.

The B circuits supply data from three sources: The speed sensor, the motor position sensor and either a park/neutral position switch (for automatic transmissions) or a clutch pedal position switch (for manual transmissions).

The speed sensor is important because the vehicle must be stopped for a shift into or out of 4L. The shift module won't make the shift if the vehicle is moving. The shift module also won't make a shift to 4L or back unless an automatic transmission is in neutral or the clutch is depressed on a manual transmission.

The motor position sensor indicates the position of the shift motor shaft. This shaft turns through approximately 270° and should stop at three indexed points, 2H, 4H and 4L. The shift control module needs to know where the shaft is before making a new shift. When this sensor isn't functioning properly or the motor stops slightly off location, the shift control module may become "confused."
The C circuits involve the switches on the vehicle's control panel. When everything is working properly, activating a switch will result in either a shift from 2H to 4H or back, or a shift from 4H to 4L or back. The default operating mode is 2H. This means that in the absence of other instructions, the shift control module will assume that the vehicle should be in 2H. If there is a failure in the system during shifts or engine start up, it will default the vehicle to 2H and permit continued operation.

Nothing Happens (Dead System)

The obvious first step in diagnosing a dead system is to check the power sources, fuses and grounds. If these check out, perform the shift control module diagnostic test. The following illustration shows the module with pigtail A, B and C attachments. The diagnostic test button and diagnostic test LED are located on the side of the shift control module.

Disconnect the B and C connectors, turn on the ignition and allow 4 seconds for the module to power up. Then push the diagnostic test button. If the LED doesn’t illuminate, the module is dead and must be replaced. If the LED comes on and stays on for 30 seconds, there is an error condition and the module will have to be replaced. If the module is OK the LED will flash 4 times.

This test, however, is not 100 percent accurate. During the test, the vehicle isn’t operating, so the shift control module isn’t receiving data and initiating shifts. If the unit passes the diagnostic test, it’s probably a good module. Check for other probable causes, although the module may need to be replaced even after passing the diagnostic test.

Sensors

Check the three sensors with the ignition on. The transmission sensors (manual or automatic) should be closed with the clutch in, or the automatic shift in neutral. The speed sensor should show 225-275 ohms with the vehicle stopped. Check at the module connection.

Check both the motor position sensors and the wiring harness at B4, B5, B6 and B7 and the input from B8. Make sure the harness is OK, then check the contacts against the following chart. Each valid combination of open and closed switches indicates a different position of the motor. For example, at the 4H position, B7 is closed, B6 is closed, B5 is open and B4 is open. Besides the three main positions (2H, 4H and 4L), intermediate positions are also shown — three between 2H and 4H and three between 4H and 4L. Combinations other than those shown in the chart indicate a defective motor sensor assembly.

Shift Motor Positions

<table>
<thead>
<tr>
<th>MOTOR POSITION</th>
<th>2H</th>
<th>EDGE 1</th>
<th>2H-4H</th>
<th>EDGE 2</th>
<th>4H</th>
<th>EDGE 3</th>
<th>4H-4L</th>
<th>EDGE 4</th>
<th>4L</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER CIRCUITS</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>MECH POSITION</td>
<td>B7</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>OPEN</td>
<td>OPEN</td>
<td>OPEN</td>
</tr>
<tr>
<td>B8</td>
<td>CLOSED</td>
<td>OPEN</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
</tr>
<tr>
<td>B9</td>
<td>OPEN</td>
<td>OPEN</td>
<td>OPEN</td>
<td>OPEN</td>
<td>OPEN</td>
<td>OPEN</td>
<td>OPEN</td>
<td>OPEN</td>
<td>OPEN</td>
</tr>
<tr>
<td>B4</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
<td>CLOSED</td>
</tr>
</tbody>
</table>

1. Three or more open switchings in any position means something is wrong with the motor and sensor assembly.
2. If the help by 2H, 4H, 4H-4L or 4L does not show up, it will not show up 4H. But in a shift requires that the vehicle must be stopped and the clutch depressed, or the automatic transmission is in neutral. If these conditions are not met, the shift will not occur,65tI though it won’t do anything.

Check Transfer Case Shift Motor

To check if the transfer case shift motor is actually functioning (because it may be hard to hear it in a noisy shop) attach a voltmeter to A4 and A5. Have someone activate a shift and look for a brief (one second) increase in voltage and listen for the relay to click on, then off.

If there is power present, then the control module is trying to run the motor. At this point, unbol the motor and have someone activate a shift again. If the motor doesn’t actually turn, it is malfunctioning and must be replaced.

If there is no power to the motor, check both the power circuits again and the sensors. If there is incorrect sensor data, the module won’t power the motor.
Check Shift Switches

If the problem isn’t in the sensors or the motor, check the control panel switches. Make this check with the ignition on. Disconnect the “B” and “C” connections to the sensors, so that their data won’t confuse the diagnosis. Now check power at the C1 connection at the module. There should be 5 volts coming from the shift control module to the 4H and 4L switches. Check C1, C2, and C3 for short to ground.

Check the switches themselves by disconnecting C1 and checking continuity across C1 to C2 and C1 to C3. If current passes when the switch buttons are pushed, the switches are OK.

Finally, check for a short between C2 and C3 by bridging between them and activating the 4H and 4L buttons. There are situations where wiring harnesses get crushed in such a way that two wires are crushed together and short, even though there is no short to ground.

Check Lamps

To check the lamps, turn the ignition on and ground C4 and C5. The lamps should light.

No Range Shift

If the vehicle won’t shift into 4L, check the speed sensor and the transmission interlocks (neutral or clutch in). Also check the 4L switch (C3) to see if the module is getting a signal. Check for corroded connections.

If the vehicle won’t shift back to 4H, follow the proper sequence of being stopped and having the vehicle in neutral (or clutch in) when pushing the switch. Check the 4L switch and the motor position sensor.

Shift From 2H to 4H Results in Chatter and Clicking Noises From the Module, But No Shift

Typically, in this situation the motor hunts for 4H, but overshoots, then hunts back and overshoots the other way. After 7-10 seconds, the module returns to the default, which is 2H. This problem is normally not the sensor input. It is usually the result of the motor running too fast or braking too slowly to allow the module to position it accurately. The motor must be replaced.

At Start Up, the Vehicle Shifts On Its Own

This can occur when the motor position sensor indicates an intermediate position between 4H and 4L. If the vehicle is started in park instead of neutral, when the driver first moves the transmission shift lever to drive, the transmission passes through neutral. As it passes through neutral, the shift module activates the shift called for by the misinformation from the motor position sensor. On manual transmissions or automatic transmissions started in neutral, the shift occurs immediately.

This may be a one-time only event. However, the motor position sensor should be checked if it happens frequently.

Indicator Lights Don’t Register the Correct Information

Ranger and Explorer have indicator lights in two locations. There are lights on the dash and LED indicator lights in the switches. If the dash lights don’t respond, look for no power or a burned-out bulb.

If the lights are on all the time, look for a short to ground. Check to see if the shift control module is activating them all as this is a malfunction.

If the button lights remain on all the time but the dash lights are not on, this means the dash lights have burned out. The button lights are on because a low current is still passing across, enough to light the LED.

If no lights illuminate as you go through the shifts and ground power and bulbs are good, then the module is at fault or the motor has stopped at an intermediate point.

Shifting on the Fly Isn’t Smooth and May Require Stopping in Order to Complete the Shift

Look for problems with the electric magnetic clutch. If the rattling or grinding goes on for more than four seconds, there may be a problem with power to the clutch from the shift control module, the clutch ground or the clutch itself. Check the wiring harness as well.