

1999 TRANSFER CASES

Borg-Warner 44-05 Electronic Controls - Explorer & Mountaineer

APPLICATION

TRANSFER CASE APPLICATIONS

Vehicle Application	Transfer Case Application
Ford Explorer	Borg-Warner 44-05
Mercury Mountaineer	Borg-Warner 44-05

DESCRIPTION & OPERATION

NOTE: Borg-Warner 44-05 transfer case is also identified as A4WD (Automatic 4-Wheel Drive).

The electronically controlled 44-05 transfer case has A4WD (automatic), 4WD HIGH and 4WD LOW ranges. Transfer case operation is conducted by 2 motor driven shift forks (2WD to 4WD and 4WD HIGH to 4WD LOW) and internal electromagnetic multi-disc clutch assembly (automatic operation).

When in A4WD, system uses 2 Hall Effect type front and rear drive shaft speed sensors to compare front and rear drive shaft speeds. When drive shaft speeds differ by a predetermined amount the Generic Electronic Module (GEM) activates internal clutch to lock transfer case and equalize drive shaft speeds.

At rest and cruising conditions, the GEM activates the transfer case clutch at a minimum duty cycle. The clutch duty cycle is longer when slipping of front or rear axle is detected, during heavy acceleration or with very light throttle at speeds more than 40 MPH.

MODULE LOCATION

Generic Electronic Module (GEM) is located behind radio console.

INPUT DEVICES

Brake On/Off (BOO) Switch

The PCM receives a signal from the BOO switch when the brake switch is operated. The GEM and PCM are linked by a communication network. When shifting into or out of LOW range, the GEM requires brake pedal to be depressed.

Clutch Pedal Position (CPP) Switch

The PCM receives a signal from the CPP switch when the clutch pedal is depressed. The GEM and PCM are linked by a communication network. When shifting into or out of LOW range, the GEM requires clutch pedal to be depressed.

Drive Shaft Speed Sensors

Hall Effect type sensors monitor front and rear drive shaft speeds and input information to GEM. This input is used primarily to control A4WD (automatic) operation.

4WD Mode Switch

Instrument panel mounted switch sends input signal to GEM pertaining to commanded transfer case range.

Shift Motor Sense Plate

The shift motor sense plate is an integral part of the electric shift motor. The sense plate sends shift motor position input to GEM.

Throttle Position (TP) Sensor

The TP sensor is a potentiometer mounted to the engine throttle body. The PCM receives a signal from TP sensor relaying throttle plate position. The GEM and PCM are linked by a communication network. Signal is used by the GEM to control A4WD clutch.

Transmission Range Switch

The TR sensor is a digital type. The PCM monitors a series of step down resistors in TR sensor that act as a voltage divider. The voltage signal corresponds with position of transaxle range selector lever. The GEM and PCM are linked by a communication network. The TR sensor also contains neutral/start and backup light circuits. Malfunction of TR sensor may cause transfer case not to shift. Improper transmission shifting or shift selection and no engine cranking may also result.

Vehicle Speed Sensor (VSS)

The VSS is a magnetic pickup that sends output speed signal to the PCM. The GEM and PCM are linked by a communication network. When shifting into or out of LOW range, the GEM requires vehicle speed to be less than 3 MPH.

OUTPUT DEVICES

Transfer Case Clutch Relay

Transfer case clutch relay is a pulse width modulated signal operated relay that operates internal electromagnetic clutch.

4WD Shift Motor Relay

The 4WD shift motor relay actuates electric shift motor mounted to transfer case. Shift motor drives a rotary cam which moves mode fork and range fork inside transfer case.

SELF-DIAGNOSTIC SYSTEM

PRELIMINARY INSPECTION

NOTE: GEM must be reprogrammed upon replacement. Refer to New Generation Star (NGS) tester screen to program tire size and axle ratio.

1. Verify customer complaint by operating 4WD system. Visually inspect for damage to switches, fuse, wiring harness, wiring connections, vacuum connections, indicator lights, and light circuits.
2. Inspect 16-pin Data Link Connector (DLC) pins for damage. The DLC is located below driver's side

of instrument panel, to the right of steering column. If pins are okay, go to next step. If pins are damaged, repair as necessary and proceed to next step.

3. If concern is still present after performing inspection, connect New Generation Star (NGS) tester to DLC. Select vehicle to be tested from NGS tester menu. If NGS tester does not communicate with vehicle, ensure program card is properly installed. Check NGS tester cable connections and ensure ignition is on. If NGS tester still does not communicate with vehicle, see appropriate MODULE COMMUNICATIONS NETWORK article in ACCESSORIES & EQUIPMENT. If NGS tester communicates with vehicle, go to **DIAGNOSTIC PROCEDURE SEQUENCE** .

DIAGNOSTIC PROCEDURE SEQUENCE

NOTE: **When performing specified test procedures, technician may be instructed to retrieve Parameter Identification (PID) information on a specified component. For information on retrieving PID, see RETRIEVING PARAMETER IDENTIFICATION (PID) INFORMATION .**

1. Ensure transmission is in Park. Ensure all controls and switches are in OFF position. Connect New Generation Star (NGS) scan tester to DLC.
2. Ensure all doors, hood and trunk are fully closed. Perform proper hook-up procedure and vehicle selection for scan tester. See **EQUIPMENT HOOK-UP** .

NOTE: **DO NOT touch any handle or switch that may produce a module input unless instructed to do so by the scan tester.**

3. Retrieve continuous Diagnostic Trouble Codes (DTCs) from GEM. See **RETRIEVING DIAGNOSTIC TROUBLE CODES** . Record all continuous DTCs.
4. Clear continuous DTCs from GEM. See **CLEARING DIAGNOSTIC TROUBLE CODES** .
5. Perform On-Demand Self-Test on GEM. See **ON-DEMAND SELF-TEST** . Record all DTCs obtained when performing On-Demand Self-Test. If no DTCs were obtained when retrieving continuous DTCs or performing On-Demand Self-Test, problem is not related to GEM or module communications network. Continue diagnosis by symptom. See **SYMPTOM DIAGNOSIS** .
6. If DTCs were obtained when retrieving continuous DTCs or performing On-Demand Self-Test, proceed to **DIAGNOSTIC TROUBLE CODE DEFINITIONS** table for DTC identification and reference to DTC testing procedure.

EQUIPMENT HOOK-UP

NOTE: **Manufacturer recommends using New Generation Star (NGS) scan tester for diagnosis of module communications network.**

1. Ensure ignition switch is in OFF position. Select proper program card for scan tester for vehicle application. With scan tester facing away from you, insert program card into slot on scan tester. Ensure program card is properly inserted into scan tester or scan tester will not operate.
2. Connect scan tester to the 16-pin Data Link Connector (DLC). The DLC is located below driver's side of instrument panel, to the right of steering column.
3. Turn ignition on. Scan tester automatically performs a initialization test. Initialization test checks scan tester memory and verifies vehicle interface module matches program card for scan tester. If an error message is now displayed on scan tester, refer to scan tester operator's manual for system messages.

4. The menu item VEHICLE AND ENGINE SELECTION should be highlighted on scan tester. Press trigger to select VEHICLE AND ENGINE SELECTION.
5. Rotate dial on scan tester to menu item SELECT NEW VEHICLE MODEL AND YEAR. Press trigger to select VEHICLE AND ENGINE SELECTION. Select model year, vehicle and engine size by rotating dial to highlight the selection, then press trigger to select. If selected vehicle is not displayed, repeat this step.

RETRIEVING DIAGNOSTIC TROUBLE CODES

NOTE: Procedure may be used for retrieving continuous Diagnostic Trouble Codes (DTC).

1. Connect New Generation Star (NGS) scan tester to Data Link Connector (DLC) and perform proper hook-up procedure. See EQUIPMENT HOOK-UP .

NOTE: If instructed to retrieve Diagnostic Trouble Codes (DTC) from a specified test procedure, ensure ignition switch is in proper position as listed in test procedure. GEM requires ignition switch to be in ON position, or test will fail.

2. Turn ignition switch to ON position unless otherwise instructed by specified test procedure. Rotate dial on scan tester to DIAGNOSTIC DATA LINK menu and press trigger.
3. Rotate dial on scan tester to highlight the desired module you wish to access. Ensure DIAGNOSTIC TEST MODES is highlighted and press trigger.
4. Rotate dial on scan tester to highlight RETRIEVE/CLEAR CONTINUOUS DTC and press trigger. Press button No. 3 to start.
5. Record all Diagnostic Trouble Codes (DTC) that are displayed for GEM. Proceed to DIAGNOSTIC TROUBLE CODE DEFINITIONS for DTC identification and reference for proper DTC testing procedure.

ON-DEMAND SELF-TEST

NOTE: On-Demand Self-Test may be used to verify operation of a selected module.

1. Connect New Generation Star (NGS) scan tester on Data Link Connector (DLC) and perform proper hook-up procedure. See procedures under EQUIPMENT HOOK-UP .

NOTE: If instructed to perform On-Demand Self-Test from a specified test procedure, ensure ignition switch is in proper position as listed in test procedure. GEM requires ignition switch to be in ON position or the test will fail.

2. Turn ignition switch to ON position unless otherwise instructed by specified test procedure. Rotate dial on scan tester to DIAGNOSTIC DATA LINK menu and press trigger.
3. Rotate dial on scan tester to highlight the desired module to be tested and press trigger. Ensure DIAGNOSTIC TEST MODES is highlighted and press trigger.
4. Rotate dial on scan tester to highlight ON-DEMAND SELF-TEST and press trigger. Press button No. 3 to start the test. Prepare vehicle for entry condition as specified for each module. Press trigger.

Record any Diagnostic Trouble Codes (DTC) that are displayed.

DIAGNOSTIC TROUBLE CODE DEFINITIONS

DIAGNOSTIC TROUBLE CODE INDEX

DTC	Description	(1) Test
B1342	GEM/CTM Defective	(2)
B1483	Brake Pedal Input Circuit Failure	<u>B</u>
B1485	Brake Pedal Input Circuit Short To Power	<u>B</u>
B2105	Throttle Position Input Out Of Range Low	<u>A</u>
B2106	Throttle Position Input Out Of Range High	<u>A</u>
P0500	VSS Signal Circuit	<u>B</u>
P1804	4WD High Indicator Open/Short To Gnd	<u>C</u>
P1806	4WD High Indicator Short To Power	<u>C</u>
P1808	4WD Low Indicator Open/Short To Gnd	<u>C</u>
P1810	4WD Low Indicator Short To Power	<u>C</u>
P1812	4WD Mode Select Switch Open/Short To Gnd	<u>A</u>
P1815	4WD Mode Select Switch Short To Power	<u>A</u>
P1820	T/C LO To HI Shift Relay Open/Short To Gnd	<u>B</u>
P1822	T/C LO To HI Shift Relay Coil Short To Power	<u>B</u>
P1824	4WD Clutch Relay Circuit Failure	<u>A</u>
P1826	4WD Clutch Relay Short To Power	<u>A</u>
P1828	T/C Shift Relay Circuit Failure	<u>B</u>
P1830	T/C Shift Relay Coil Short To Power	<u>B</u>
P1836	Front Drive Shaft Speed Sensor Circuit	<u>B</u>
P1837	Rear Drive Shaft Speed Sensor Circuit	<u>B</u>
P1838	T/C Shift Motor Circuit Failure	<u>B</u>
P1846	T/C Contact Plate "A" Open Circuit	<u>B</u>
P1850	T/C Contact Plate "B" Open Circuit	<u>B</u>
P1854	T/C Contact Plate "C" Open Circuit	<u>B</u>
P1858	T/C Contact Plate "D" Open Circuit	<u>B</u>
P1866	T/C System Concern	<u>B</u>
P1867	T/C Contact Plate General Circuit Failure	<u>B</u>
P1874	Hall Effect Sensor Power Circuit Failure	<u>B</u>
P1875	Hall Effect Sensor Power Circuit Short	<u>B</u>
P1891	T/C Contact Plate Ground Return Open Circuit	<u>B</u>

(1) See **SYMPTOM TESTS** .

(2) Clear codes and retest system. If DTC B1342 is still present, replace GEM.

CLEARING DIAGNOSTIC TROUBLE CODES

1. Connect New Generation Star (NGS) scan tester on Data Link Connector (DLC) and perform proper hook-up. See **EQUIPMENT HOOK-UP** .
2. Turn ignition switch to ON position unless otherwise instructed by specified test procedure. Rotate

dial on scan tester to DIAGNOSTIC DATA LINK menu and press trigger.

3. Rotate dial on scan tester to highlight the desired module you wish to access. Ensure DIAGNOSTIC TEST MODES is highlighted and press trigger.
4. Rotate dial on scan tester to highlight RETRIEVE/CLEAR CONTINUOUS DTC and press trigger. Press button No. 3 to start.
5. To clear an individual DTC from a selected module, rotate dial on scan tool to highlight the DTC to be cleared. Press button No. 8. This will clear only that DTC from that module.
6. To clear DTC from a selected module, press button No. 7. This clears all DTCs from that module. After DTC is cleared from ABS control module, turn ignition switch to OFF position and then back to the RUN position.

RETRIEVING PARAMETER IDENTIFICATION (PID) INFORMATION

NOTE: This procedure may be used to verify operation of inputs and outputs for a selected module.

1. Connect New Generation Star (NGS) scan tester on Data Link Connector (DLC) and perform proper hook-up. See **EQUIPMENT HOOK-UP**.

NOTE: If instructed to retrieve PID from a specified test procedure, ensure ignition switch is in proper position as listed in test procedure. GEM requires ignition switch to be in ON position or the test will fail.

2. Turn ignition switch to ON position unless otherwise instructed by specified test procedure. Rotate dial on scan tester to DIAGNOSTIC DATA LINK menu and press trigger.
3. Rotate dial on scan tester to highlight the desired module you wish to access and press trigger. Rotate dial on scan tester to PID/DATA MONITOR AND RECORD and press trigger.
4. Rotate dial on scan tester to highlight the PID acronyms you wish to view and press trigger. Repeat this procedure until all desired PIDs are selected. When all PID acronyms have been selected, press button No. 7 to view all selected PIDs.

SYMPTOM DIAGNOSIS

VEHICLE DOES NOT OPERATE PROPERLY IN A4WD & 4WD HIGH MODES

Possible causes: open or shorts in harness, mode switch, speed sensors, internal clutch, transfer case and/or GEM. Go to **TEST A** under SYMPTOM TESTS.

VEHICLE DOES NOT SHIFT BETWEEN A4WD, 4WD HIGH & 4WD LOW MODES PROPERLY, OPERATES PROPERLY IN A4WD MODE

Possible causes: open or shorts in harness, mode switch, contact plate sensors, shift motor, shift relay, transfer case, GEM, transmission range sensor, neutral safety switch, speed sensors, BOO switch, 4WABS control module and/or vehicle speed sensor. Go to **TEST B** under SYMPTOM TESTS.

4WD OR 4WD LO RANGE INDICATOR NOT OPERATING PROPERLY

Possible causes: open or shorts in harness, indicator light, instrument cluster and/or GEM. Go to **TEST C** under SYMPTOM TESTS.

NO COMMUNICATION WITH GEM

Possible causes: open or shorts in harness, fuses and/or GEM. Go to **TEST D** under SYMPTOM TESTS.

SYMPTOM TESTS

NOTE: For GEM connector number identification, see **GEM CONNECTOR IDENTIFICATION** table. Also see appropriate wiring diagram in **WIRING DIAGRAMS**.

GEM CONNECTOR IDENTIFICATION

Connector No.	Description
C280	26-Pin
C281	16-Pin
C282	22-Pin
C283	18-Pin

TEST A: IMPROPER OPERATION IN A4WD & 4WD HIGH MODES

1. Check Ignition States; Monitor GEM PID IGN_GEM

Turn ignition off. Connect NGS tester. Depress clutch on manual transmission models. Monitor Generic Electronic Module (GEM) Parameter Identification (PID) Ignition Switch Status (IGN_GEM) while turning ignition switch through START, RUN, OFF and ACC positions. If values agree, go to next step. If values do not agree, see appropriate STEERING COLUMN SWITCHES article in ACCESSORIES & EQUIPMENT.

NOTE: In next step, if DTC B1398 is retrieved with DTC P1824, repair DTC B1398 first, then test system for normal operation. See appropriate STEERING COLUMN SWITCHES article in ACCESSORIES & EQUIPMENT. If DTC B1342 is retrieved, replace GEM. Clear DTC and retest system. If DTC B1371, B1302, B1398, B1814 or B1818 is retrieved, see **DIAGNOSTIC TROUBLE CODE INDEX** table under **DIAGNOSTIC TROUBLE CODE DEFINITIONS**.

2. Retrieve DTC

Retrieve and document continuous DTCs. Clear continuous DTC. Retrieve on-demand DTC. If DTC is recorded, go to appropriate step(s). See **TEST "A" INDEX** table. If no DTC is retrieved, go to next step.

TEST "A" INDEX

DTC	Go To Step
B2105	41
B2106	41
P0500	31
P1812	5
P1815	5
P1824	19

P1826	19
P1836	31
P1837	31
P1874	31
P1875	31

3. Check 4WD HIGH Indicator Light

Trigger GEM active command HIGH LAMP ON, then OFF. If 4WD HIGH indicator illuminates then goes off, go to next step. If indicator does not illuminate then go off, go to **TEST C** .

4. Check 4WD LOW Indicator Light

Trigger GEM active command LOW LAMP ON, then OFF. If 4WD LOW indicator illuminates then goes off, go to next step. If indicator does not illuminate then go off, go to **TEST C** .

5. Check 4WD Mode Switch-AUTO Position

Monitor GEM PID 4WD switch status (4WD_SW). Place mode switch in AUTO position. If PID indicates AUTO, go to next step. If PID does not indicate AUTO, go to step 8 .

6. Check 4WD Mode Switch-4WD HIGH Position

Monitor GEM PID 4WD_SW. Place mode switch in 4WD HIGH position. If PID indicates 4WD HIGH, go to next step. If PID does not indicate 4WD HIGH, go to step 8 .

7. Check 4WD Mode Switch-4WD LOW Position

Monitor GEM PID 4WD_SW. Place mode switch in 4WD LOW position. If PID does not indicate 4WD LOW, go to next step. If PID does indicate 4WD LOW, go to step 17 .

8. Check 4WD Mode Switch In AUTO Position

Turn ignition off. Disconnect 4WD mode switch connector. Place mode switch in AUTO position. Using ohmmeter, measure resistance between terminals No. 2 and 3 (center terminals) on mode switch connector. If resistance is 3700-4100 ohms, go to next step. If resistance is not as specified, replace mode switch. Clear DTC and retest system.

9. Check 4WD Mode Switch In 4WD HIGH Position

Place mode switch in 4WD HIGH position. Measure resistance between terminals No. 2 and 3 (center terminals) on mode switch connector. If resistance is 1050-1150 ohms, go to next step. If resistance is not as specified, replace mode switch. Clear DTC and retest system.

10. Check 4WD Mode Switch In 4WD LOW Position

Place mode switch in 4WD LOW position. Measure resistance between terminals No. 2 and 3 (center terminals) on mode switch connector. If resistance is 340-380 ohms, go to next step. If resistance is not as specified, replace mode switch. Clear DTC and retest system.

11. Check Circuit 465 (White/Light Blue Wire) For Open

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Measure resistance of White/Light Blue wire between terminal No. 3 on mode switch harness connector and terminal No. 8 on GEM 22-pin harness connector. See **Fig. 2** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open in White/Light Blue wire. Clear DTC and retest system.

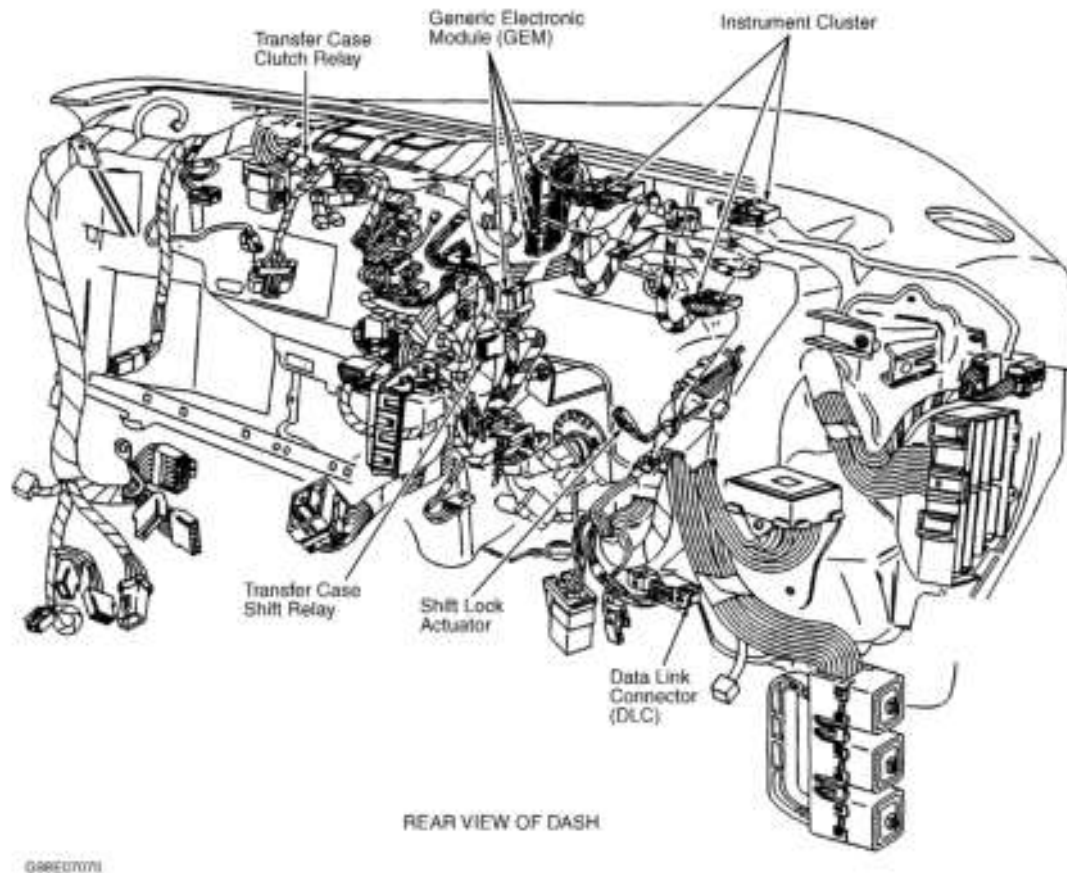
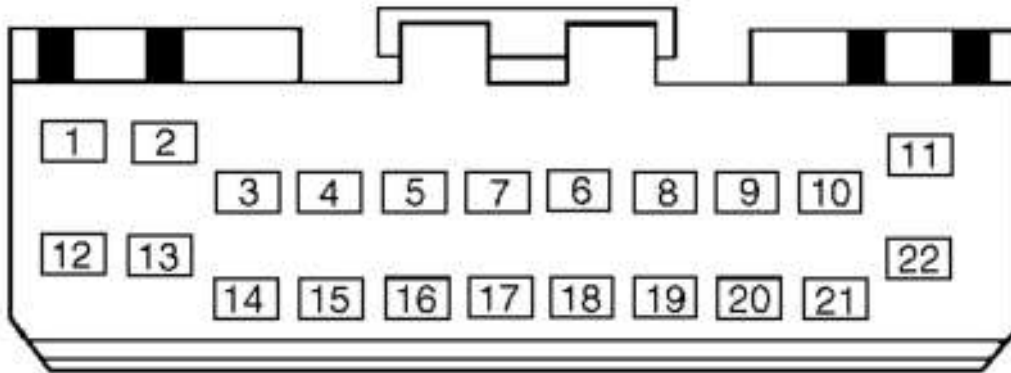


Fig. 1: Locating GEM Modules, T/C Clutch Relay & T/C Shift Relay
Courtesy of FORD MOTOR CO.



G99D54612

Fig. 2: Identifying GEM 22-Pin C282 Harness Connector Terminals
 Courtesy of FORD MOTOR CO.

12. Check Circuit 465 (White/Light Blue Wire) For Short To Ground

Using ohmmeter, measure resistance between ground and terminal No. 3 on 4WD mode switch harness connector. If resistance is more than 10 k/ohms, go to next step. If resistance is 10 k/ohms or less, repair White/Light Blue wire for short to ground. Clear DTC and retest system.

13. Check Circuit 465 (White/Light Blue Wire) For Short To Power

Turn ignition to RUN (engine off). Using DVOM, measure voltage between ground and terminal No. 3 on 4WD mode switch harness connector. If any voltage is indicated, repair short in White/Light Blue wire. Clear DTC and retest system. If no voltage is present, go to next step.

14. Check Circuit 359 (Gray/Red Wire) For Open

Turn ignition off. Disconnect GEM 26-pin C280 connector. Measure resistance of Gray/Red wire between terminal No. 2 on mode switch harness connector and terminal No. 21 on GEM 26-pin connector. See **Fig. 3**. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open in Gray/Red wire. Clear DTC and retest system.

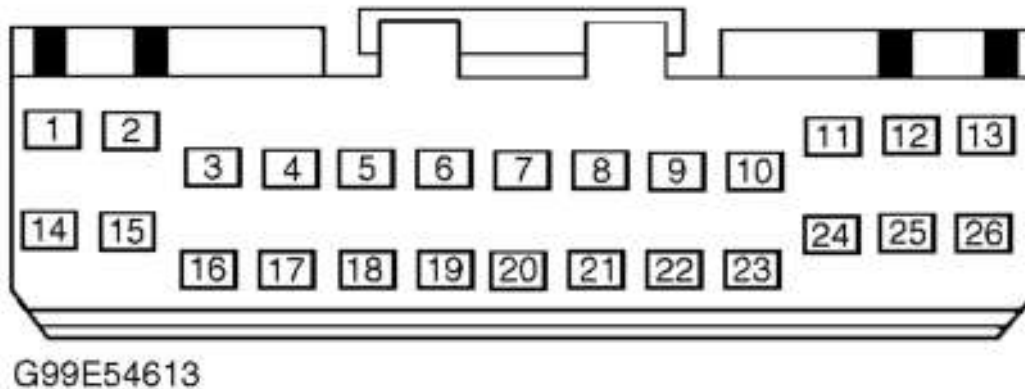


Fig. 3: Identifying GEM 26-Pin Connector Terminals
 Courtesy of FORD MOTOR CO.

15. Check Circuit 359 (Gray/Red Wire) For Short To Ground

Using ohmmeter, measure resistance between ground and terminal No. 2 on 4WD mode switch harness connector. If resistance is more than 10 k/ohms, go to next step. If resistance is 10 k/ohms or less, repair Gray/Red wire for short to ground. Clear DTC and retest system.

16. Check Circuit 359 (Gray/Red Wire) For Short To Power

Turn ignition to RUN (engine off). With DVOM, measure voltage between ground and terminal No. 2 on 4WD mode switch harness connector. If any voltage is indicated, repair short in Gray/Red wire. Clear DTC and retest system. If no voltage is present, replace GEM. Clear DTC and retest system.

17. Check Clutch Relay

Disconnect clutch relay harness connector located behind instrument panel. See **Fig. 1** . Connect jumper wire between battery positive terminal and relay terminal No.1. See **Fig. 4** . Connect second jumper between ground and relay terminal No. 2. Measure voltage between relay terminals No. 2 and 4. If no voltage is present, go to next step. If any voltage is present, replace relay. Clear DTC and retest system.

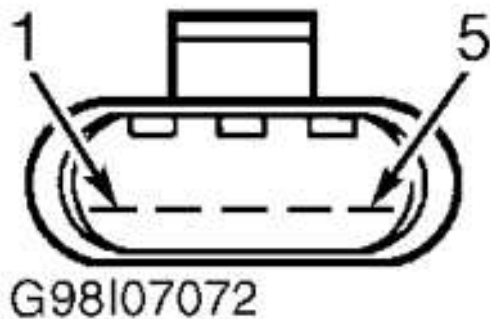


Fig. 4: T/C Clutch Relay Terminals
 Courtesy of FORD MOTOR CO.

18. Check Clutch Relay

Connect jumper wire between ground and relay terminal No. 3. Measure voltage between relay terminals No. 2 and 4. If voltage is more than 10 volts, reconnect relay and go to next step. If voltage is 10 volts or less, replace relay. Clear DTC and retest system.

19. Check Clutch Relay Coil Circuit

Place mode switch in 4WD HIGH. Monitor GEM PID 4WDCLST. If display is ON---, OFF ---, go to step 24 . If display is ON-B-, go to next step. If display is OFFO-G, go to step 21 .

20. Check Circuit 275 (Yellow Wire) For Short To Power

Turn ignition off. Disconnect clutch relay connector and GEM 22-pin connector. Turn ignition to RUN (engine off). Using DVOM, measure voltage on Yellow wire between ground and relay harness connector terminal No. 3. If voltage is present, repair short in Yellow wire. Clear DTC and retest system. If no voltage is present, reconnect system. Retrieve DTC and retest system. If system is still inoperative, replace GEM. Clear DTC and retest system.

21. Check Circuit 400 (Light Blue/Black Wire) For Voltage

Turn ignition off. Disconnect clutch relay connector. Turn ignition on. Trigger GEM active command ACCY RLY to ON. Measure voltage on Light Blue/Black wire between ground and relay harness connector terminal No. 1. Measure voltage on Light Blue/Black wire between ground and relay harness connector terminal No. 5. If voltage is more than 10 volts, go to next step. If voltage is 10 volts or less, repair Light Blue/Black wire. Clear DTC and retest system.

22. Check Circuit 275 (Yellow Wire) For Short To Ground

Turn ignition off. Disconnect GEM 22-pin connector. Using ohmmeter, measure resistance of Yellow wire circuit between ground and clutch relay harness connector terminal No. 3. If resistance is more

than 10 k/ohms, go to next step. If resistance is 10 k/ohms or less, repair short to ground in Yellow wire. Clear DTC and retest system.

23. Check Circuit 275 (Yellow Wire) Circuit For Open

Measure resistance of Yellow wire between terminal on clutch relay harness connector terminal No. 3 and terminal No. 15 on GEM 22-pin harness connector. If resistance is less than 5 ohms, replace GEM. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open in Yellow wire. Clear DTC and retest system.

24. Check Electric Clutch Energized

Raise and support vehicle. Turn ignition on. Place transmission in Neutral. Place mode switch in 4WD HIGH. Trigger GEM active command ACCY RLY to ON. Rotate front drive shaft. If front drive shaft locks to rear drive shaft, go to next step. If front drive shaft does not lock to rear drive shaft, go to step 26 .

25. Check Electric Clutch Not Energized

Raise and support vehicle. Turn ignition on. Place transmission in Neutral. Place mode switch in 4WD HIGH. Trigger GEM active command ACCY RLY to OFF. Rotate front drive shaft. If front drive shaft locks to rear drive shaft, go to step 27 . If front drive shaft does not lock to rear drive shaft, go to step 31 .

26. Check Voltage To Electric Clutch

Turn ignition off. Disconnect transfer case 16-pin connector. Turn ignition on. Trigger GEM active command ACCY RLY to ON. Measure voltage between ground and terminal No. 16 (Brown wire) on 16-pin harness connector. See **Fig. 5** . If voltage is more than 10 volts, replace electric clutch. Clear DTC and retest system. If voltage is 10 volts or less, go to step 29 .

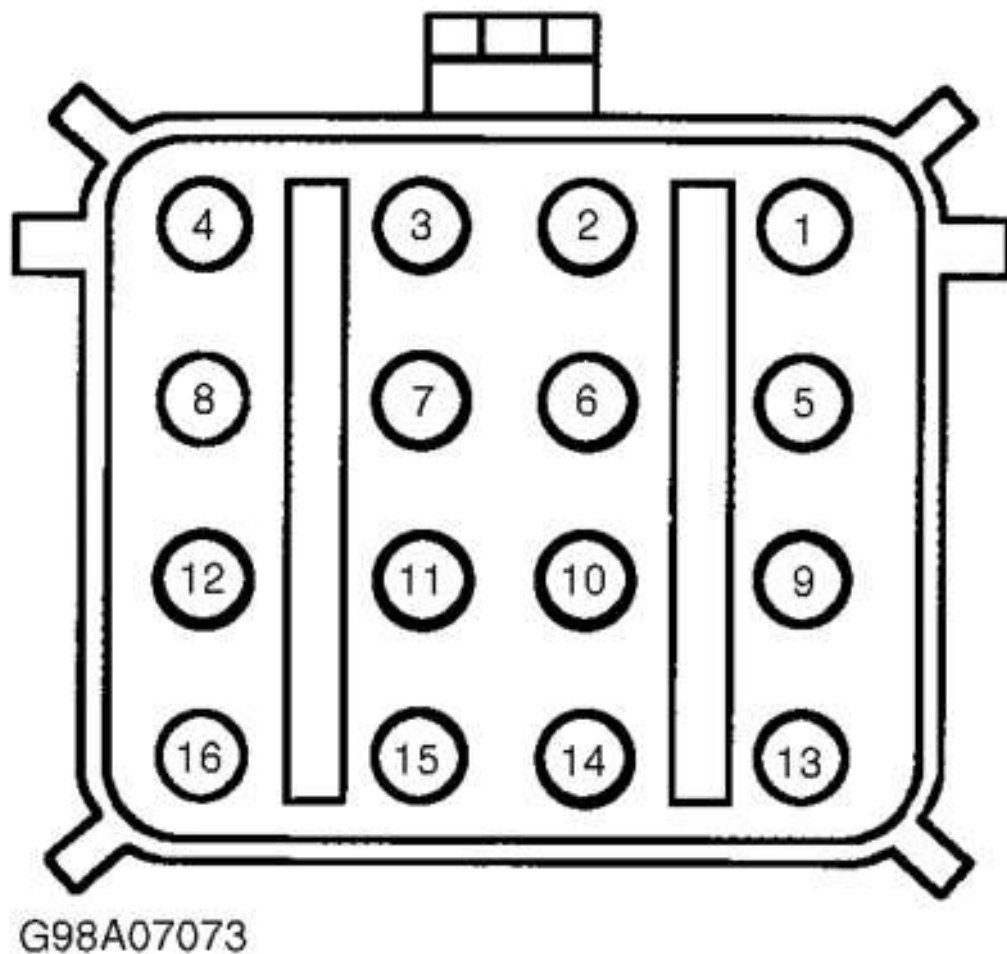


Fig. 5: Identifying Transfer Case 16-Pin Harness Connector Terminals
 Courtesy of FORD MOTOR CO.

27. Check Voltage To Electric Clutch

Turn ignition off. Disconnect transfer case 16-pin connector. Using DVOM, measure voltage between terminal No. 16 (Brown wire) on 16-pin harness connector and ground. See **Fig. 5** . If voltage is present, go to next step. If no voltage is present, replace electric clutch. Clear DTC and retest system.

28. Check Circuit 779 (Brown Wire) For Short To Power

Turn ignition off. Disconnect clutch relay harness connector. See **Fig. 1** . Turn ignition on. Measure voltage between ground and terminal No. 4 on clutch relay harness connector. If voltage is present, repair short to power in Brown wire. Clear DTC and retest system. If no voltage is present, replace clutch relay. Clear DTC and retest system.

29. Check Voltage to Clutch Relay Circuit 400 (Light Blue/Black Wire)

Turn ignition off. Disconnect clutch relay. Trigger GEM active command ACCY RLY to ON. Measure voltage between clutch relay terminals No. 1 and 5 to ground. If voltage is more than 10 volts, go to next step. If voltage is less than 10 volts, repair short in Light Blue/Black wire. Clear DTC and retest system.

30. Check Circuit 779 (Brown Wire) For Open

Measure resistance of Brown wire between terminal No. 16 on transfer case 16-pin harness connector and terminal No. 4 on clutch relay connector. If resistance is less than 5 ohms, replace GEM. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open in Brown wire. Clear DTC and retest system.

31. Check Drive Shaft Speed Sensors

Monitor GEM PID TRA_FSP and TRA_RSP while driving vehicle 0-55 MPH. If PID values match speedometer reading, go to step 39 . If values do not match speedometer reading, go to next step.

32. Check Circuit 539 (Pink/Light Blue Wire) For Short To Power

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Turn ignition on. Using voltmeter, measure voltage between ground and terminal No. 2 (Pink/Light Blue wire) on GEM harness connector. See **Fig. 2** . If no voltage is present, reconnect GEM connector and go to next step. If voltage is present, repair short to power in Pink/Light Blue wire. Clear DTC and retest system.

33. Check Front & Rear Drive Shaft Speed Sensor Circuit 774 (Light Green Wire) Voltage

Turn ignition off. Disconnect transfer case 16-pin harness connector. Turn ignition on. Measure voltage between ground and terminals No. 3 and 7 (Light Green wires) on 16-pin connector. See **Fig. 5** . If voltage is 10 volts or less, go to next step. If voltage is more than 10 volts, go to step 36 .

34. Check Circuit 774 (Light Green Wire) For Open

Turn ignition off. Measure resistance of Light Green wire between terminals No. 3 and 7 on transfer case 16-pin harness connector and terminal No. 1 on GEM 22-pin connector. If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open in Light Green wire. Clear DTC and retest system.

35. Check Circuit 774 (Light Green Wire) For Short To Ground

Measure resistance between ground and terminal No. 1 (Light Green wire) on GEM 22-pin connector. See **Fig. 2** . If resistance is 10 k/ohms or less, repair short to ground in Light Green wire. Clear DTC and retest system. If resistance is more than 10 k/ohms, replace GEM. Clear DTC and retest system.

36. Check Circuit 359 (Gray/Red Wire) For Open

Disconnect GEM 26-pin harness connector. See **Fig. 1** . Measure resistance of Gray/Red wire between terminal No. 21 on GEM connector and terminals No. 6 and 8 on transfer case 16-pin harness connector. See **Fig. 3** and **Fig. 5** . If resistance is less than 5 ohms and DTC P1836 was present in step 2) , go to next step. If resistance is less than 5 ohms and DTC P1837 was present in step 2) , go to step 38 . If DTC P1836 and P1837 were not retrieved, replace GEM. Clear DTC and retest system. If resistance is more than 5 ohms, repair open in Gray/Red wire. Clear DTC and retest system.

37. Check Front Drive Shaft Speed Sensor Circuit 236 (Black/Light Green Wire) For Open

Measure resistance of Black/Light Green wire between terminal No. 6 on GEM 22-pin harness connector and terminal No. 4 on transfer case 16-pin harness connector. If resistance is less than 5 ohms, replace front drive shaft speed sensor. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open in Black/Light Green wire. Clear DTC and retest system.

38. Check Rear Drive Shaft Speed Sensor Circuit 772 (Light Blue Wire) For Open

Measure resistance of Light Blue wire between terminal No. 5 on GEM 22-pin harness connector and terminal No. 2 on transfer case 16-pin harness connector. If resistance is less than 5 ohms, replace rear drive shaft speed sensor. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open in Black/Light Blue wire. Clear DTC and retest system.

39. Check Vehicle Speed Signal

Monitor GEM PID VSS_GEM while driving vehicle 0-55 MPH. If PID value matches speedometer reading, replace GEM. Clear DTC and retest system. If PID values do not match speedometer reading, go to next step.

40. Check Circuit 679 (Gray/Black Wire) For Open

Turn ignition off. Disconnect 4WABS control module. Disconnect 18-pin GEM connector. Measure resistance of Gray/Black wire between terminal No. 9 on GEM harness connector and terminal No. 19 on 4WABS module. See **Fig. 6**. If resistance is less than 5 ohms, problem is in 4WABS system. see appropriate article in BRAKES. If resistance is more than 5 ohms, repair open in Gray/Black wire. Clear DTC and retest system.

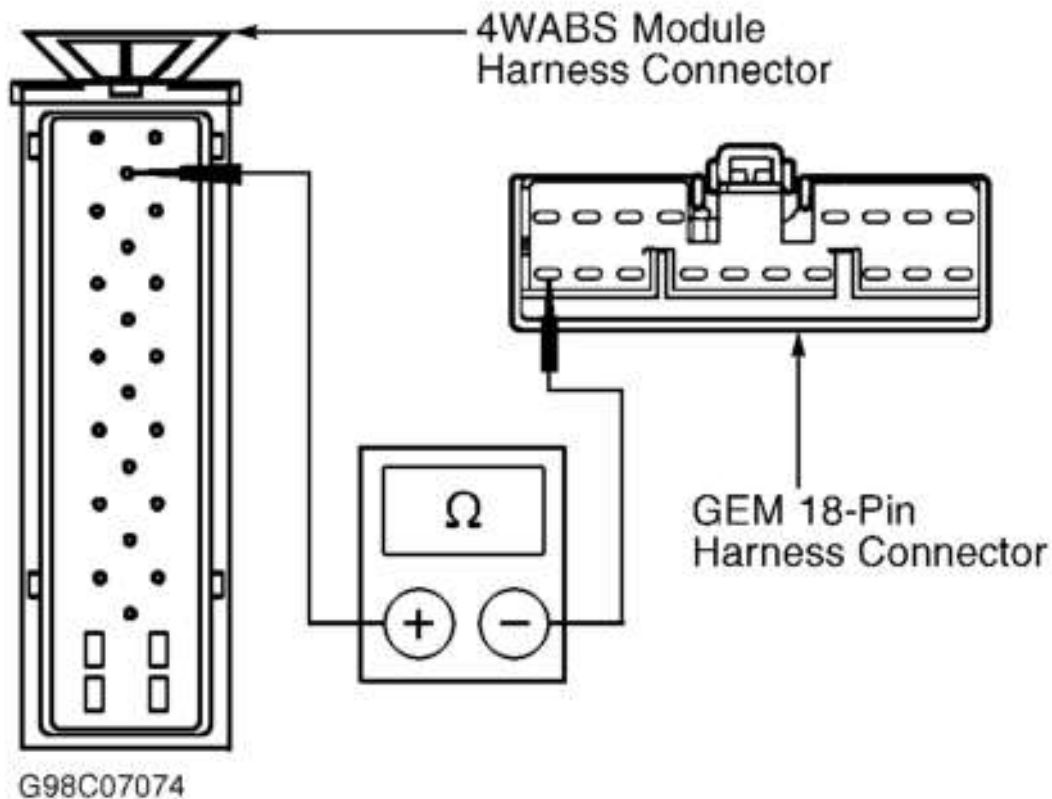


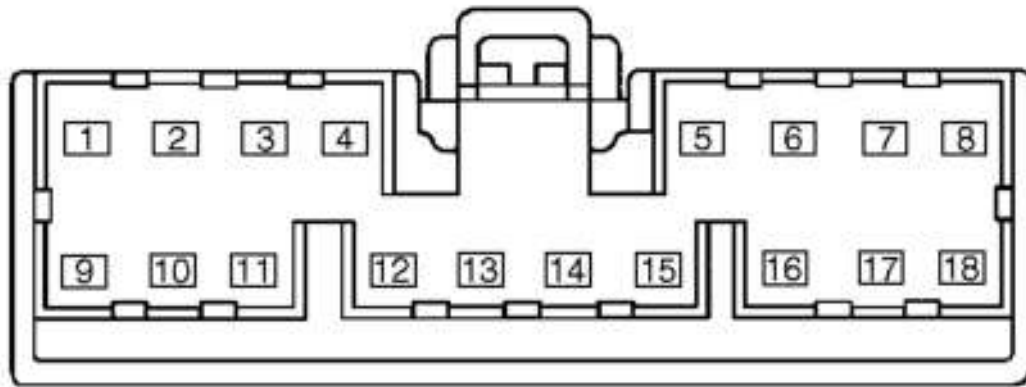
Fig. 6: Measuring Continuity Of Circuit 679
 Courtesy of FORD MOTOR CO.

41. Check Throttle Position Input

Turn ignition on. Monitor GEM PID TPI while pressing and releasing accelerator. If GEM PID TPI decreases when accelerator is pressed and increase when accelerator is released, disconnect GEM 18-pin C283 connector and PCM connector C202. Inspect circuit 357 (Yellow/White wire) for corrosion or damage. Repair as necessary. If circuit is okay, reconnect connectors. Clear DTC and retest system. If GEM PID TPI does not meet specification, go to next step.

42. Check Circuit 357 (Yellow/White Wire) For Open & Short To Ground

Turn ignition off. Disconnect PCM C202 harness connector. Disconnect 18-pin GEM connector. See **Fig. 1** . Connect 104-pin Breakout Box. Measure resistance of Yellow/White wire between pin No. 45 on breakout box and terminal No. 13 on GEM 18-pin connector. See **Fig. 7** . Measure resistance between ground and terminal No. 13 on GEM connector. If resistance is less than 5 ohms between 2 connectors and more than 10 k/ohms between GEM connector and ground, go to next step. If resistance does not meet specification, repair open in Yellow/White wire. Clear DTC and retest system.



G99F54614

Fig. 7: Identifying GEM 18-Pin C283 Connector
 Courtesy of FORD MOTOR CO.

43. Check Circuit 357 (Yellow/White Wire) For Short To Power

Turn ignition on. Using voltmeter, measure voltage between ground and terminal No. 13 on GEM 18-pin harness connector. If voltage is present, repair short to power in Yellow/White wire. Clear DTC and retest system. If no voltage is present, problem is in PCM. See appropriate BASIC DIAGNOSTIC PROCEDURES article in ENGINE PERFORMANCE.

TEST B: VEHICLE DOES NOT SHIFT BETWEEN A4WD, 4WD HIGH & 4WD LOW MODES PROPERLY, OPERATES PROPERLY IN A4WD

NOTE: For GEM connector number identification, see GEM CONNECTOR IDENTIFICATION table. Also see appropriate wiring diagram in WIRING DIAGRAMS.

GEM CONNECTOR IDENTIFICATION

Connector No.	Description
C280	26-Pin
C281	16-Pin
C282	22-Pin
C283	18-Pin

1. Check Ignition States

Turn ignition off. Connect NGS tester. Monitor Generic Electronic Module (GEM) Parameter Identification (PID) Ignition Switch Status (IGN_GEM) while turning ignition switch through START, RUN, OFF and ACC positions. If vehicle is equipped with manual transmission, depress clutch pedal when turning ignition switch to START position. If values agree, go to next step. If values do not agree, see appropriate STEERING COLUMN SWITCHES article in ACCESSORIES & EQUIPMENT.

2. Retrieve DTC

Retrieve and document continuous DTC. Clear continuous DTC. Retrieve on-demand DTC. If DTC is recorded, go to appropriate step(s). See **TEST "B" INDEX** table. If DTC B1371, B1302, B1398, B1814 or B1818 is recorded see **DIAGNOSTIC TROUBLE CODE INDEX** under DIAGNOSTIC TROUBLE CODE DEFINITIONS. If no DTC is retrieved, go to next step.

TEST "B" INDEX

DTC	Go To Step
P0500	73
P1342	(1)
P1483	17
P1485	17
P1812	3
P1815	3
P1820	55
P1822	55
P1828	55
P1830	55
P1836	31
P1837	31
P1838	55
P1846	40
P1850	40
P1854	40
P1858	40
P1866	40
P1867	40
P1874	31
P1875	31
P1891	31

(1) Replace GEM. See **Fig. 1** . Clear DTCs and retest system.

3. Check 4WD HIGH Indicator Light

Trigger GEM active command HIGH LAMP ON, then OFF. If 4WD HIGH indicator illuminates then goes off, go to next step. If indicator does not illuminate then go off, go to **TEST C** under SYMPTOM TESTS.

4. Check 4WD LOW Indicator Light

Trigger GEM active command LOW LAMP ON, then OFF. If 4WD LOW indicator illuminates then goes off, go to next step. If indicator does not illuminate then go off, go to **TEST C** under SYMPTOM TESTS.

5. Check 4WD Mode Switch AUTO Position

Monitor GEM PID 4WD switch status 4WD_SW. Place mode switch in AUTO position. If PID indicates AUTO, go to next step. If PID does not indicate AUTO, go to step 8 .

6. Check 4WD Mode Switch 4WD HIGH Position

Monitor GEM PID 4WD_SW. Place mode switch in 4WD HIGH position. If PID indicates 4WD HIGH, go to next step. If PID does not indicate 4WD HIGH, go to step 8 .

7. Check 4WD Mode Switch 4WD LOW Position

Monitor GEM PID 4WD_SW. Place mode switch in 4WD LOW position. If PID does not indicate 4WD LOW, go to next step. If PID does indicate 4WD LOW, go to step 17 .

8. Check 4WD Mode Switch In AUTO Position

Turn ignition off. Disconnect 4WD mode switch connector. Place mode switch in AUTO position. Using external ohmmeter, measure resistance between terminals No. 2 and 3 (center terminals) on mode switch connector. If resistance is 3700-4100 ohms, go to next step. If resistance is not as specified, replace mode switch. Clear DTC and retest system.

9. Check 4WD Mode Switch In 4WD HIGH Position

Place mode switch in 4WD HIGH position. Measure resistance between terminals No. 2 and 3 (center terminals) on mode switch connector. If resistance is 1050-1150 ohms, go to next step. If resistance is not as specified, replace mode switch. Clear DTC and retest system.

10. Check 4WD Mode Switch In 4WD LOW Position

Place mode switch in 4WD LOW position. Measure resistance between terminals No. 2 and 3 (center terminals) on mode switch connector. If resistance is 340-380 ohms, go to next step. If resistance is not as specified, replace mode switch. Clear DTC and retest system.

11. Check Circuit 465 (White/Light Blue Wire) For Open

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Measure resistance of White/Light Blue wire between terminal No. 3 on mode switch harness connector and terminal No. 8 on GEM 22-pin harness connector. See **Fig. 2** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open in White/Light Blue wire. Clear DTC and retest system.

12. Check Circuit 465 (White/Light Blue Wire) For Short To Ground

Using ohmmeter, measure resistance between ground and terminal No. 3 on 4WD mode switch harness connector. If resistance is more than 10 k/ohms, go to next step. If resistance is 10 k/ohms or less, repair White/Light Blue wire for short to ground. Clear DTC and retest system.

13. Check Circuit 465 (White/Light Blue Wire) For Short To Power

Turn ignition to RUN (engine off). Using DVOM, measure voltage between ground and terminal No. 3 on 4WD mode switch harness connector. If any voltage is indicated, repair short in White/Light Blue wire. Clear DTC and retest system. If no voltage is present, go to next step.

14. Check Circuit 359 (Gray/Red Wire) For Open

Turn ignition off. Disconnect GEM 26-pin connector. Measure resistance of Gray/Red wire between terminal No. 2 on mode switch harness connector and terminal No. 21 on GEM 26-pin connector. See **Fig. 3** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open in Gray/Red wire. Clear DTC and retest system.

15. Check Circuit 359 (Gray/Red Wire) For Short To Ground

Using ohmmeter, measure resistance between ground and terminal No. 2 on 4WD mode switch harness connector. If resistance is more than 10 k/ohms, go to next step. If resistance is 10 k/ohms or less, repair Gray/Red wire for short to ground. Clear DTC and retest system.

16. Check Circuit 359 (Gray/Red Wire) For Short To Power

Turn ignition to RUN (engine off). With DVOM, measure voltage between ground and terminal No. 2 on 4WD mode switch harness connector. If any voltage is indicated, repair short in Gray/Red wire. Clear DTC and retest system. If no voltage is present, replace GEM. Clear DTC and retest system.

17. Check Brake Pedal Position (BPP) Switch

While monitoring PID BOO_GEM, depress brake pedal. If PID displayed is ON, go to step 22 . If PID is not displayed ON, go to next step.

18. Check Fuse No. 13 (20-Amp)

Inspect fuse No. 13 (20-amp). If fuse is okay, go to next step. If fuse is blown, replace fuse. Clear DTC and retest system. If fuse blows again, repair circuit for short to ground and retest system.

19. Check Voltage To Brake Pedal Position (BPP) Switch Circuit 10 (Light Green/Red Wire)

Disconnect BPP switch connector. Using DVOM, measure voltage between ground and Light Green/Red wire terminal on BPP switch harness connector. If voltage is 10 volts or less, repair open Light Green/Red wire. Clear DTC and retest system. If voltage is more than 10 volts, go to next step.

20. Check Brake Pedal Position (BPP) Switch

While monitoring PID BOO_GEM, connect jumper wire across BPP harness connector terminals No. 2 and 5. If PID displayed is ON, replace BPP switch. Clear DTC and retest system. If PID is not displayed ON, go to next step.

21. Check Circuit 810 (Red/Light Green Wire) For Open

Disconnect GEM 22-pin connector. Using ohmmeter, measure resistance of Red/Light Green wire between terminal No. 2 on BPP switch harness connector and terminal No. 13 on GEM harness connector. See **Fig. 2** . If resistance is less than 5 ohms, replace GEM. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open Red/Light Green wire. Clear DTC and retest system.

22. Check Clutch Interlock

Turn ignition on. Monitor GEM PIN CLTCHSW. On A/T equipped vehicles, place shift lever in Park. On M/T equipped vehicles, depress clutch pedal. Scan tool should display ENGAGED. Place shift lever in any other position, or release clutch pedal. Scan tool should display NOT_ENGAGED. If

scan tool is as specified on A/T vehicles, go to step 26 . If scan tool is as specified on M/T vehicles, go to step 29 . If scan tool display is not as specified, go to next step. Clear DTC and retest system.

23. Check Voltage At Junction Panel Fuse No. 28 (7.5-Amp)

Disconnect fuse junction panel fuse No. 28 (7.5-amp). Turn ignition on. Using DVOM, measure voltage ground and terminal No. 2 on fuse No. 28 (7.5-amp) socket. If voltage is more than 10 volts, go to next step. If voltage is 10 volts or less, see appropriate STARTERS article in STARTING & CHARGING SYSTEMS. If okay, replace GEM. Clear DTC and retest system.

24. Check Circuit 1000 (Red/Light Green Wire) For Open & Short To Ground

Turn ignition off. Disconnect GEM 18-pin connector. See **Fig. 1** . Measure resistance of Red/Light Green wire between terminal No. 14 on GEM harness connector and terminal No. 1 on fuse No. 28 socket. Resistance should be less than 5 ohms. Measure resistance between ground and terminal No. 14 on GEM harness connector. Resistance should be more than 10 k/ohms. If resistance is as specified, go to next step. If resistance is not as specified, repair Red/Light Green wire for short or open. Clear DTC and retest system.

25. Check Circuit 1000 (Red/Light Green Wire) For Short To Power

Turn ignition on. Measure voltage between ground and terminal No. 14 on GEM 18-pin harness connector. If voltage is present, repair Red/Light Green wire for short to voltage. Clear DTC and retest system. If no voltage is present, replace GEM. Clear DTC and retest system.

26. Check Transmission Range Sensor

Monitor GEM PID NTRL__SW. place transmission in Neutral. Ensure GEM PID indicates NTRL. Verify GEM PID indicates notNTRL when transmission is in any position other than Neutral. If scan tool display is as specified, go to step 31 . If scan tool display is not as specified, go to next step.

27. Check Digital TR Sensor Circuit 57 (Black Wire) To Ground

Disconnect digital TR sensor. Measure resistance between TR sensor terminal No. 7, circuit 57 and ground. See **Fig. 8** . If resistance is less than 5 ohms, go to next step. If resistance is not as specified, repair Black wire. Clear DTC and retest system.

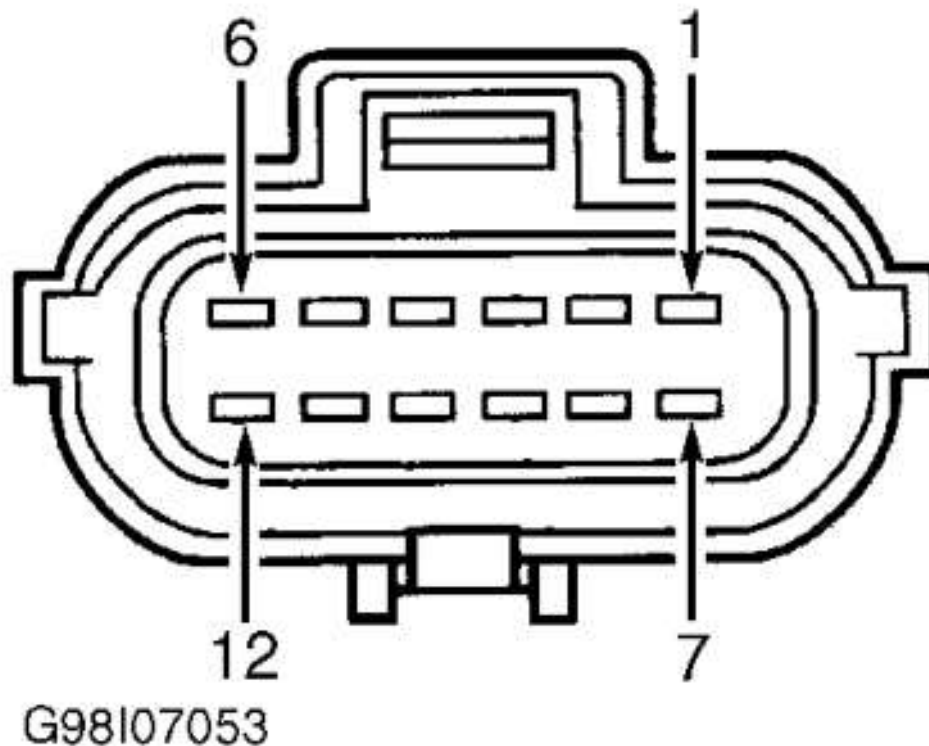


Fig. 8: Identifying Digital TR Sensor Harness Connector Terminals
 Courtesy of FORD MOTOR CO.

28. Check Digital TR Sensor

Monitor GEM PID NTRL__SW. Connect jumper wire between terminals No. 7 (Black wire) and No. 8 (Red/White wire) on TR sensor harness connector. See **Fig. 8** . Turn ignition on. Verify GEM PID indicates NTRL. Remove jumper wire. Monitor GEM PID NTRL__SW. Verify GEM PID indicates notNTRL. If scan tool is as specified, replace digital TR sensor. Clear DTC and retest system. If scan tool is not as specified, go to next step.

29. Check Circuit 463 (Red/White Wire) For Open

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Using ohmmeter, measure resistance of Red/White wire between terminal No. 8 on TR sensor harness connector and terminal No. 22 on GEM harness connector. See **Fig. 2** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open Red/White wire. Clear DTC and retest system.

30. Check Circuit 463 (Red/White Wire) For Short To Ground

Measure resistance between ground and terminal No. 22 on GEM connector. If resistance is less than 10 k/ohms, repair Red/White wire. If resistance is more than 10 k/ohms, replace GEM. Clear DTC

and retest system.

31. Check Drive Shaft Speed Sensors

Place 4WD mode switch in 4WD HIGH position. Monitor GEM PID TRA_FSP and TRA_RSP while driving vehicle 0-55 MPH. If PID values match speedometer reading, go to step 39 . If values do not match speedometer reading, go to next step.

32. Check Circuit 539 (Pink/Light Blue Wire) For Short To Power

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Turn ignition on. Using voltmeter, measure voltage between ground and terminal No. 2 (Pink/Light Blue wire) on GEM harness connector. If no voltage is present, reconnect GEM connector and go to next step. If voltage is present, repair short to power in Pink/Light Blue wire. Clear DTC and retest system.

33. Check Drive Shaft Speed Sensor Circuit 774 (Light Green Wire) Voltage

Turn ignition off. Disconnect transfer case 16-pin harness connector. Turn ignition on. Measure voltage between ground and terminals No. 3 and 7 (Light Green wires) on 16-pin connector. See **Fig. 5** . If voltage is 10 volts or less, go to next step. If voltage is more than 10 volts, go to step 36 .

34. Check Circuit 774 (Light Green Wire) For Open

Turn ignition off. Disconnect GEM 22-pin connector. Measure resistance of Light Green wire between terminals No. 3 and 7 on transfer case 16-pin harness connector and terminal No. 1 on GEM 22-pin connector. See **Fig. 2** and **Fig. 5** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open in Light Green wire. Clear DTC and retest system.

35. Check Circuit 774 (Light Green Wire) For Short To Ground

Measure resistance between ground and terminal No. 1 (Light Green wire) on GEM 22-pin connector. See **Fig. 2** . If resistance is 10 k/ohms or less, repair short to ground in Light Green wire. Clear DTC and retest system. If resistance is more than 10 k/ohms, replace GEM. Clear DTC and retest system.

36. Check Circuit 359 (Gray/Red Wire) For Open

Disconnect GEM 26-pin harness connector. See **Fig. 1** . Measure resistance of Gray/Red wire between terminal No. 21 on GEM connector and terminals No. 6 and 8 on transfer case 16-pin harness connector. See **Fig. 3** and **Fig. 5** . If resistance is less than 5 ohms and DTC P1836 was present in step 2 , go to next step. If resistance is less than 5 ohms and DTC P1837 was present in step 2 , go to step 38 . If resistance is less than 5 ohms, and DTC P1836 or P1837 are not present, replace GEM. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open in Gray/Red wire circuit. Clear DTC and retest system.

37. Check Front Drive Shaft Speed Sensor Circuit 236 (Black/Light Green Wire) For Open

Measure resistance of Black/Light Green wire between terminal No. 6 on GEM 22-pin harness connector and terminal No. 4 on transfer case 16-pin harness connector. See **Fig. 2** and **Fig. 5** . If resistance is less than 5 ohms, replace front drive shaft speed sensor. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open in Black/Light Green wire. Clear DTC and retest system.

38. Check Rear Drive Shaft Speed Sensor Circuit 772 (Light Blue Wire) For Open

Measure resistance of Light Blue wire between terminal No. 5 on GEM 22-pin harness connector and terminal No. 2 on transfer case 16-pin harness connector. See **Fig. 2** and **Fig. 5** . If resistance is less than 5 ohms, replace rear drive shaft speed sensor. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open in Light Blue wire. Clear DTC and retest system.

39. Check Vehicle Speed Signal

Monitor GEM PID VSS_GEM while driving vehicle 0-55 MPH. If PID values matches speedometer reading, go to next step. If PID values do not match speedometer reading, go to step 73 .

40. Check Contact Plate Switches

Monitor GEM PIDs PLATE_A, PLATE_B, PLATE_C, PLATE_D. While depressing brake pedal, place 4WD mode switch in 4WD HIGH position. Record PIDs. Depress brake pedal and shift transmission into Neutral (A/T) or depress clutch (M/T). Move mode switch to 4WD LOW position. Record PIDs. See **4WD MODE SWITCH PID OUTPUTS** table. If PIDs recorded match table, transfer case may have internal problem. Repair as needed. Clear DTC and retest system. If PIDs recorded do not match table, go to next step.

4WD MODE SWITCH PID OUTPUTS

Auto/4WD High	4WD Low
NGS Software 11.0 Version & Prior	
PLATE_A	
CLOSED	CLOSED
PLATE_B	
CLOSED	OPEN
PLATE_C	
OPEN	CLOSED
PLATE_D	
CLOSED	OPEN
NGS Software 12.0 Version & Higher	
PLATE_A	
CLOSED	OPEN
PLATE_B	
OPEN	CLOSED
PLATE_C	
CLOSED	OPEN
PLATE_D	
CLOSED	CLOSED

41. Check Contact Plate Switch "A" Circuit 771 (Pink/Yellow Wire)

Turn ignition off. Disconnect transfer case 16-pin connector. Turn ignition on. Monitor GEM PID PLATE_A. PID should be OPEN. Connect jumper wire across connector terminals No. 5 and 10. PID should change to CLOSED. If PLATE_A PIDs are as specified, go to step 46 . If PLATE_A PIDs are not as specified, go to next step.

42. Check Circuit 771 (Pink/Yellow Wire) For Open

Turn ignition off. Disconnect GEM 22-pin harness connector. See **Fig. 1** . Measure resistance of Pink/Yellow wire between terminal No. 21 on GEM connector and terminal No. 5 on transfer case 16-pin harness connector. See **Fig. 2** and **Fig. 5** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open Pink/Yellow wire. Clear DTC and retest system. If DTC is still present, go to step 44 .

43. Check Circuit 771 (Pink/Yellow Wire) For Short To Ground

Measure resistance between ground and terminal No. 5 on transfer case 16-pin harness connector. If resistance is more than 10 k/ohms, go to next step. If resistance is 10 k/ohms or less, repair Pink/Yellow wire for short to ground. Clear DTC and retest system.

44. Check Circuit 762 (Yellow/White Wire) For Open

Measure resistance of Yellow/White wire between terminal No. 12 on GEM connector and terminal No. 10 on transfer case 16-pin harness connector. See **Fig. 2** and **Fig. 5** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open Yellow/White wire. Clear DTC, cycle ignition and retest system.

45. Check Circuit 762 (Yellow/White Wire) For Short To Ground

Measure resistance between ground and terminal No. 10 on transfer case 16-pin harness connector. If resistance is more than 10 k/ohms, replace GEM. Clear DTC and retest system. If resistance is 10 k/ohms or less, repair Yellow/White wire for short to ground. Clear DTC, cycle ignition and retest system.

46. Check Contact Plate Switch "B" Circuit 770 (White Wire)

Turn ignition on. Monitor GEM PID PLATE_B. PID should be OPEN. Connect jumper wire between transfer case connector terminals No. 1 and 10. PID should change to CLOSED. If PLATE_B PIDs are as specified, go to step 49 . If PLATE_B PIDs are not as specified, go to next step.

47. Check Circuit 770 (White Wire) For Open

Turn ignition off. Disconnect GEM 22-pin harness connector. See **Fig. 1** . Measure resistance of White wire between terminal No. 20 on GEM connector and terminal No. 1 on transfer case 16-pin harness connector. See **Fig. 2** and **Fig. 5** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open White wire. Clear DTC, cycle ignition and retest system. If DTC is still present, go to step 49 .

48. Check Circuit 770 (White Wire) For Short To Ground

Measure resistance between ground and terminal No. 1 on transfer case 16-pin harness connector. If resistance is more than 10 k/ohms, replace GEM. Clear DTC and retest system. If resistance is 10 k/ohms or less, repair White wire for short to ground. Clear DTC, cycle ignition and retest system.

49. Check Contact Plate Switch "C" Circuit 764 (Brown/White Wire)

Turn ignition on. Monitor GEM PID PLATE_C. PID should be OPEN. Connect jumper wire between

transfer case connector terminals No. 9 and 10. PID should change to CLOSED. If PLATE_C PIDs are as specified, go to step 52 . If PLATE_C PIDs are not as specified, go to next step.

50. Check Circuit 764 (Brown/White Wire) For Open

Turn ignition off. Disconnect GEM 22-pin harness connector. See **Fig. 1** . Measure resistance of Brown/White wire between terminal No. 19 on GEM connector and terminal No. 9 on transfer case 16-pin harness connector. See **Fig. 2** and **Fig. 5** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open Brown/White wire. Clear DTC and retest system. If DTC is still present, reconnect GEM and go to step 52 .

51. Check Circuit 764 (Brown/White Wire) For Short To Ground

Measure resistance between ground and terminal No. 9 on transfer case 16-pin harness connector. If resistance is more than 10 k/ohms, replace GEM. Clear DTC and retest system. If resistance is 10 k/ohms or less, repair Brown/White wire for short to ground. Clear DTC, cycle ignition and retest system.

52. Check Contact Plate Switch "D" Circuit 763 (Orange/White Wire)

Turn ignition on. Monitor GEM PID PLATE_D. PID should be OPEN. Connect jumper wire across transfer case connector terminals No. 10 and 13. PID should change to CLOSED. If PLATE_D PIDs are as specified, replace transfer case shift motor. Clear DTC, cycle ignition and retest system. If PLATE_D PIDs are not as specified, go to next step.

53. Check Circuit 763 (Orange/White Wire) For Open

Turn ignition off. Disconnect GEM 22-pin harness connector. See **Fig. 1** . Measure resistance of Orange/White wire between terminal No. 18 on GEM connector and terminal No. 13 on transfer case 16-pin harness connector. See **Fig. 2** and **Fig. 5** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open Orange/White wire. Clear DTC, cycle ignition and retest system.

54. Check Circuit 763 (Orange/White Wire) For Short To Ground

Measure resistance between ground and terminal No. 13 on transfer case 16-pin harness connector. If resistance is more than 10 k/ohms, replace GEM. Clear DTC, cycle ignition and retest system. If resistance is 10 k/ohms or less, repair Orange/White wire for short to ground. Clear DTC, cycle ignition and retest system.

55. Check Transfer Case Relays

Monitor GEM PIDs MTR_CCW and MTR_CW. Toggle active command CW/CCW on, then off. If PIDs MTR_CCW and MTR_CW indicate ON---, OFF---, go to step 64 . If PIDs MTR_CCW and MTR_CW display ON-B-, go to step 61 . If PIDS display OFFO-G, go to next step.

56. Check Voltage At Transfer Case Shift Relay Coil Circuit 705 (Light Green/Orange Wire)

Turn ignition off. Disconnect transfer case shift relay connector. See **Fig. 1** . Using DVOM, measure voltage of Light Green/Orange wire between ground and terminal No. 5 on shift relay harness connector. See **Fig. 9** . If voltage is 10 volts or less, repair open Light Green/Orange wire. Clear DTC and retest system. If voltage is more than 10 volts, go to next step.

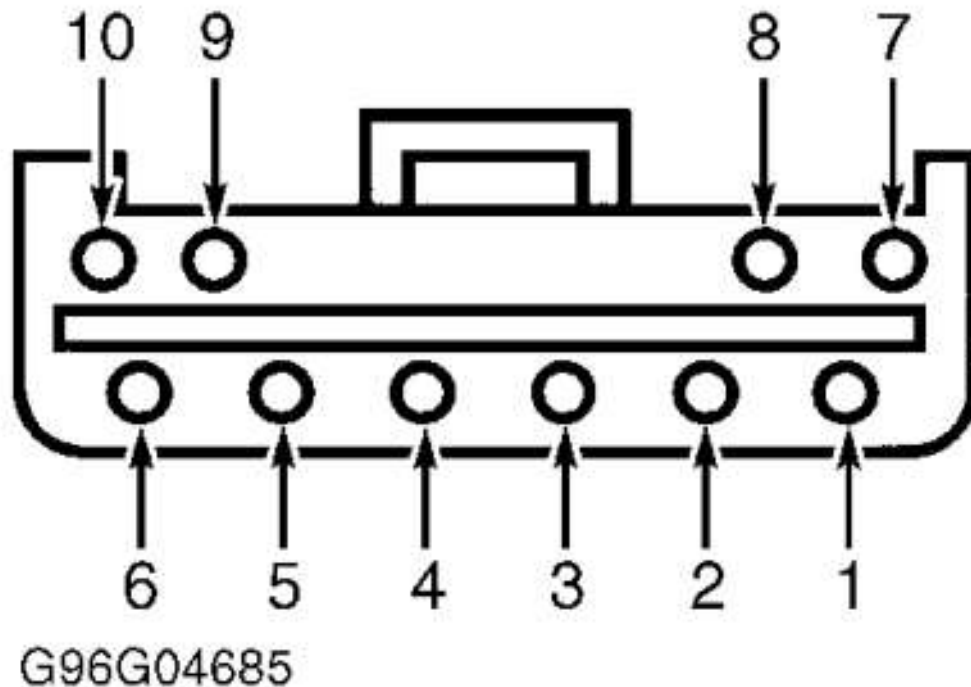


Fig. 9: Transfer Case Shift Relay Harness Connector Terminals
 Courtesy of FORD MOTOR CO.

57. Check Circuit 513 (Brown/Pink Wire) For Open

Disconnect GEM 22-pin connector. See **Fig. 1** . Using ohmmeter, measure resistance of Brown/Pink wire between terminal No. 9 on shift relay harness connector and terminal No. 17 on GEM harness connector. See **Fig. 2** and **Fig. 9** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open Brown/Pink wire. Clear DTC and retest system.

58. Check Circuit 339 (Gray Wire) For Open

Measure resistance of Gray wire between terminal No. 8 on shift relay harness connector and terminal No. 16 on GEM harness connector. See **Fig. 2** and **Fig. 9** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open Gray wire. Clear DTC and retest system.

59. Check Circuit 513 (Brown/Pink Wire) For Short To Ground

Measure resistance between ground and terminal No. 9 on shift relay harness connector. See **Fig. 9** . If resistance is more than 10 k/ohms, go to next step. If resistance is 10 k/ohms or less, repair Brown/Pink wire for short to ground. Clear DTC and retest system.

60. Check Circuit 339 (Gray Wire) For Short To Ground

Measure resistance between ground and terminal No. 8 on shift relay harness connector. See **Fig. 9** . If resistance is more than 10 k/ohms, go to step 63 . If resistance is 10 k/ohms or less, repair Gray wire for short to ground. Clear DTC and retest system.

61. Check Circuit 339 (Gray Wire) For Short To Power

Ensure ignition is off. Disconnect GEM 22-pin connector and transfer case shift relay connector. See **Fig. 1** . Turn ignition on. Measure voltage between ground and terminal No. 8 on shift relay harness connector. See **Fig. 9** . If voltage is not present, go to next step. If voltage is present, repair Gray wire for short to voltage. Clear DTC and retest system.

62. Check Circuit 513 (Brown/Pink Wire) For Short To Power

Measure voltage between ground and terminal No. 9 on shift relay harness connector. See **Fig. 9** . If voltage is not present, go to next step. If voltage is present, repair Brown/Pink wire for short to voltage. Clear DTC and retest system.

63. Check Transfer Case Shift Relay Coils

Turn ignition off. Using ohmmeter, measure resistance between terminal No. 5 and terminals No. 8 and 9 on transfer case shift relay connector. If resistance measured for both circuits is 60-100 ohms, replace GEM. Clear DTC and retest system. If resistance measured for both circuits is not 60-100 ohms, replace transfer case shift motor relay. Clear DTC and retest system.

64. Check Voltage To Transfer Case Shift Motor

Turn ignition off. Disconnect transfer case 16-pin connector. Turn ignition on. Using scan tool, set active command CW/CCW to ON. Using DVOM, measure voltage between ground and terminals No. 14 and 15 on 16-pin harness connector. See **Fig. 5** . If voltage is more than 10 volts, go to step 66 . If voltage is 10 volts or less, go to next step.

65. Check Voltage To Transfer Case Shift Relay Circuit 704 (Dark Green/Light Green Wire) Switch Side

Turn ignition off. Disconnect transfer case shift relay. See **Fig. 1** . Measure voltage between ground and terminal No. 3 (Dark Green/Light Green wire) on shift relay harness connector. See **Fig. 9** . If voltage is more than 10 volts, go to step 70 . If voltage is 10 volts or less, repair open Dark Green/Light Green wire. Clear DTC and retest system.

66. Check Voltage To Transfer Case Shift Motor

Turn ignition on. Using scan tool, set active command CW/CCW to OFF. Using DVOM, measure voltage between ground and terminals No. 14 (Orange wire) and 15 (Yellow wire) on transfer case 16-pin harness connector. See **Fig. 5** . If voltage is 10 volts or less, go to step 69 . If voltage is more than 10 volts, go to next step.

67. Check Circuit 777 (Yellow Wire) For Short To Power

Turn ignition off. Disconnect transfer case 16-pin connector transfer case shift relay. Turn ignition on. Measure voltage between ground and terminal No. 15 (Yellow wire) on transfer case 16-pin harness connector. See **Fig. 5** . If voltage is present, repair Yellow wire for short to voltage. Clear DTC and retest system. If voltage is not present, go to next step.

68. Check Circuit 778 (Orange Wire) For Short To Power

Measure voltage between ground and terminal No. 14 (Orange wire) on transfer case 16-pin harness connector. See **Fig. 5** . If voltage is present, repair Orange wire for short to voltage. Clear DTC and retest system. If voltage is not present, replace transfer case shift relay. Clear DTC and retest system.

69. Check Circuits 777 (Yellow Wire) & 778 (Orange Wire) For Open Through Transfer Case Relay

Set active command CW/CCW to OFF. Using ohmmeter, measure resistance between ground and terminals No. 14 (Orange wire) and 15 (Yellow wire) on transfer case 16-pin harness connector. See **Fig. 5** . If resistance for both circuits is less than 5 ohms, connect 16-pin connector and go to step 40 . If resistance is 5 ohms or greater for either circuit, go to step 72 .

70. Check Circuit 778 (Orange Wire) For Open

Measure resistance of Orange wire between terminal No. 14 on transfer case 16-pin harness connector and terminal No. 10 on shift relay harness connector. See **Fig. 5** and **Fig. 9** . If resistance is less than 5 ohms, go to next step. If resistance is 5 ohms or greater, repair open Orange wire. Clear DTC and retest system.

71. Check Circuit 777 (Yellow Wire) For Open

Measure resistance of Yellow wire between terminal No. 15 on transfer case 16-pin harness connector and terminal No. 7 on shift relay harness connector. See **Fig. 5** and **Fig. 9** . If resistance is less than 5 ohms, replace transfer case shift relay. Clear DTC and retest system. If resistance is 5 ohms or greater, repair open Yellow wire. Clear DTC and retest system.

72. Check Ground To Transfer Case Shift Relay

Ensure ignition is off. Disconnect transfer case shift relay. See **Fig. 1** . Measure resistance between ground and terminal No. 1 (Black wire) on shift relay harness connector. If resistance is 5 ohms or greater, repair open circuit No. 57 (Black wire). Clear DTC and retest system. If resistance is less than 5 ohms, replace transfer case shift relay. Clear DTC and retest system.

73. Check Circuit 679 (Gray/Black Wire) For Open

Turn ignition off. Disconnect 4-Wheel ABS (4WABS) module harness connector. 4WABS module is located on frame rail in engine compartment with brake pressure control valve block and pump motor. Disconnect GEM 18-pin harness connector. See **Fig. 1** . Using ohmmeter, measure resistance of Gray/Black wire between terminal No. 19 on 4WABS module harness connector and terminal No. 9 on GEM harness connector. See **Fig. 7** . If resistance is less than 5 ohms, see appropriate ANTI-LOCK article in BRAKES. If resistance is 5 ohms or greater, repair open in Gray/Black wire. Clear DTC and retest system.

TEST C: 4X4 HIGH &/OR 4X4 LOW INDICATOR NOT OPERATING PROPERLY

1. Check Ignition States

Turn ignition off. Connect NGS tester. Monitor Generic Electronic Module (GEM) Parameter Identification (PID) Ignition Switch Status (IGN_GEM) while turning ignition switch through

START, RUN, OFF and ACC positions. If vehicle is equipped with manual transmission, depress clutch pedal when turning ignition switch to START position. If values agree, go to next step. If values do not agree, see appropriate STEERING COLUMN SWITCHES article in ACCESSORIES & EQUIPMENT.

2. Retrieve DTC

Retrieve and document continuous DTC. Clear continuous DTC. Retrieve on-demand DTC. If DTC is recorded, go to appropriate step(s). See **TEST "C" INDEX** table. If no DTC is retrieved, go to next step.

TEST "C" INDEX

DTC	Go To Step
P1342	(1)
P1804, P1806, P1808 & P1810	3
(1) Replace GEM.	

3. Verify Inoperative Indicator Light

If 4X4 HIGH indicator light is not operating, go to next step. If 4X4 HIGH indicator light is operating properly but 4X4 LOW indicator light is not operating properly, go to step 9 . If both indicator lights are not operating properly, go to appropriate INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT.

4. Check 4X4 HIGH Indicator Light

Turn ignition switch to RUN. Using scan tool, monitor PID 4WDHIGH. Toggle active command HIGH LAMP to ON, then OFF. If 4X4 HIGH indicator light toggles on and off, indicator light is operating correctly. Go to **TEST A** . If scan tool displays ON-B-, go to step 7 . If scan tool displays OFFO-G, go to next step.

5. Check GEM

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Connect jumper wire between ground and terminal No. 14 (Gray wire) on GEM connector. See **Fig. 2** . Turn ignition switch to RUN. If 4X4 HIGH indicator light illuminates, replace GEM. Clear DTCs and retest system. If indicator light does not illuminate, go to next step.

6. Check Circuit 783 (Gray Wire) For Open

Ensure ignition is off. Disconnect instrument cluster 16-pin connector. Measure resistance of Gray wire between terminal No. 14 on GEM 22-pin harness connector and terminal No. 3 on instrument cluster harness connector. If resistance is 5 ohms or greater, repair open Gray wire. Clear DTCs and retest system. If resistance is less than 5 ohms, replace instrument cluster. Clear DTCs and retest system.

7. Check Instrument Cluster For Short To Power

Turn ignition off. Disconnect instrument cluster 16-pin connector. Turn ignition switch to RUN. Using scan tool, monitor PID 4WDHIGH. Toggle active command HIGH LAMP to ON, then OFF. If

scan tool displays ON-B-, go to next step. If scan tool does not display ON-B-, replace instrument cluster printed circuit. Clear DTCs and retest system.

8. **Check Circuit 783 (Gray Wire) For Short To Power**

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Using DVOM, measure voltage between ground and terminal No. 14 (Gray wire) on GEM harness connector. See **Fig. 2** . If voltage is present, repair Gray wire for short to voltage. If voltage is not present, replace GEM. Clear DTCs and retest system.

9. **Check 4X4 LOW Indicator Light**

Turn ignition on. Using scan tool, monitor GEM PID 4WDLOW. Toggle active command LOW LAMP to ON, then OFF. If 4X4 LOW indicator light toggles on and off, indicator light is operating correctly. Go to **TEST A** . If scan tool displays ON-B-, go to step 12 . If scan tool displays OFFO-G, go to next step.

10. **Check GEM**

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Connect jumper wire between ground and terminal No. 10 (Light Blue/Black wire) on GEM connector. See **Fig. 2** . Turn ignition on. If 4X4 LOW indicator light illuminates, replace GEM. Clear DTCs and retest system. If indicator light does not illuminate, go to next step.

11. **Check Circuit 784 (Light Blue/Black Wire) For Open**

Ensure ignition is off. Disconnect instrument cluster 16-pin connector. Measure resistance of Light Blue/Black wire between terminal No. 10 on GEM 22-pin harness connector and terminal No. 2 on instrument cluster harness connector. If resistance is 5 ohms or greater, repair open Light Blue/Black wire. Clear DTCs and retest system. If resistance is less than 5 ohms, replace instrument cluster. Clear DTCs and retest system.

12. **Check Instrument Cluster For Short To Power**

Turn ignition off. Disconnect instrument cluster 16-pin connector. Turn ignition switch to RUN. Using scan tool, monitor PID 4WDLOW. Toggle active command LOW LAMP to ON, then OFF. If scan tool displays ON-B-, go to next step. If scan tool does not display ON-B-, replace instrument cluster printed circuit. Clear DTCs and retest system.

13. **Check Circuit 784 (Light Blue/Black Wire) For Short To Power**

Turn ignition off. Disconnect GEM 22-pin connector. See **Fig. 1** . Turn ignition switch to RUN. Using DVOM, measure voltage between ground and terminal No. 10 on GEM harness connector. See **Fig. 2** . If voltage is present, repair Light Blue/Black wire for short to voltage. If voltage is not present, replace GEM. Clear DTCs and retest system.

TEST D: NO COMMUNICATION WITH GEM

1. **Check Power Distribution Box Maxi-Fuse No. 1 (60-Amp)**

Inspect fuse No. 1 (60-amp). Replace as needed. Clear DTC and retest system. If fuse blows again, inspect and repair circuit for short to ground. If fuse is okay, go to next step.

2. Check Junction Panel Fuse No. 25 (7.5-Amp)

Inspect fuse No. 25 (7.5-amp). Replace as needed. Clear DTC and retest system. If fuse blows again, inspect and repair circuit for short to ground. If fuse is okay, go to next step.

3. Check Circuit 1052 (Tan/Black Wire) For Voltage

Measure voltage of Tan/Black wire between ground and pin No. 2 on fuse No. 25 socket. See **Fig. 10** . If voltage is more than 10 volts, go to next step. If voltage is 10 volts or less, repair open Tan/Black wire. Clear DTC and retest system.

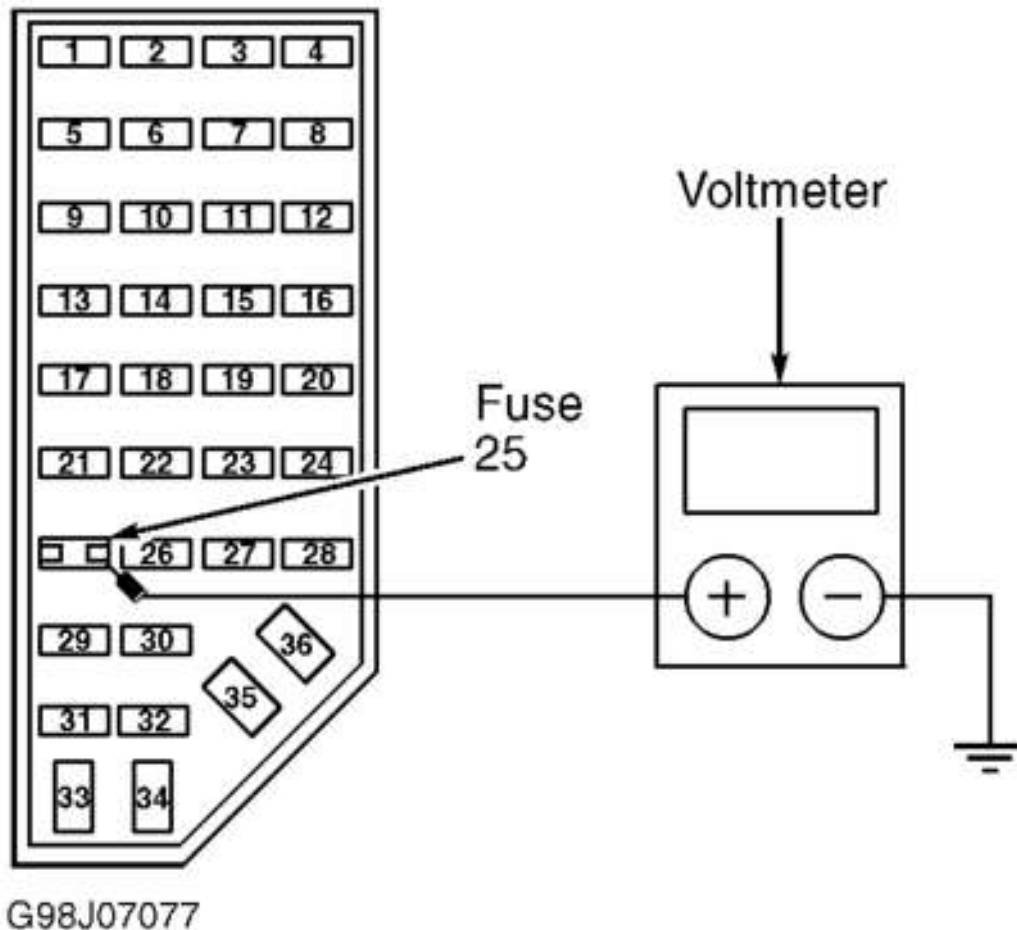


Fig. 10: Measure Voltage On Fuse No. 25
Courtesy of FORD MOTOR CO.

4. Check Voltage To GEM Circuit 1001 (White/Yellow Wire)

Turn ignition off. Disconnect GEM 18-pin connector. See **Fig. 1** . Measure voltage between ground and terminal No. 11 (White/Yellow wire) on GEM harness connector. See **Fig. 7** . If voltage is more than 10 volts, go to next step. If voltage is 10 volts or less, repair open White/Yellow wire. Clear DTC

and retest system.

5. Check Circuit 570 (Black/White Wire) For Open

Disconnect GEM 26-pin connector. Measure resistance of Black/White wire between ground and terminals No. 14 and 26 on GEM harness connector. If resistance is 5 ohms or greater, repair open Black/White wire. Clear DTC and retest system. If resistance is less than 5 ohms, go to next step.

6. Check Circuit 57 (Black Wire) For Open

Measure resistance of Black wire between ground and terminal No. 18 on GEM 18-pin harness connector. If resistance is less than 5 ohms, see appropriate MODULE COMMUNICATIONS NETWORK article in ACCESSORIES & EQUIPMENT. If resistance is 5 ohms or greater, repair open Black wire. Clear DTC and retest system.

REMOVAL & INSTALLATION

SHIFT SELECTOR SWITCH

Removal & Installation

1. Remove 2 screws from front of center instrument panel finish panel, and position panel aside. Disconnect shift select switch, cigar lighter, defogger, rear wiper and radio electrical connectors.
2. Remove center instrument panel trim panel. Remove shift selector knob. Remove 2 screws, and remove shift selector switch. To install, reverse removal procedure.