

Four- Wheel Drive Systems - Expedition & Navigator

DESCRIPTION AND OPERATION

FOUR-WHEEL DRIVE SYSTEMS

The automatic 4-wheel drive transfer case system consists of the following:

- Automatic 4WD indicator light
- Brake pedal position (BPP) switch
- Integrated wheel ends (IWE) solenoid
- Torque on demand (TOD) relay
- 4WD control module - integral to the powertrain control module (PCM)
- 4WD high indicator light
- 4WD low indicator light
- 4WD mode select switch (MSS)
- Shift position sensor
- Throttle position output (TPO) from the PCM
- Transmission range sensor
- Average front and rear wheel speed signals from the anti-lock brake system

Integrated Wheel End (IWE) System

The integrated wheel end (IWE) system contains the following:

- Vacuum reservoir
- IWE solenoid
- IWEs (spring loaded vacuum hubs)
- Vacuum hoses
- Check valve

The IWE system uses vacuum hubs that engage the front wheel hubs to the front halfshafts or disengage the front wheel hubs from the front halfshafts.

The IWE solenoid receives engine vacuum from the vacuum reservoir.

When the 4-wheel drive system is in 2WD mode, the 4x4 module (PCM) supplies a ground path to the IWE solenoid to apply vacuum to the integrated wheel ends (disengaging the front hubs from the front halfshafts). In 4WD mode, the 4x4 module (PCM) does not supply the ground path to the IWE solenoid, vacuum is not applied to the integrated wheel ends and an internal spring keeps the front hubs engaged to the front halfshafts

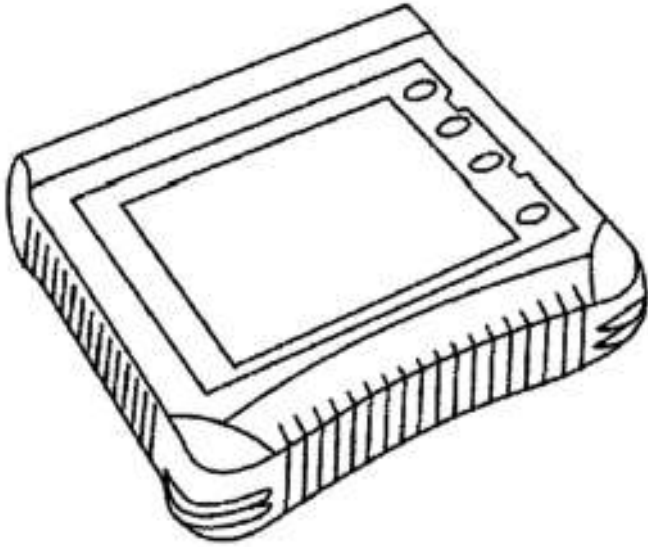
DIAGNOSIS AND TESTING

FOUR-WHEEL DRIVE SYSTEMS

Refer to **TRANSMISSION** (Expedition) or **TRANSMISSION** (Navigator) for schematic and connector information.

Special Tool(s)

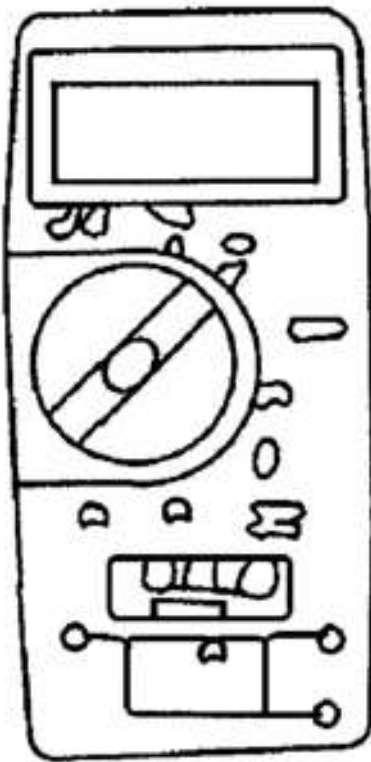
SPECIAL TOOLS DESCRIPTION



ST2332-A

Worldwide Diagnostic System (WDS)
Vehicle Communication Module (VCM)
with appropriate adapters, or equivalent
diagnostic tool

73III Automotive Meter 105-R0057 or
equivalent



ST1137-A

88 Digital Multimeter or equivalent 105-R0053





ST2735-A

Flex Probe Kit 105-R025B

Principles of Operation

The automatic four-wheel drive (A4WD) system is an electronic-shift 4WD system that allows the operator to choose between 2WD and three different 4WD modes. The operator can switch between A4WD and 4WD HIGH modes at any speed. To engage or disengage 4WD LOW range, the vehicle speed must be less than 3 km/h (2 mph), the brake pedal must be pressed and the transmission must be in NEUTRAL.

Wheel slip is sensed using one axle shaft speed sensor on each axle. Based on throttle position and wheel slip, a pulse width modulated (PWM) signal is transmitted to the transfer case clutch when a predetermined slip-threshold is exceeded.

The 4WD control module (PCM) will provide the IVD brake system with current clutch duty cycle and whether or not IVD may command the clutch duty cycle.

The brake subsystem sends the following information signals to the 4WD system:

- Occurrences of brake events and failures. For additional information, refer to **ANTI-LOCK CONTROL** .
- Steering wheel angle status. For additional information, refer to **ANTI-LOCK CONTROL** .
- Average rear wheel speed. For additional information, **ANTI-LOCK CONTROL** .
- Average front wheel speed. For additional information, **ANTI-LOCK CONTROL** .
- Delta front wheel speeds. For additional information, refer to **ANTI-LOCK CONTROL** .

A concern with any of the above listed brake system signals will affect operation of the 4WD system.

The throttle position output signal is provided to the 4WD control module from the powertrain control module (PCM). This signal is used by the 4WD control module in controlling the 4WD clutch.

The shift motor sense plate, an integral part of the gearmotor encoder assembly, informs the 4WD control module of the transfer case position.

The digital transmission range (TR) sensor is located on the LH side of the transmission. This sensor informs the 4WD control module when the transmission is in NEUTRAL.

The electric shift motor is mounted externally to the gearmotor encoder assembly at the rear of the transfer case. It drives a rotary cam which moves the mode fork and range fork within the transfer case between the HIGH range (A4WD, 4WD HIGH) and 4WD LOW range positions.

The 4WD shift motor is controlled by the 4WD control module which shifts the transfer case shift motor between HIGH range (A4WD, 4WD HIGH) and 4WD LOW modes.

The solid-state clutch is duty-cycled by the 4WD control module to activate the 4WD clutch within the transfer case.

In the A4WD system, the 4WD control module varies the torque sent to the front driveline by controlling the transfer case clutch. At rest and under cruising conditions, the 4WD control module activates the transfer case clutch a minimum duty cycle (percentage of time the clutch is turned on), which allows for the slight difference between the front and rear driveshafts which normally occurs when negotiating a corner on dry pavement. Under any of the following conditions, the 4WD control module will increase the duty cycle in order to prevent or control slip:

- Slip is detected
- Heavy acceleration (throttle position)

Feature inputs:

- Brake ON/OFF switch
- Mode select switch (MSS)
- Wheel speed signal (transmitted from the ABS module)
- Throttle position information (transmitted from the PCM)
- Gearmotor encoder contact plate position inputs A, B, C, D

Feature outputs:

- Solid state clutch (pulse width modulated signal)
- 4WD LOW indicator
- 4WD shift motor outputs

Shifts between A4WD and 4WD HIGH can be made at any speed. Listed below are the inputs and outputs needed by the 4WD control module to execute a change between any of these modes.

Feature inputs:

- Wheel speed signal

- Throttle position information
- 4WD Mode Select Switch (MSS)

Feature outputs:

- 4WD shift motor outputs
- Solid state clutch (pulse width modulated signal)
- 4WD HIGH switch indicator

When shifting into or out of LOW range, the 4WD control module requires that the vehicle speed is less than 3 km/h (2 mph), the brake is applied, and the transmission is in NEUTRAL.

Feature inputs:

- Throttle position information (transmitted from PCM)
- MSS
- Gearmotor encoder contact plate position inputs A, B, C, D
- Wheel speed signal (transmitted from ABS module)
- Brake ON/OFF (BOO) switch input (battery voltage when brake pedal is depressed, open circuit when not activated)

Feature outputs:

- 4WD shift motor outputs
- 4WD LOW switch indicator
- Solid state clutch (pulse width modulated signal)

Inspection and Verification - Electronic On-Demand

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

VISUAL INSPECTION CHART

Mechanical	Electrical
<ul style="list-style-type: none"> • Halfshafts • Integrated wheel ends (IWE) • Shift motor • Driveshaft and universal joints • Vacuum leaks • Fluid leaks • Matching tire sizes • Transfer case 	<ul style="list-style-type: none"> • Central junction box (CJB) mini fuses: <ul style="list-style-type: none"> ○ (10A) (IWE vacuum solenoid) ○ (25A) • Central junction box (CJB) fuse 115 (30A) • Wiring harness • Mode select switch (MSS) • Synchronization clutch • Connector(s) • IWE vacuum solenoid • Circuitry

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, connect the diagnostic tool to the data link connector and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed (if using NGS+).
 - check the connections to the vehicle.
 - check the ignition switch position.
5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.
6. Carry out the data link diagnostics test. If the diagnostic tool responds with:
 - SCP+, SCP-, UBP or CAN or ISO circuits fault; all electronic control units no response/not equipped, refer to **MODULE COMMUNICATIONS NETWORK** .
 - No response/not equipped for powertrain control module (PCM). Refer to **MODULE COMMUNICATIONS NETWORK** to diagnose module communication problems.
 - No response/not equipped for 4x4 module (PCM), GO to **PINPOINT TEST A.**
 - System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out the self test diagnostics for the 4x4 module (PCM).
7. If the DTCs retrieved are related to the concern, go to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** to continue diagnostics.
8. If no DTCs related to the concern are retrieved, GO to **SYMPTOM CHART.**

4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index

4X4 MODULE (PCM) DIAGNOSTIC TROUBLE CODE (DTC) INDEX

DTC	Description	Source	Action
B1317	Battery Voltage High	4x4 Module (PCM)	CHECK the battery and charging system for faults. REFER to <u>CHARGING SYSTEM - GENERAL INFORMATION</u> . CLEAR the DTC. REPEAT the self test.
B1318	Battery Voltage Low	4x4 Module (PCM)	CHECK the battery and charging system for faults. REFER to <u>CHARGING SYSTEM - GENERAL INFORMATION</u> . CLEAR the DTC. REPEAT the self test.
B1342	ECU is Defective	4x4 Module (PCM)	CLEAR the DTC. REPEAT the self test. If DTC B1342 is retrieved, INSTALL a 4x4 module (integral to PCM). For 4.6L engine, REFER to <u>ELECTRONIC ENGINE CONTROLS</u> . REPEAT the self test.
C1728	Transfer Case Unable to Transition Between 2WD HIGH and 4WD HIGH	4x4 Module (PCM)	GO to <u>PINPOINT TEST C.</u>
C1729	Transfer Case Unable to Transition Between 4WD HIGH and 4WD LOW	4x4 Module (PCM)	GO to <u>PINPOINT TEST D.</u>
C1979	IWE Solenoid Circuit Failure	4x4 Module (PCM)	GO to <u>PINPOINT TEST B.</u>

C1980	IWE Solenoid Circuit Short to Battery	4x4 Module (PCM)	Go to <u>PINPOINT TEST B.</u>
P1812	Transmission 4-Wheel Drive Mode Select Circuit Failure	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1815	Transmission 4-Wheel Drive Mode Select Short Circuit to Ground	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1820	Transfer Case Clockwise Shift Relay Coil Circuit Failure	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1822	Transfer Case Clockwise Shift Relay Coil Short Circuit To Battery	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1824	Transmission 4-Wheel Drive Clutch Relay Circuit Failure	4x4 Module (PCM)	GO to <u>PINPOINT TEST E.</u>
P1826	Transmission 4-Wheel Drive Low Clutch Relay Short Circuit to Battery	4x4 Module (PCM)	Go to <u>PINPOINT TEST E.</u>
P1827	Transmission 4-Wheel Drive Low Clutch Relay Short Circuit to Ground	4x4 Module (PCM)	Go to <u>PINPOINT TEST E.</u>
P1828	Transfer Case Counterclockwise Shift Relay Coil Circuit Failure	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1830	Transfer Case Counterclockwise Shift Relay Coil Short Circuit To Battery	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1849	Transmission Transfer Case Contact Plate A Short Circuit to Ground	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1853	Transmission Transfer Case Contact Plate B Short Circuit to Ground	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1857	Transmission Transfer Case Contact Plate C Short Circuit to Ground	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1861	Transmission Transfer Case Contact Plate D Short Circuit to Ground	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1867	Transmission Transfer Case Contact Plate General Circuit Failure	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>
P1891	Transmission Transfer Case Contact Plate Ground Return Open Circuit	4x4 Module (PCM)	Go to <u>PINPOINT TEST C.</u>

U1900	CAN Communication BUS Fault - Received Error	4x4 Module (PCM)	DIAGNOSE the module communication network. REFER to <u>MODULE COMMUNICATIONS NETWORK</u> .
U2023	Fault Received From External Node	4x4 Module (PCM)	DIAGNOSE the module communication network. REFER to <u>MODULE COMMUNICATIONS NETWORK</u> .
U2050	Application Not Programmed	4x4 Module (PCM)	Method 3 programming fault. REFER to <u>MODULE CONFIGURATION</u> for 4x4 module (PCM) programming information.

Symptom Chart

Symptom Chart

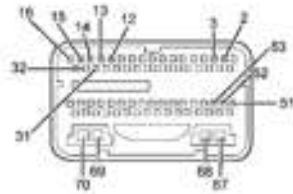
SYMPTOM CHART

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the 4x4 module (PCM) 	<ul style="list-style-type: none"> Diagnostic tool. Data link connector (DLC). 4x4 module (PCM). Circuitry. 	<ul style="list-style-type: none"> Go to <u>PINPOINT TEST A.</u>
<ul style="list-style-type: none"> The instrument cluster 4L and 4H indicators do not operate correctly/do not operate/flash 	<ul style="list-style-type: none"> Instrument cluster. Circuitry. 4x4 module (PCM). 	<ul style="list-style-type: none"> GO to <u>PINPOINT TEST I.</u>
<ul style="list-style-type: none"> The vehicle does not shift between 2WD and 4WD modes correctly 	<ul style="list-style-type: none"> Mode select switch (MSS). Transfer case. Transfer case clutch. Integrated wheel ends (IWEs). 4x4 module (PCM). Circuitry. 	<ul style="list-style-type: none"> Go to <u>PINPOINT TEST C.</u>
<ul style="list-style-type: none"> The vehicle does not shift between 4H and 4L modes correctly 	<ul style="list-style-type: none"> Transfer case. Mode select switch. 4x4 module (PCM). Transmission drag torque. 	<ul style="list-style-type: none"> Go to <u>PINPOINT TEST D.</u>
	<ul style="list-style-type: none"> Transfer case 	

<ul style="list-style-type: none"> • 4WD does not engage at speed correctly 	<ul style="list-style-type: none"> clutch coil. • 4x4 module (PCM). • Integrated wheel ends (IWEs). 	<ul style="list-style-type: none"> • Go to <u>PINPOINT TEST E.</u>
<ul style="list-style-type: none"> • The front axle does not engage/disengage correctly/makes noise in 2H under heavy throttle 	<ul style="list-style-type: none"> • Mode select switch. • Integrated wheel ends (IWE). • IWE solenoid. • Vacuum leaks. • 4x4 module (PCM). • Front halfshaft. 	<ul style="list-style-type: none"> • Go to <u>PINPOINT TEST B.</u>
<ul style="list-style-type: none"> • The 4x4 system jumps out of gear 	<ul style="list-style-type: none"> • Transfer case. • IWE vent. • Mode select switch (MSS). 	<ul style="list-style-type: none"> • GO to <u>PINPOINT TEST F.</u>
<ul style="list-style-type: none"> • Straightline driveline wind-up 	<ul style="list-style-type: none"> • Tire inflation pressure. • Tire and wheel size. • Tire wear. • Axle ratio. 	<ul style="list-style-type: none"> • GO to <u>PINPOINT TEST G.</u>
<ul style="list-style-type: none"> • Grinding noise during 4WD engagement, especially at high speeds 	<ul style="list-style-type: none"> • Front halfshaft speeds not turning at the same speed. 	<ul style="list-style-type: none"> • INSTALL the S-spring in the front differential. REFER to <u>FRONT DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR</u> for S-spring installation.
<ul style="list-style-type: none"> • Flashing 4x4 high and 4x4 low indicators 3 times every 2 minutes. 	<ul style="list-style-type: none"> • Loss of CAN communication between 4x4 module (PCM) and instrument cluster. • No communication with the 4x4 module (PCM). 	<ul style="list-style-type: none"> • CHECK the instrument cluster for faults. REFER to <u>INSTRUMENT CLUSTER</u> . • CHECK 4x4 module (PCM) communication. Go to <u>PINPOINT TEST A.</u>
	<ul style="list-style-type: none"> • Tire inflation pressure. • Tire and wheel size. 	<ul style="list-style-type: none"> • MAKE SURE that all tires and wheels are the same size and that the inflation pressures are correct. • CHECK tire tread wear to see if there is more than 0.15 mm (0.06 in) difference in

<ul style="list-style-type: none"> • The transfer case makes noise 	<ul style="list-style-type: none"> • Tire tread wear. • Internal components. • Fluid level. 	<p>tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again.</p> <ul style="list-style-type: none"> • OPERATE the vehicle in all transmission gears. If there is noise in the transmission in NEUTRAL, or in some gears and not in others, REMOVE and REPAIR the transmission. REFER to <u>AUTOMATIC TRANSMISSION - 4R70E/4R75E</u> . If there is noise in all gears, DISASSEMBLE the transfer case. REFER to <u>TRANSFER CASE - AUTOMATIC SHIFT</u> . CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new parts as necessary. • FILL with automatic transmission fluid. REFER to <u>TRANSFER CASE - AUTOMATIC SHIFT</u> .
<ul style="list-style-type: none"> • Unable to duplicate customer concern 	<ul style="list-style-type: none"> • 4x4 system and/or related components. 	<ul style="list-style-type: none"> • CARRY OUT the torque-on demand Functional Test. GO to <u>PINPOINT TEST H</u>.
<ul style="list-style-type: none"> • The vehicle does not shift between A4WD and 4H correctly 	<ul style="list-style-type: none"> • Mode selection switch (MSS). • Transfer case. • Circuitry. • 4x4 module (PCM). 	<ul style="list-style-type: none"> • Go to <u>PINPOINT TEST C</u>.
<ul style="list-style-type: none"> • Vehicle has no torque or inadequate torque at rear wheels in A4WD mode 	<ul style="list-style-type: none"> • Transfer case. • Circuitry. • 4x4 module (PCM). 	<ul style="list-style-type: none"> • Go to <u>PINPOINT TEST H</u>.
<ul style="list-style-type: none"> • Vehicle binds in a turn/resists turning/pulsates in a straight line in A4WD mode 	<ul style="list-style-type: none"> • Unmatched tire sizes. • Unequal amounts of tire wear. • Unequal tire inflation pressures. • Throttle pedal position failure. • Transfer case clutch. • Circuitry. • 4x4 module (PCM). 	<ul style="list-style-type: none"> • GO to <u>PINPOINT TEST J</u>.

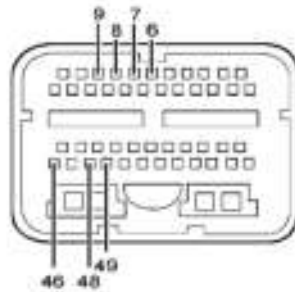
Connector Circuit Reference



4000008

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
2	CKT 1814 (WH/LB) CAN Bus communications circuit.	Less than 5 ohms between the DLC and the module in concern. Greater than 10,000 ohms between the DLC and ground with all network modules disconnected.
3	CKT 1815 (PK/LB) CAN Bus communications circuit.	Less than 5 ohms between the DLC and the module in concern. Greater than 10,000 ohms between the DLC and ground with all network modules disconnected.
12	CKT 1524 (DB) Power circuit to 4x4 module (PCM) for 4WD functionality.	Not at all times. 0 volts or greater between 4x4 module (PCM) and ground. 10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) disconnected.
13	CKT 1524 (DB) Power circuit to 4x4 module (PCM) for 4WD functionality.	Not at all times. 0 volts or greater between 4x4 module (PCM) and ground. 10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) disconnected.
14	CKT 923 (DN/YE) Transfer case shift motor clockwise rotation (low to high) relay control circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) disconnected. 5 ohms or less between the 4x4 module (PCM) and the clockwise rotation relay. 0 volts or greater between the 4x4 module (PCM) and ground with the clockwise relay connected.
15	CKT 926 (DK) Transfer case shift motor counterclockwise rotation (high to low) relay control circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) disconnected. 5 ohms or less between the 4x4 module (PCM) and the counterclockwise rotation relay. 0 volts or greater between the 4x4 module (PCM) and ground with the clockwise relay connected.
16	CKT 688 (RD) Drivetrain wheel end (IWE) solenoid control circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the IWE solenoid disconnected. 5 ohms or less between the 4x4 module (PCM) and IWE solenoid.
31	CKT 682 (DB/WH) 4WD Mode select switch (MSS) signal return circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and MSS disconnected. 5 ohms or less between the 4x4 module (PCM) and MSS.
32	CKT 790 (DB) 4WD Mode select switch (MSS) signal circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and MSS disconnected. 5 ohms or less between the 4x4 module (PCM) and MSS.
51	CKT 361 (RD) VPWR circuit.	Not in RUN/START. 0 volts or greater between 4x4 module (PCM) and ground. 10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) disconnected.
52	CKT 361 (RD) VPWR circuit.	Not in RUN/START. 0 volts or greater between 4x4 module (PCM) and ground. 10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) disconnected.
53	CKT 361 (RD) VPWR circuit.	Not in RUN/START. 0 volts or greater between 4x4 module (PCM) and ground. 10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) disconnected.
67	CKT 576a (BK/WH) 4x4 module (PCM) ground circuit.	5 ohms or less between the 4x4 module (PCM) and ground.
68	CKT 576b (BK/WH) 4x4 module (PCM) ground circuit.	5 ohms or less between the 4x4 module (PCM) and ground.
69	CKT 576c (BK/WH) 4x4 module (PCM) ground circuit.	5 ohms or less between the 4x4 module (PCM) and ground.
70	CKT 576d (BK/WH) 4x4 module (PCM) ground circuit.	5 ohms or less between the 4x4 module (PCM) and ground.

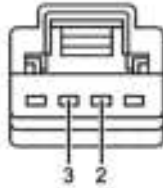
Fig. 1: Identifying 4X4 Module (PCM) C175B (Body)
 Courtesy of FORD MOTOR CO.



A0091922

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
6	CKT 771 (VT/YE) Transfer case shift motor position contact plate encoder signal position 1.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
7	CKT 770 (WH) Transfer case shift motor position contact plate encoder signal position 2.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
8	CKT 764 (BR/WH) Transfer case shift motor position contact plate encoder signal position 3.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
9	CKT 763 (OG/WH) Transfer case shift motor position contact plate encoder signal position 4.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
46	CKT 762 (YE/WH) Transfer case shift motor position contact plate encoder signal return.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
48	Not used.	—
49	CKT 779 (BN) Transfer case synchronization clutch power supply circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.

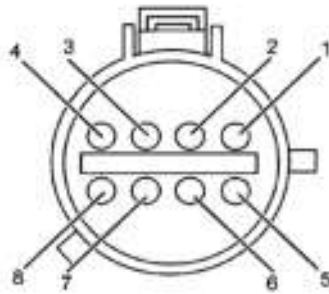
Fig. 2: Identifying 4X4 Module (PCM) C175T (Transmission)
 Courtesy of FORD MOTOR CO.



A0092312

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
2	CKT 682 (DB/W11) 4WD Mode select switch (MSS) signal return circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and MSS disconnected. 5 ohms or less between the 4x4 module (PCM) and MSS.
3	CKT 780 (DB) 4WD Mode select switch (MSS) signal circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and MSS disconnected. 5 ohms or less between the 4x4 module (PCM) and MSS.

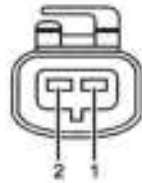
Fig. 3: Identifying Mode Select Switch (MSS) C284
 Courtesy of FORD MOTOR CO.



N0035001

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
1	CKT 770 (WH) Transfer case shift motor position contact plate encoder signal position 2.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
2	CKT 764 (BR/WH) Transfer case shift motor position contact plate encoder signal position 3.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
3	CKT 763 (OG/WH) Transfer case shift motor position contact plate encoder signal position 4.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
4	CKT 777 (YE) Transfer case shift motor counterclockwise rotation power supply circuit.	10,000 ohms or greater between the counterclockwise rotation relay and ground with the counterclockwise relay and transfer case disconnected. 5 ohms or less between the counterclockwise relay and the transfer case.
5	CKT 771 (PK/YE) Transfer case shift motor position contact plate encoder signal position 1.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
6	CKT 762 (WH/YE) Transfer case shift motor position contact plate encoder signal return.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.
7	CKT 763 (OG/WH) Transfer case shift motor clockwise rotation power supply circuit.	10,000 ohms or greater between the clockwise rotation relay and ground with the clockwise relay and transfer case disconnected. 5 ohms or less between the clockwise relay and the transfer case.
8	CKT 779 (BN) Transfer case synchronization clutch power supply circuit.	10,000 ohms or greater between the 4x4 module (PCM) and ground with the 4x4 module (PCM) and the transfer case disconnected. 5 ohms or less between the 4x4 module (PCM) and the transfer case.

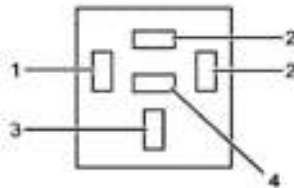
Fig. 4: Identifying Transfer Case C350
 Courtesy of FORD MOTOR CO.



N0036751

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
1	CKT 474 (OG/LG) IWE solenoid power supply circuit.	Hot at all times. 9 volts or greater between the IWE solenoid and ground. 10,000 ohms or greater between the IWE solenoid and ground with the IWE solenoid disconnected.
2	CKT 605 (RD) IWE solenoid control circuit.	10,000 ohms or greater between the IWE solenoid and ground with the IWE solenoid and the 4x4 module (PCM) disconnected. 5 ohms or less between the IWE solenoid and the 4x4 module (PCM).

Fig. 5: Identifying Integrated Wheel End (IWE) Solenoid C1157
 Courtesy of FORD MOTOR CO.



A0092313

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
1 (CW)	CKT 975 (BN/YE) Transfer case shift motor clockwise rotation relay control circuit.	10,000 ohms or greater between the clockwise relay and ground with the clockwise relay and the 4x4 module (PCM) disconnected. 5 ohms or less between the clockwise relay and the 4x4 module (PCM).
1 (CCW)	CKT 976 (OG) Transfer case shift motor counterclockwise rotation relay control circuit.	10,000 ohms or greater between the clockwise relay and ground with the clockwise relay and the 4x4 module (PCM) disconnected. 5 ohms or less between the clockwise relay and the 4x4 module (PCM).
2 (CW)	CKT 704d (DG/LG) Transfer case shift motor clockwise rotation relay power supply circuit.	Hot at all times. 9 volts or greater between the clockwise relay and ground.
2 (CCW)	CKT 704b (DG/LG) Transfer case shift motor counterclockwise rotation relay power supply circuit.	Hot at all times. 9 volts or greater between the clockwise relay and ground.
3 (CW)	CKT 778 (OG) Transfer case shift motor clockwise rotation power supply circuit.	10,000 ohms or greater between the clockwise rotation relay and ground with the clockwise relay and transfer case disconnected. 5 ohms or less between the clockwise relay and the transfer case.
3 (CCW)	CKT 777 (YE) Transfer case shift motor counterclockwise rotation power supply circuit.	10,000 ohms or greater between the clockwise rotation relay and ground with the clockwise relay and transfer case disconnected. 5 ohms or less between the clockwise relay and the transfer case.
4	CKT 57a/b (BK) Relay ground circuit.	5 ohms or less between connector pin and ground.

Fig. 6: Identifying Shift Motor Clockwise Rotation Relay/Shift Motor Counterclockwise Rotation

Relay

Courtesy of FORD MOTOR CO.

Pinpoint Tests

Pinpoint Test A: No Communication With the 4x4 Module (PCM)

Refer to TRANSMISSION (Expedition) or TRANSMISSION (Navigator) for schematic and connector information.

Normal Operation

In order for the 4x4 module (PCM) to communicate with the diagnostic tool, the operating voltage required to supply the 4x4 module (PCM) is in a range between 9 and 16 volts. Voltage is supplied by circuit 1524 (DB).

Possible Causes

- Power supply:
 - circuit 1524 (DB)
- Central distribution junction box (CJB) mini-fuse 30 (25A)
- Charging system.
- Battery.

Testing

CAUTION: Use the Flex Probe Kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

A1 CHECK FOR DIAGNOSTIC TOOL COMMUNICATION WITH THE VEHICLE

- Verify diagnostic tool communication with the vehicle.
 - If using the using WDS, follow the directions and carry out the network test.
 - If using NGS, verify that the correct cable is used and the vehicle and engine selection information is correct.
- **WDS: Does the network test pass for the PCM?**

NGS: Does the diagnostic tool communicate with the PCM?

Yes : GO to A2.

No : REFER to the appropriate diagnostic tool manual for further diagnosis.

A2 CHECK FOR VOLTAGE INPUT TO THE 4x4 MODULE (PCM)

- Disconnect: 4x4 Module (PCM) C175b.
- Measure the voltage between C175b-12, circuit 1524 (DB), harness side and ground; and between C175b-13, circuit 1524 (DB) and ground.
- **Are the voltages greater than 9 volts?**

Yes : GO to A6.

No : GO to A3.

A3 CHECK THE POWER DISTRIBUTION JUNCTION BOX (PDJB) MINI-FUSES

- Check PDJB mini-fuse 30 (25A).
- **Is the fuse OK?**

Yes : GO to A4.

No : CHECK circuit 1524 (DB). REPAIR as necessary. REPEAT the self test.

A4 CHECK FOR BATTERY VOLTAGE FROM THE CENTRAL JUNCTION BOX (CJB)

- Key in ON position.
- Measure the voltage between CJB input side fuse cavity 30 and ground.
- **Is the voltage greater than 9 volts?**

Yes : REPAIR or INSTALL new components as necessary. REPEAT the self test.

No : GO to A5.

A5 CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING

- Start the engine. Measure the battery voltage at the positive battery terminal.
- **Is the voltage greater than 9 volts?**

Yes : REPAIR circuit 1524 (DB). REPEAT the self test.

No : CHECK the charging system. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** .

A6 CHECK THE GROUND CIRCUITS FOR AN OPEN

- Disconnect the battery ground cable. Refer to **BATTERY, MOUNTING AND CABLES** .
- Disconnect: 4x4 Module (PCM) C175b.
- Measure the resistance between C175b-66, circuit 567 (LB/YE) and ground; and between C175b-67, circuits 570a C175b-68, circuit 570b C175b-69, circuits 570c C175b-70 circuit 570d, (BK/WH) and ground.
- **Are the resistances less than 5 ohms?**

Yes : GO to A7.

No : REPAIR the affected circuit(s). REPEAT the self test.

A7 CHECK THE VOLTAGE ON GROUND CIRCUITS

- Measure the voltage between C175b-66, circuit 567 (LB/YE) and ground; and between C175b-67, circuit 570a, C175b-68, circuit 570b, C175b-69, circuit 570c, C175b-70, circuit 570d and ground.
- **Is voltage greater than 9 volts?**

Yes : REPAIR the affected circuit(s). REPEAT the self test.

No : DISCONNECT all 4x4 module (PCM) connectors. CHECK for corrosion, and/or pushed-out pins. The condition may have been caused by a loose or corroded connector. REPAIR or CLEAN as necessary. If not, INSTALL a new 4x4 module (integral to the PCM). REFER to **ELECTRONIC ENGINE CONTROLS** . TEST the system for normal operation.

Pinpoint Test B: The Front Axle Does Not Engage/Disengage Correctly/Makes Noise In 2H Under Heavy Throttle

Normal Operation

In 2WD, the 4x4 module (PCM) supplies a ground path to the IWE solenoid to apply vacuum to the integrated wheel ends (disengaging the front hubs from the front axle). In 4WD, the 4x4 module (PCM) does not supply the ground path to the IWE solenoid, vacuum is not applied to the integrated wheel ends and

an internal spring keeps the hubs engaged. Systematically check the necessary inputs and outputs at the 4x4 module (PCM), internal components of the transfer case, mode select switch, IWE components and drive axles.

Possible Causes

- Mode select switch
- Integrated wheel end (IWE)
- IWE solenoid
- Transfer case
- Vacuum leaks
- Front axle assembly
- 4x4 module (PCM)
- Circuit 605 (RD)
- Circuit 474 (OG/LG)
- CJB fuse 11 (10A)

Testing

B1 CHECK FOR DTCs

- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- Carry out the on-demand self test.
- **Are DTCs C1979 or C1980 present?**
Yes : If DTC C1979 is retrieved, GO to B13.

If DTC C1980 is retrieved, GO to B15.

No : GO to B2.

B2 CHECK FOR GRINDING NOISES AT HIGH SPEEDS

- Turn the MSS from 2WD to 4WD at rest. Drive the vehicle.
- Turn the MSS from 2WD to 4WD while driving the vehicle at low speed.
- Turn the MSS from 2WD to 4WD while driving the vehicle at high speed.
- **Is the axle system fully functional at rest, but there is a grinding noise during engagement, especially at high speed?**

Yes : If the concern is excessive front axle noise during 4WD engagement (especially at high speeds), INSTALL the S-spring in the front differential. REFER to **FRONT DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR** .

No : GO to B3.

B3 CHECK THE TRANSFER CASE SHIFT TO 2H

- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.

NOTE: If it is difficult to read the motor position, use the active command to energize the transfer case motor contact plate position return circuit.

- Monitor the 4x4 module (PCM) PID for the contact plate position while switching the MSS to 2H.

MODE SELECT SWITCH POSITION REFERENCE

Mode Select Switch Position	Contact Plate Position			
	1 (A)	2 (B)	3 (C)	4 (D)
2H/A4WD	CLOSED	OPEN	CLOSED	CLOSED
4H	OPEN	CLOSED	CLOSED	OPEN
4L	OPEN	CLOSED	OPEN	CLOSED

- Does the 4x4 module (PCM) PID and instrument cluster indicator lamp indicate that vehicle shifted into 2H?

Yes : GO to B4.

No : Go to PINPOINT TEST C.

B4 CHECK THE IWE DISENGAGEMENT

- Raise and support the vehicle off the ground until the front wheels can be spun freely. Refer to JACKING & LIFTING.

NOTE: The engine must be idling during the following steps to supply vacuum to the IWE solenoid.

- Start the engine and allow to idle.
- Switch the MSS to 2H.
- Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft.
- Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft.
- **Did either front halfshaft rotate?**

Yes : GO to B10.

No : GO to B5.

B5 CHECK THE TRANSFER CASE SHIFT INTO 4H

NOTE: If it is difficult to read the motor position, use the active command to energize the transfer case motor contact plate position return circuit.

- Monitor the 4x4 module (PCM) PID for the contact plate position while switching the MSS to 4H.

MODE SELECT SWITCH POSITION REFERENCE

Mode Select Switch Position	Contact Plate Position			
	1 (A)	2 (B)	3 (C)	4 (D)

2H/A4WD	CLOSED	OPEN	CLOSED	CLOSED
4H	OPEN	CLOSED	CLOSED	OPEN
4L	OPEN	CLOSED	OPEN	CLOSED

- Does the 4x4 module (PCM) PID and instrument cluster indicator lamp indicate that the MSS in 4H?

Yes : GO to B6.

No : Go to PINPOINT TEST C.

B6 CHECK THE IWE ENGAGEMENT

- Raise and support the vehicle off the ground until the front wheels can be spun freely. Refer to JACKING & LIFTING.

NOTE: The engine must be idling during the following steps to supply vacuum to the IWE solenoid.

- Start the engine and allow to idle.
- Switch the MSS to 4H.
- Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft.
- Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft.
- **Did both front halfshafts rotate?**

Yes : CHECK that all driveline fasteners are present and tightened to specification. REFER to DRIVELINE SYSTEM-GENERAL INFORMATION for further diagnosis of the front axle.

No : GO to B7.

B7 CHECK THE IWE SOLENOID OUTPUT IN 4H

NOTE: The engine must be idling during the following steps to supply vacuum to the IWE solenoid.

- Start the engine.
- Disconnect the output vacuum line at the IWE solenoid.
- Switch the MSS to 4H.
- Measure the vacuum at the output port of the IWE solenoid.
- **Is the vacuum less than 25 mm (1 in) Hg?**

Yes : Key in OFF position. GO to B25.

No : GO to B8.

B8 CHECK THE IWE SOLENOID OUTPUT IN 4H WITH THE DIAGNOSTIC TOOL

- Key in OFF position.
- Connect the diagnostic tool.

NOTE: The engine must be idling during the following steps to supply vacuum to the IWE solenoid.

- Start the engine.
- Enter the following diagnostic mode on the diagnostic tool: Active Command.
- Using the diagnostic tool, command the IWE solenoid to engage the IWEs (solenoid OFF).
- Measure the vacuum at the output port of the IWE solenoid.
- **Is the vacuum less than 25 mm (1 in) Hg?**
Yes : End active command. GO to B19.
No : GO to B9.

B9 CHECK THE IWE SOLENOID

- Disconnect: IWE Solenoid C1157.
- Measure the vacuum at the output port of the IWE solenoid.
- **Is the vacuum less than 25 mm (1 in) Hg?**
Yes : End active command. GO to B17.
No : End active command. INSTALL a new IWE solenoid. REPEAT the self test.

B10 CHECK THE IWE SOLENOID OUTPUT VACUUM IN 2WD

NOTE: **The engine must be idling during the following steps to supply vacuum to the IWE solenoid.**

- Start the engine.
- Disconnect the output vacuum line at the IWE solenoid.
- Switch the MSS to 2H.
- Measure the vacuum at the output port of the IWE solenoid.
- **Is the vacuum greater than 254 mm (10 in) Hg?**
Yes : GO to B20.
No : GO to B11.

B11 CHECK THE IWE SOLENOID INPUT VACUUM

- Measure the vacuum at the input port of the IWE solenoid.
- **Is the vacuum greater than 254 mm (10 in) Hg?**
Yes : GO to B12.
No : REPAIR the vacuum leak. CLEAR the DTCs. REPEAT the self test.

B12 CHECK THE IWE SOLENOID OUTPUT IN 2WD WITH THE DIAGNOSTIC TOOL

- Key in OFF position.
- Connect the diagnostic tool.

NOTE: **The engine must be idling during the following steps to supply vacuum to the IWE solenoid.**

- Start the engine.
- Enter the following diagnostic mode on the diagnostic tool: Active Command.
- Using the diagnostic tool, command the IWE solenoid to disengage the IWEs (IWE solenoid ON).
- Measure the vacuum at the output port of the IWE solenoid.

- Is the vacuum greater than 254 mm (10 in) Hg?

Yes : End active command. GO to B19.

No : End active command. GO to B13.

B13 CHECK CIRCUIT 474 (OG/LG) FOR VOLTAGE

- Key in OFF position.
- Disconnect: IWE Solenoid C1157.
- Measure the voltage between IWE solenoid C1157-1, circuit 474 (OG/LG) and ground.

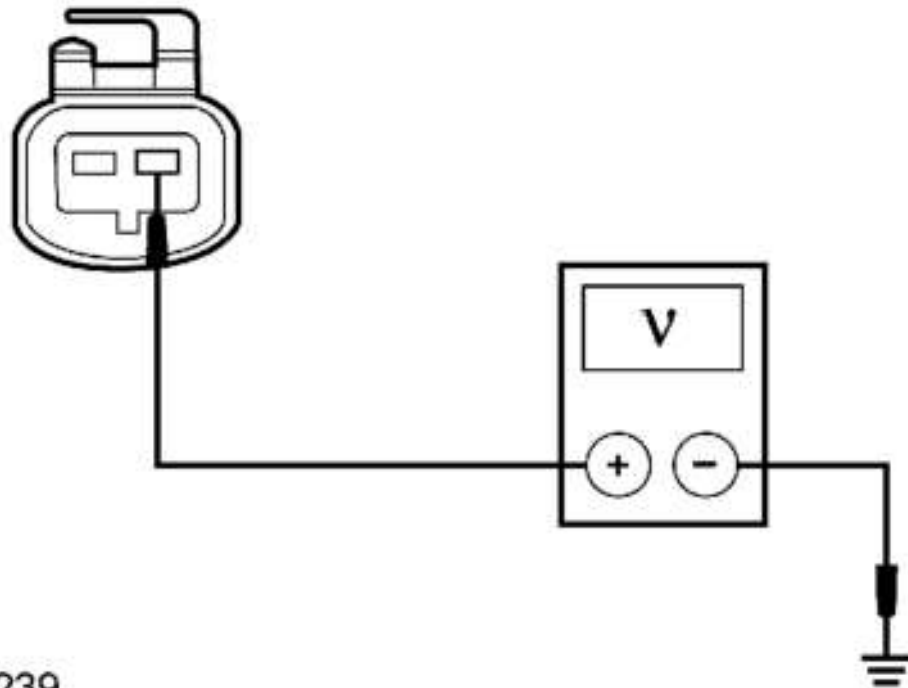


Fig. 7: Measuring Voltage Between IWE Solenoid C1157-1, Circuit 474 (OG/LG) And Ground

Courtesy of FORD MOTOR CO.

- Is the voltage greater than 9 volts?

Yes : GO to B14.

No : CHECK CJB fuse 11 (10A) for an open. VERIFY that the fuse blows when the air conditioning (A/C) system compressor cycles. If this occurs, REFER to **CLIMATE CONTROL SYSTEM-GENERAL INFORMATION** . REPAIR the circuit as necessary. CLEAR the DTCs. REPEAT the self test.

B14 CHECK THE IWE SOLENOID OPERATION

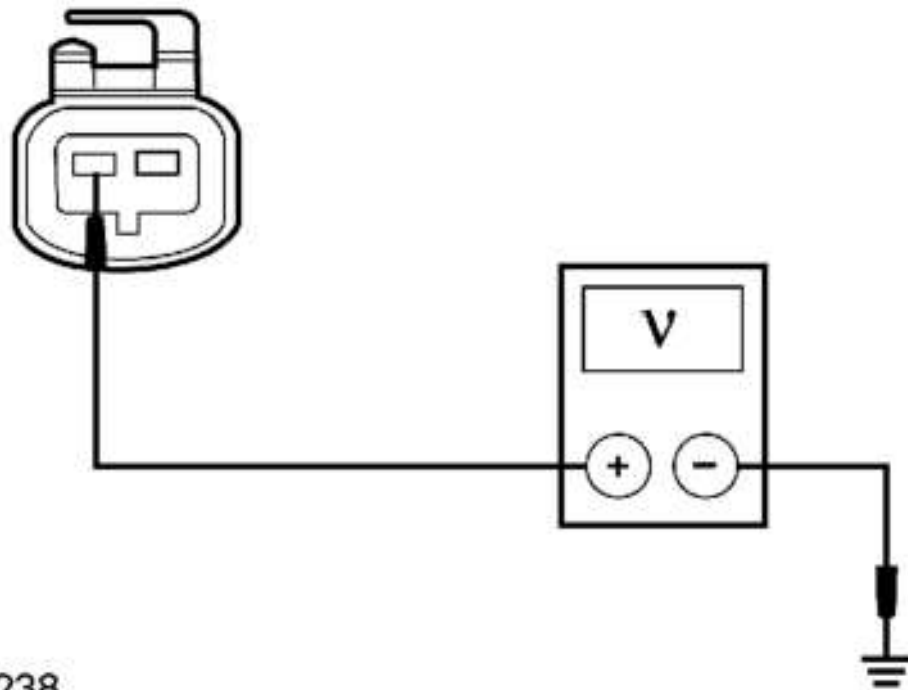
- Connect: IWE Solenoid C1157.

NOTE: The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage.

- Start the engine.
- Connect a 10 amp fused jumper wire between the IWE solenoid C1157-1, circuit 605 (RD), component side and ground.
- Measure the vacuum at the IWE solenoid output vacuum port.
- **Is the IWE solenoid output port vacuum greater than 254 mm (10 in) Hg?**
Yes : DISCONNECT the fused jumper. GO to B15.
No : INSTALL a new IWE solenoid. CLEAR the DTCs. REPEAT the self test.

B15 CHECK CIRCUIT 605 (RD) FOR A SHORT TO VOLTAGE

- Key in OFF position.
- Disconnect: IWE Solenoid C1157.
- Disconnect: 4x4 Module (PCM) C175b.
- Key in ON position.
- Measure the voltage between IWE solenoid C1157-2, circuit 605 (RD), harness side and ground.



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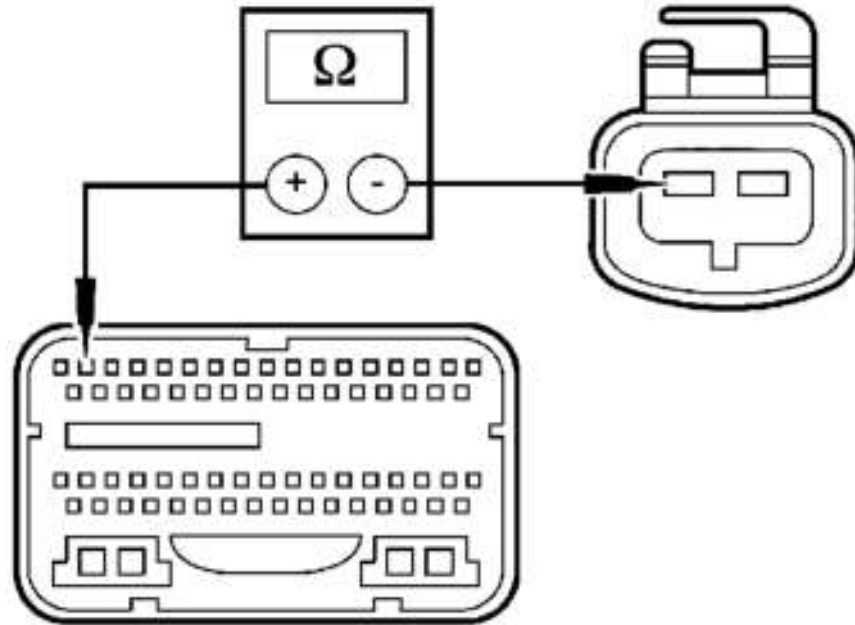
Fig. 8: Measuring Voltage Between IWE Solenoid C1157-2, Circuit 605 (RD), Harness Side And Ground

Courtesy of FORD MOTOR CO.

- **Is voltage present?**
Yes : REPAIR the circuit. CLEAR the DTCs. REPEAT the self test.
No : GO to B16.

B16 CHECK CIRCUIT 605 (RD) FOR AN OPEN

- Key in OFF position.
- Measure the resistance between IWE solenoid C1157-2, circuit 605 (RD), harness side and 4x4 module (PCM) C175b-16, circuit 605 (RD), harness side.



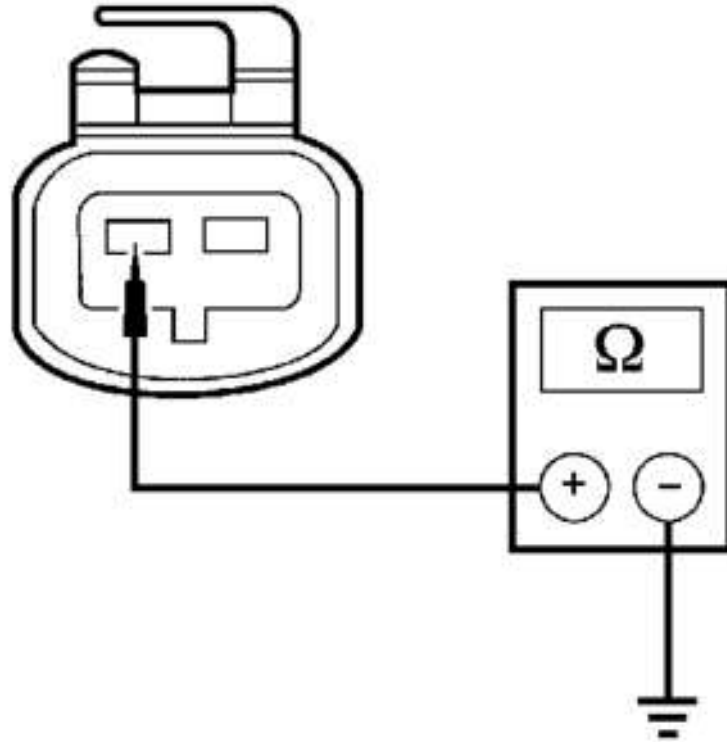
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Fig. 9: Measuring Resistance Between IWE Solenoid C1157-2, Circuit 605 (RD) And 4X4 Module (PCM) C175B-16, Circuit 605 (RD), Harness Side
 Courtesy of FORD MOTOR CO.

- **Is the resistance less than 5 ohms?**
 Yes : GO to B17.
 No : REPAIR the circuit. CLEAR the DTCs. REPEAT the self test.

B17 CHECK CIRCUIT 605 (RD) FOR A SHORT TO GROUND

- Key in OFF position.
- Disconnect: 4x4 Module (PCM) C175b.
- Measure the resistance between IWE solenoid C1157-2, circuit 605 (RD), harness side and ground.



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Fig. 10: Measuring Resistance Between IWE Solenoid C1157-2, Circuit 605 (RD), Harness Side And Ground
 Courtesy of FORD MOTOR CO.

- Is the resistance greater than 10,000 ohms?

Yes : GO to B18.

No : REPAIR the circuit. CLEAR the DTCs. REPEAT the self test.

B18 CHECK THE IWE SOLENOID RESISTANCE

- Measure the resistance between IWE solenoid C1157-1 and C1157-2 component side.

Is the resistance between 68 and 78 ohms?

Yes : GO to B19

No : INSTALL a new IWE solenoid. CLEAR the DTCs. REPEAT the self-test.

B19 CHECK THE 4x4 MODULE

- Disconnect all 4x4 module (PCM) connectors.
- Check for:
 - corrosion
 - pushed-out pins
- Connect all 4x4 module (PCM) connectors and make sure they are seated correctly.
- Operate the system and verify the concern is still present.

- **Is the concern still present?**

Yes : INSTALL a new 4x4 module (integral to PCM). REFER to **FUEL CHARGING & CONTROLS** . CLEAR the DTCs. REPEAT the self test.

No : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self test.

B20 CHECK THE IWE VACUUM SYSTEM

- Key in OFF position.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE system through the apply vacuum circuit.
- Observe the vacuum reading.
- **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**

Yes : GO to B20.

No : CONNECT the vacuum lines to the IWE solenoid. GO to B24.

B21 CHECK THE RH IWE LEAK RATE

- Raise and support the vehicle on a hoist. Refer to **JACKING & LIFTING** .
- Disconnect the vacuum line from the larger port on the RH IWE.
- Apply 508 mm (20 in) Hg of vacuum to the RH IWE port and observe vacuum reading.
- **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**

Yes : INSTALL a new IWE. REFER to **SUSPENSION SYSTEM-GENERAL INFORMATION** . GO to B20.

No : GO to B21.

B22 CHECK THE LH IWE LEAK RATE

- Disconnect the vacuum line from the larger port at the LH IWE.
- Apply 205 mm (20 in) Hg of vacuum to the LH IWE port and observe vacuum reading.
- **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**

Yes : INSTALL a new IWE. REFER to **SUSPENSION SYSTEM-GENERAL INFORMATION** . GO to B20.

No : GO to B22.

B23 CHECK THE IWE VACUUM SUPPLY TUBE

- Disconnect both vacuum lines from the IWE solenoid.
- Plug both LH and RH IWE vacuum lines. Apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit and observe the vacuum reading.
- **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**

Yes : INSTALL new vacuum lines as necessary. GO to B20.

No : GO to B23.

B24 CHECK THE IWE VACUUM SUPPLY AT EACH IWE IN 2H

- Connect a hand-held vacuum gauge to the LH IWE vacuum supply tube.

NOTE: **The engine must be idling during the following steps to supply the vacuum required for the IWEs to engage and disengage.**

- Start the engine.

- Switch the MSS to 2H while observing the vacuum gauge.
- Repeat these steps for the RH IWE.
- **Are the vacuum readings greater than 254 mm (10 in) Hg?**

Yes : GO to B27.

No : INSTALL new vacuum lines as necessary. GO to B20.

B25 CHECK THE LH IWE VACUUM LINE FOR AN OBSTRUCTION

- Disconnect both vacuum lines from the IWE solenoid.
- Raise and support the vehicle on a hoist. Refer to **JACKING & LIFTING** .
- Disconnect the vacuum line at the LH IWE.
- Connect a hand vacuum pump to the LH IWE vacuum line and attempt to draw a vacuum on the line.

- **Did the vacuum pump draw a vacuum on the LH IWE vacuum line?**

Yes : INSTALL a new vacuum line. CLEAR the DTCs. REPEAT the self test.

No : CONNECT the vacuum line to the LH IWE. GO to B25.

B26 CHECK THE RH IWE VACUUM LINE FOR AN OBSTRUCTION

- Disconnect the larger vacuum line at the RH IWE.
- Connect a vacuum pump to the RH IWE vacuum line and attempt to draw a vacuum on the line.

- **Did the vacuum pump draw a vacuum on the RH IWE vacuum line?**

Yes : INSTALL a new vacuum line. CLEAR the DTCs. REPEAT the self test.

No : CONNECT the vacuum line to the RH IWE. GO to B26.

B27 CHECK THE LH IWE OPERATION

- Raise and support the vehicle on a hoist. Refer to **JACKING & LIFTING** .
- Connect a vacuum pump to the larger IWE vacuum port.
- Observe the LH halfshaft while rotating the LH front tire. Apply and release vacuum to manually engage and disengage the LH IWE.

- **Did the LH IWE disengage between 152 and 203 mm (6 to 8 in) Hg?**

Yes : GO to B27.

No : INSTALL a new LH IWE. CLEAR the DTCs. REPEAT the self test.

B28 CHECK THE RH IWE OPERATION

- Connect a vacuum pump to the larger RH IWE vacuum port.
- Observe the RH halfshaft while rotating the RH front tire. Apply and release vacuum to manually engage and disengage the LH IWE.

- **Did the RH IWE disengage between 152 and 203 mm (6 to 8 in) Hg?**

Yes : CLEAR the DTC(s). REPEAT the self test. Go to **PINPOINT TEST H**.

No : INSTALL a new RH IWE. CLEAR the DTCs. REPEAT the self test.

Pinpoint Test C: The Vehicle Does Not Shift Between 2WD And 4WD Modes Correctly

Normal Operation

The mode select switch communicates the operator's choice to the 4x4 module (PCM). The 4x4 module (PCM) then controls the transfer case clutch, transfer case motor and integrated wheel ends (IWEs) as necessary. If the vehicle is not responding to the operator's intentions, systematically check the necessary

inputs and outputs of the 4x4 module (PCM), components of the transfer case, IWE components and half shafts. Check all circuits for opens and shorts to power or ground.

Possible Causes

- Transfer case
- Integrated wheel ends (IWE)
- IWE solenoid
- 4x4 module (PCM)
- Front axle assembly
- CJB fuse 115 (30A)
- Circuit 682 (DB/WH)
- Circuit 780 (DB)
- Circuit 704 (DG/LG)
- Mode select switch (MSS)

PINPOINT TEST C: THE VEHICLE DOES NOT SHIFT BETWEEN 2WD AND 4WD MODES CORRECTLY

C1 CHECK FOR DTCs

- Connect the diagnostic tool.
- Carry out the 4x4 module (PCM) on-demand self test.
- **Are DTCs retrieved?**

Yes : If DTC P1812, GO to C3. If DTC P1815, GO to C7. DTC P1867 or P1891, GO to C15. If DTC P1849, P1853, P1857, or P1861, GO to C17. If DTC P1820 or P1828, GO to C20. If DTC P1822 or P1830, GO to C28.

No : GO to C2.

C2 CHECK THE IGNITION SWITCH STATUS PID

- Key in ON position.
- Monitor the ignition switch status PID.
- **Do the ignition switch PIDs match the ignition switch positions?**

Yes : GO to C3.

No : CHECK the ignition switch. REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** . After the fault is repaired, CLEAR the DTC. REPEAT the self test.

C3 CHECK THE MODE SELECT SWITCH (MSS) POSITION PIDS

- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- Monitor each MSS PID while cycling through each MSS position.
- **Does each MSS PID agree with each switch position?**

Yes : GO to C8.

No : GO to C4.

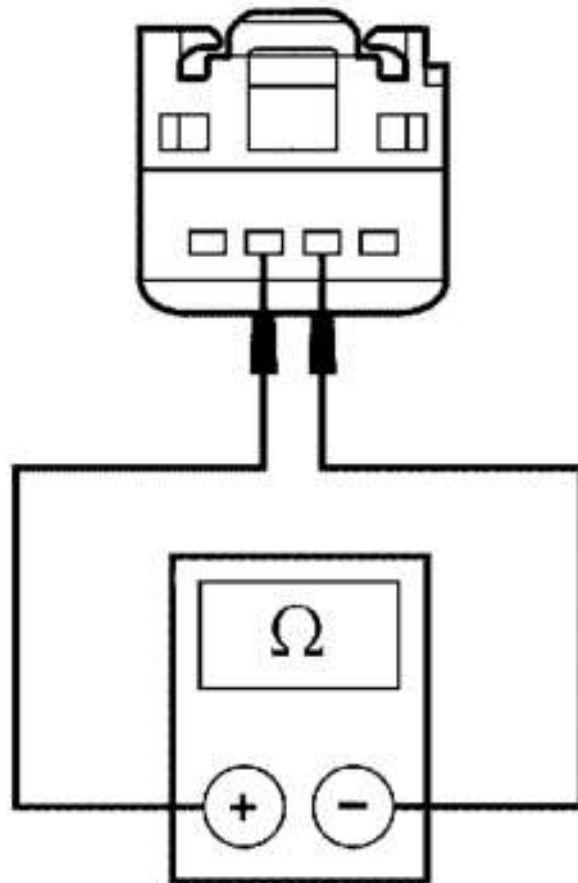
C4 CHECK THE MSS

- Key in OFF position.

- Disconnect: MSS C284.
- Measure the resistance between MSS C284, terminals 2 and 3, while rotating the switch through all positions. Refer to the following chart.

MODE SELECT SWITCH (MSS) POSITION REFERENCE

Mode Select Switch (MSS) Position	Resistance
4L	62 ohms
4H	130 ohms
2H	620 ohms
A4WD	270 ohms



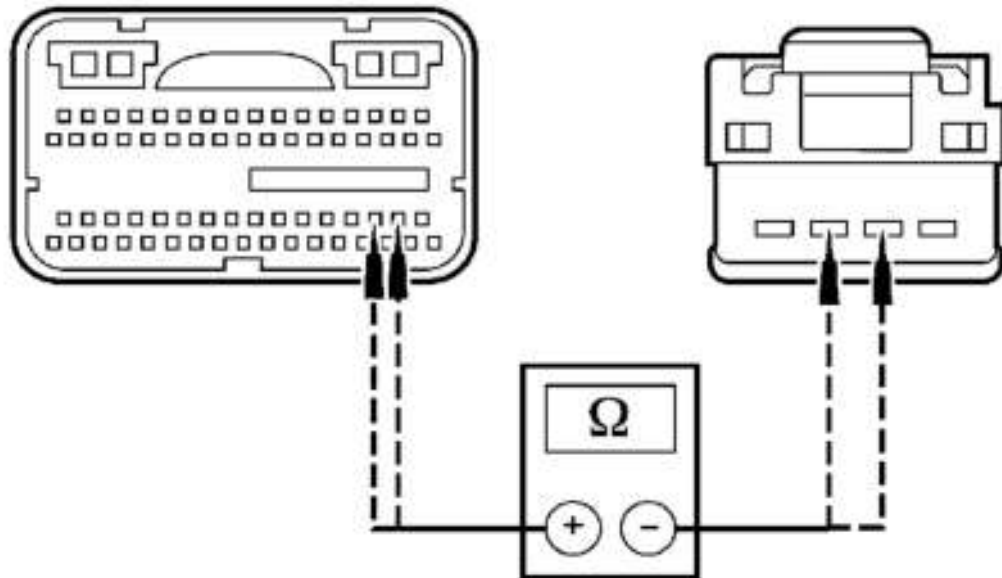
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Fig. 11: Measuring Resistance Between MSS C284, Terminals 2 And 3
 Courtesy of FORD MOTOR CO.

- **Are the resistance values within specification?**
Yes : GO to C5.
No : INSTALL a new MSS. CLEAR the DTC(s). REPEAT the self test.

C5 CHECK CIRCUITS 682 (DB/WH) AND 780 (DB) FOR AN OPEN

- Measure the resistance between MSS C284-2, harness side and 4x4 module (PCM) C175b-31, harness side, circuit 682 (DB/WH).



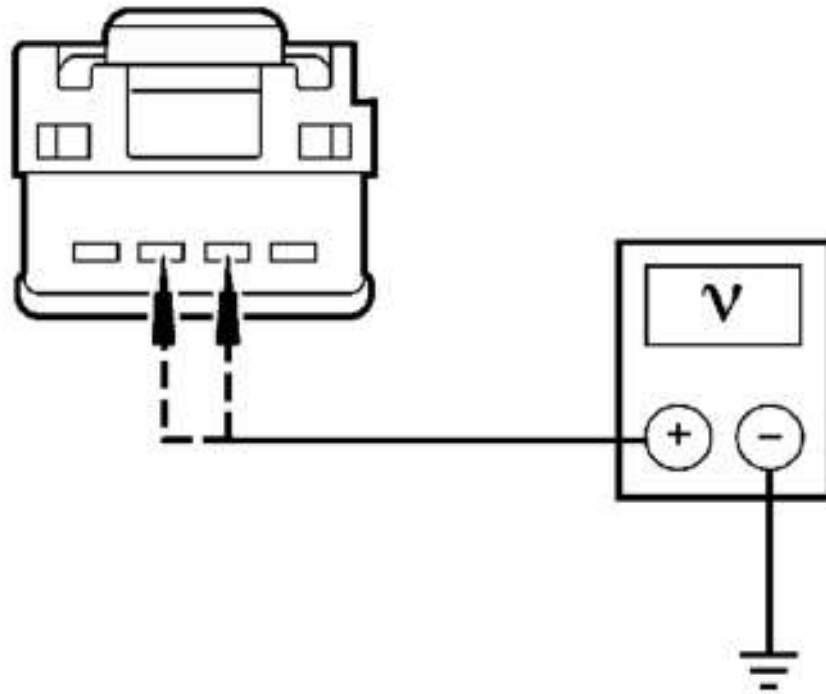
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Fig. 12: Checking Circuits 682 (DB/WH) And 780 (DB) For An Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-3, harness side and 4x4 module (PCM) C175b-32, harness side, circuit 780 (DB).
- **Is the resistance less than 5 ohms?**
Yes : GO to C6.
No : REPAIR the affected circuit(s). CLEAR the DTC(s). REPEAT the self test.

C6 CHECK CIRCUITS 682 (DB/WH) AND 780 (DB) FOR SHORT TO VOLTAGE

- Measure the voltage between MSS C284-2, harness side and ground.



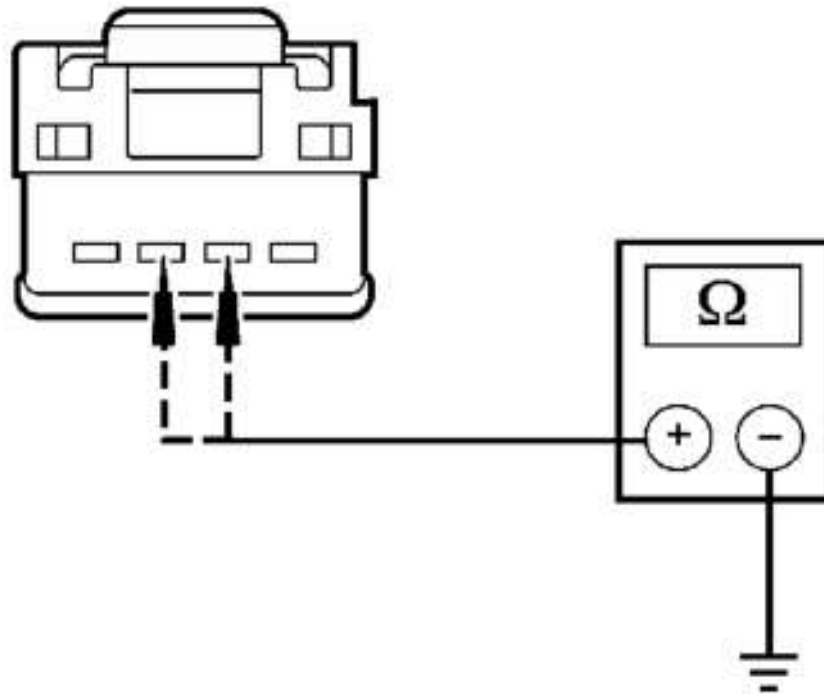
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Fig. 13: Measuring Voltage Between MSS C284-2, Harness Side And Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-3, harness side and ground.
- **Is the voltage greater than 9 volts?**
Yes : REPAIR the affected circuit(s). CLEAR the DTC(s). REPEAT the self test.
No : GO to C7.

C7 CHECK CIRCUITS 682 (DB/WH) AND 780 (DB) FOR SHORT TO GROUND

- Measure the resistance between MSS C284-2, harness side and ground.
- Measure the resistance between MSS C284-3, harness side and ground.



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Fig. 14: Checking Circuits 682 (DB/WH) And 780 (DB) For Short To Ground
 Courtesy of FORD MOTOR CO.

- **Is the resistance greater than 10,000 ohms?**

Yes : GO to C29.

No : REPAIR the affected circuit(s). CLEAR the DTC(s). REPEAT the self test.

C8 CHECK FOR 4H WIND-UP

- Switch the MSS to 4H.
- Drive the vehicle on a dry, hard surface in turns.
- **Is wind-up present in turns?**

Yes : GO to C11.

No : GO to C9.

C9 CHECK FOR TRANSFER CASE ENGAGEMENT

- Raise and support the vehicle. Refer to **JACKING & LIFTING** .
- Rotate the rear driveshaft.
- Observe the front driveshaft.
- **Did the front driveshaft rotate?**

Yes : GO to C10.

No : GO to C13.

C10 CHECK FOR IWE ENGAGEMENT

NOTE: The engine must be at idle during the following steps to supply vacuum for IWE engagement/disengagement.

- Start the engine and allow to idle.
- Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft and universal joint.
- Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft and universal joint.
- **Did the front halfshafts rotate?**
Yes : CHECK that all driveline fasteners are present and tightened to specification. REFER to **DRIVELINE SYSTEM-GENERAL INFORMATION** for further diagnosis of the front axle.
No : Go to **PINPOINT TEST B.**

C11 CHECK FOR IWE DISENGAGEMENT

- Switch the MSS to 2H.
- Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft and universal joint.
- Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft and universal joint.
- **Did either front axle shaft and universal joint rotate?**
Yes : Go to **PINPOINT TEST B.**
No : GO to C12.

C12 CHECK FOR TRANSFER CASE DISENGAGEMENT

- Raise the vehicle on hoist. Refer to **JACKING & LIFTING**.
- Rotate the rear driveshaft while observing the front driveshaft.
- **Does the front driveshaft rotate?**
Yes : The system is functioning correctly.
No : GO to C13.

C13 CHECK THE TRANSFER CASE CONTACT PLATE POSITION PIDS

- Connect the diagnostic tool.
- Monitor the transfer case contact plate position PID.

NOTE: If it is difficult to read the motor position, use the active command to energize the transfer case motor contact plate position return circuit.

- Switch the MSS from 2H to 4H.

MODE SELECT SWITCH POSITION REFERENCE

Mode Select Switch Position	Contact Plate Position			
	1 (A)	2 (B)	3 (C)	4 (D)
2H/A4WD	CLOSED	OPEN	CLOSED	CLOSED
4H	OPEN	CLOSED	CLOSED	OPEN
4L	OPEN	CLOSED	OPEN	CLOSED

- **Does the transfer case contact plate PID indicate 4H?**

Yes : GO to C30.

No : GO to C14.

C14 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION

- Remove the transfer case shift motor from the transfer case, leaving the wiring connector connected.
- Observe the transfer case shift motor while switching the MSS from 2H to 4H.
- **Does the transfer case shift motor rotate from the 2H position to the 4H position?**

Yes : GO to C30.

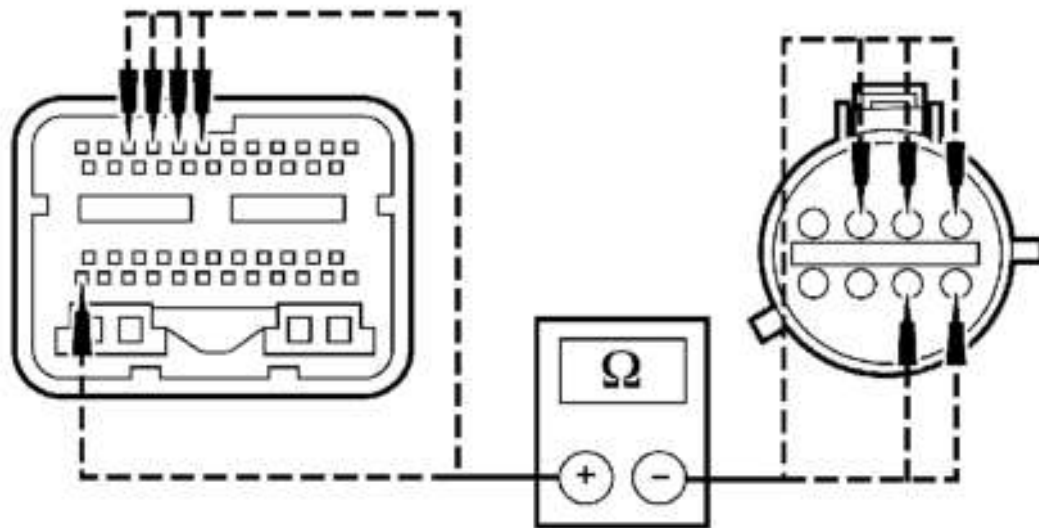
No : GO to C15.

C15 CHECK CIRCUITS 770 (WH), 771 (VT/YE), 764 (BR/WH), 763 (OG/WH) AND CIRCUIT 762 (YE/WH) FOR AN OPEN

- Key in OFF position.
- Disconnect: Transfer Case C350.
- Disconnect: 4x4 Module (PCM) C175t.
- Measure the resistance of the following circuits between 4x4 module (PCM) C175t, harness side and transfer case C350, harness side:

CIRCUIT REFERENCE

Circuit	C175t	C350
770 (WH)	7	1
771 (VT/YE)	6	5
764 (BR/WH)	8	2
763 (OG/WH)	9	3
762 (YE/WH)	46	6



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Fig. 15: Measuring Resistance Between 4X4 Module (PCM) C175T, Harness Side And Transfer Case C350
 Courtesy of FORD MOTOR CO.

- Are the resistances less than 5 ohms?

Yes : GO to C16.

No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

C16 CHECK CIRCUITS 770 (WH), 771 (VT/YE), 764 (BR/WH), 763 (OG/WH) AND CIRCUIT 762 (YE/WH) FOR A SHORT TO VOLTAGE

- Measure the voltage between the following circuits at 4x4 module (PCM) C1751, harness side and ground:

CIRCUIT REFERENCE

Circuit	Pin
770 (WH)	7
771 (VT/YE)	6
764 (BR/WH)	8
763 (OG/WH)	9
762 (YE/WH)	46

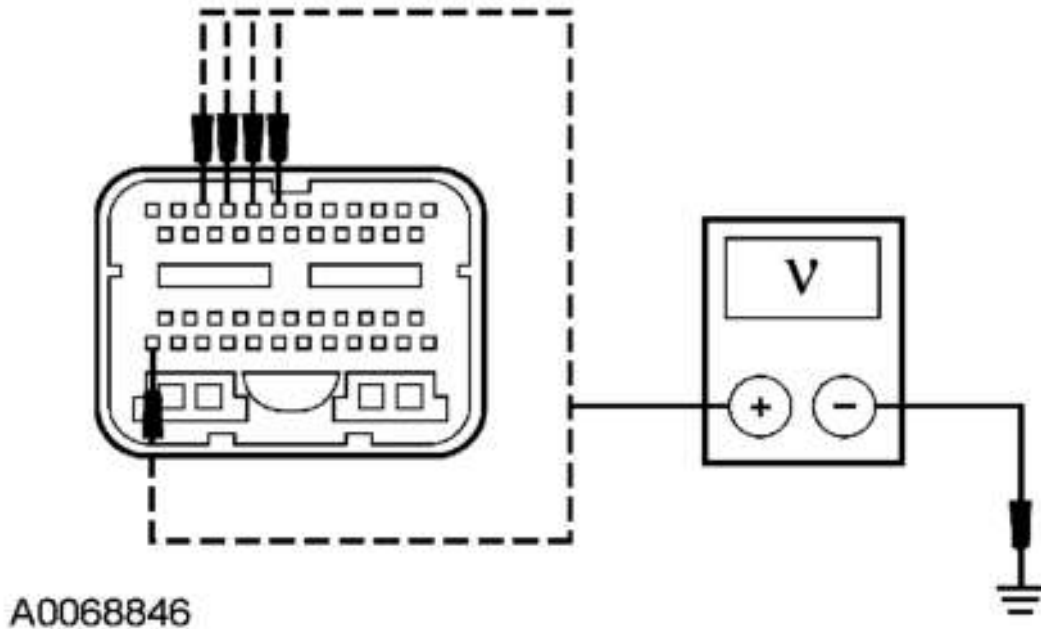


Fig. 16: Measuring Voltage Between Circuits At 4X4 Module (PCM) C1751, Harness Side And Ground

Courtesy of FORD MOTOR CO.

- **Is the voltage greater than 9 volts?**

Yes : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

No : GO to C17.

C17 CHECK CIRCUITS 770 (WH), 771 (VT/YE), 764 (BR/WH), 763 (OG/WH) AND CIRCUIT 762 (YE/WH) FOR A SHORT TO GROUND

- Measure the resistance between the following circuits at 4x4 module (PCM) C175t, harness side and ground:

CIRCUIT REFERENCE

Circuit	Pin
770 (WH)	7
771 (VT/YE)	6
764 (BR/WH)	8
763 (OG/WH)	9
762 (YE/WH)	46

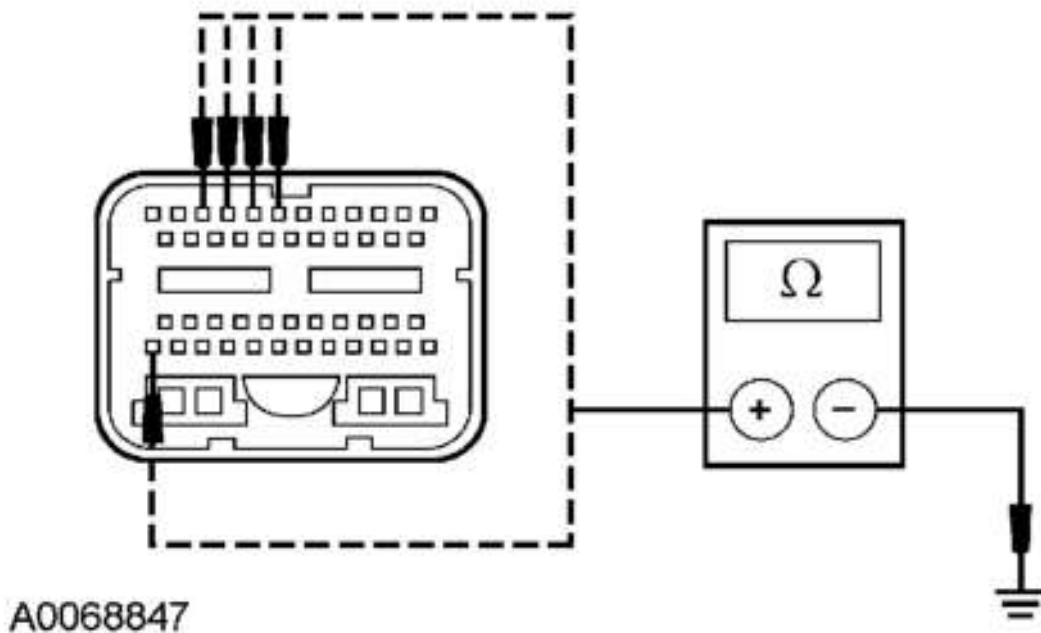


Fig. 17: Measuring Resistance Between Circuits At 4X4 Module (PCM) C175T, Harness Side And Ground

Courtesy of FORD MOTOR CO.

- Are the resistances greater than 10,000 ohms?

Yes : GO to C18.

No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

C18 CHECK THE SHIFT MOTOR FOR AN INTERNAL SHORT TO GROUND

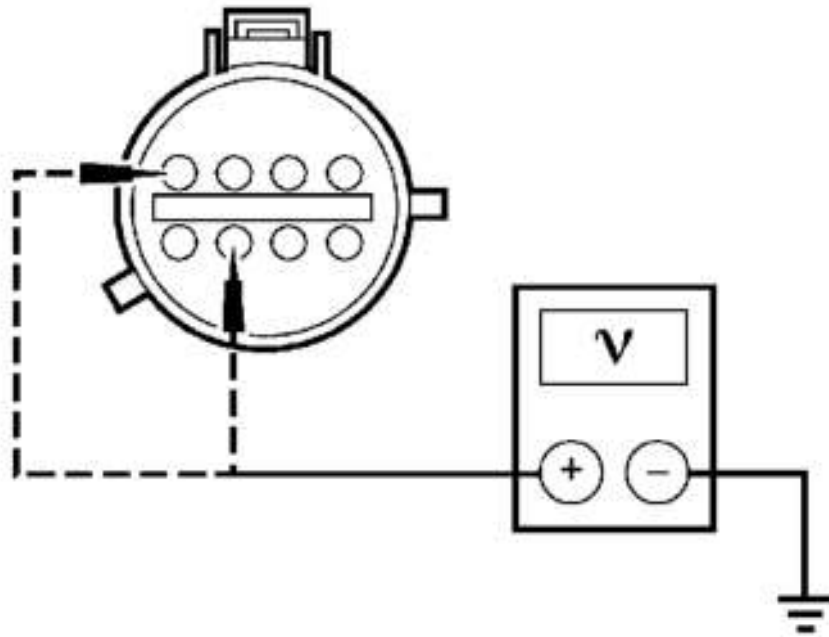
- Measure the resistance between shift motor C350 pins 2, 3 component side and ground.
- Is the resistance greater than 10,000 ohms?

Yes : GO to C19.

No : INSTALL a new transfer case shift motor. CLEAR the DTC(s). REPEAT the self test, then GO to C29.

C19 CHECK CIRCUITS 777 (YE) AND 778 (OG) FOR POWER DURING ACTIVE COMMANDS

- Enter the active command mode on the diagnostic tool.
- Enter the clockwise transfer case shift motor relay active command ON and OFF and measure the voltage between transfer case C350-7, circuit 778 (OG), harness side and ground. Enter the counterclockwise transfer case shift motor relay active command ON and OFF and measure the voltage between transfer case C350-4, circuit 777 (YE), harness side and ground.



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Fig. 18: Measuring Voltage Between Transfer Case C350-4, Circuit 777 (YE), Harness Side And Ground
 Courtesy of FORD MOTOR CO.

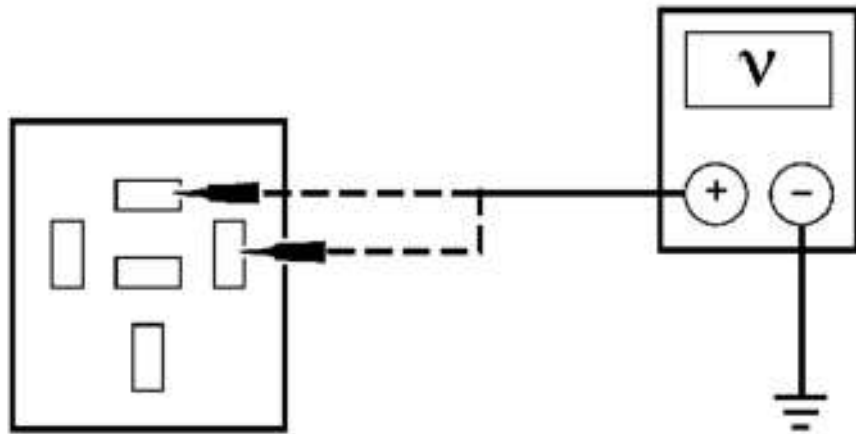
- **Are the voltages 9 volts or greater on the circuit being commanded?**

Yes : INSTALL a new transfer case shift motor. CLEAR the DTC(s). REPEAT the self test, then GO to C29.

No : GO to C20.

C20 CHECK THE CW/CCW RELAY CIRCUITS FOR VOLTAGE

- Key in OFF position.
- Disconnect: Clockwise (CW) Relay C1129.
- Disconnect: Counterclockwise (CCW) Relay C1173.
- Measure the voltage between CW motor relay C1129-2, circuit 704 (DG/LG), harness side and ground.



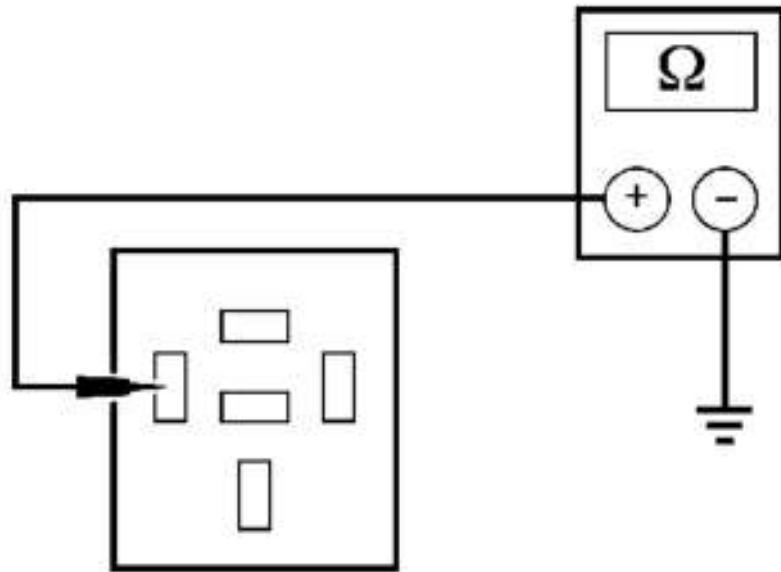
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Fig. 19: Measuring Voltage Between CW Motor Relay C1129-2, Circuit 704 (DG/LG), Harness Side And Ground
 Courtesy of FORD MOTOR CO.

- Measure the voltage between CCW motor relay C1173-2, circuit 704 (DG/LG), harness side and ground.
- **Is the voltage 9 volts or greater?**
 Yes : GO to C21.
 No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

C21 CHECK THE CW/CCW RELAY GROUND CIRCUITS

- Measure the resistance between CW motor relay C1129-1, circuit 57b (BK), harness side and ground.



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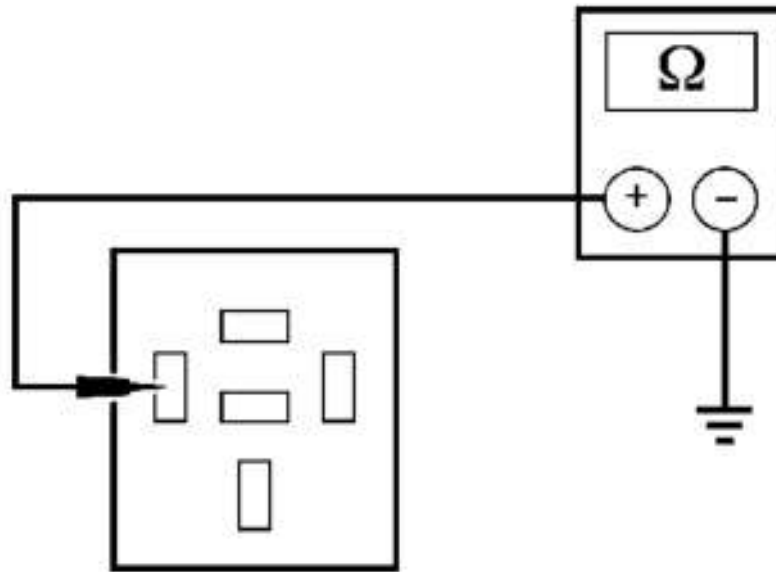
**Fig. 20: Measuring Resistance Between CW Motor Relay C1129-1, Circuit 57B (BK),
Harness Side And Ground**

Courtesy of FORD MOTOR CO.

- Measure the resistance between CCW motor relay C1173-1, circuit 57a (BK), harness side and ground.
- **Is the resistance less than 5 ohms?**
 Yes : GO to C22.
 No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

C22 CHECK CW/CCW RELAY CONTROL CIRCUITS

- Using the diagnostic tool active commands, command the motor to CW (low to high) and CCW (high to low).



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Fig. 21: Checking Resistance

Courtesy of FORD MOTOR CO.

- Measure the resistance between CW relay C1129-1, circuit 975 (BN/YE) and ground; and between CCW relay C1173-1, circuit 976 (OG) and ground when commanded to move CW (low to high) or CCW (high to low).
- **Is pin 1 of the appropriate relay grounded (5 ohms or less resistance) when the shift motor is commanded to move in that direction?**

Yes : GO to C23.

No : GO to C26.

C23 CHECK CIRCUIT 777 (YE) AND CIRCUIT 778 (OG) FOR AN OPEN

- Key in OFF position.
- Disconnect: CW Motor Relay C1129.
- Disconnect: CCW Motor Relay C1173.
- Measure the resistance between transfer case C350-4, circuit 777 (YE), harness side and CCW motor relay C1173-3, circuit 777 (YE), harness side; and between transfer case C350-7, circuit 778 (OG), harness side and clockwise motor relay C1129-3, circuit 778 (OG), harness side.

- **Are the resistances less than 5 ohms?**

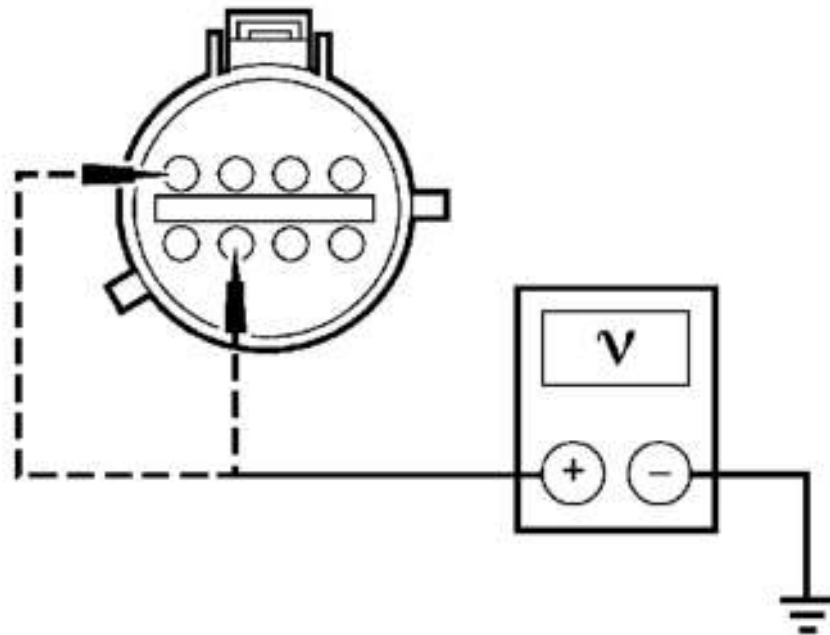
Yes : GO to C24.

No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

C24 CHECK CIRCUIT 777 (YE) AND CIRCUIT 778 (OG) FOR SHORT TO POWER

- Key in ON position.

- Measure the voltage between transfer case C350-4, circuit 777 (YE), harness side and ground; and between transfer case C350-7, circuit 778 (OG), harness side and ground.



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Fig. 22: Measuring Voltage Between Transfer Case C350-4, Circuit 777 (YE), Harness Side And Ground

Courtesy of FORD MOTOR CO.

- **Is the voltage greater than 9 volts?**

Yes : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

No : GO to C25.

C25 CHECK CIRCUIT 777 (YE) AND CIRCUIT 778 (OG) FOR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between transfer case C350-4, circuit 777 (YE), harness side and ground; and between the transfer case C350-7, circuit 778 (OG), harness side and ground.
- **Are the resistances greater than 10,000 ohms?**

Yes : INSTALL a new relay. CLEAR the DTC(s). REPEAT the self test.

No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

C26 CHECK THE RELAY CONTROL CIRCUIT 975 (BN/YE) AND CIRCUIT 976 (OG) FOR AN OPEN

- Disconnect: 4x4 Module (PCM) C175b.
- Measure the resistance between 4x4 module (PCM) C175b-14, circuit 975 (BN/YE), harness side and CW motor relay C1129-1, circuit 975 (BN/YE), harness side; and between 4x4 module (PCM) C175b-15, circuit 976 (OG), harness side and counterclockwise motor relay C1173-1,

circuit 976 (OG), harness side.

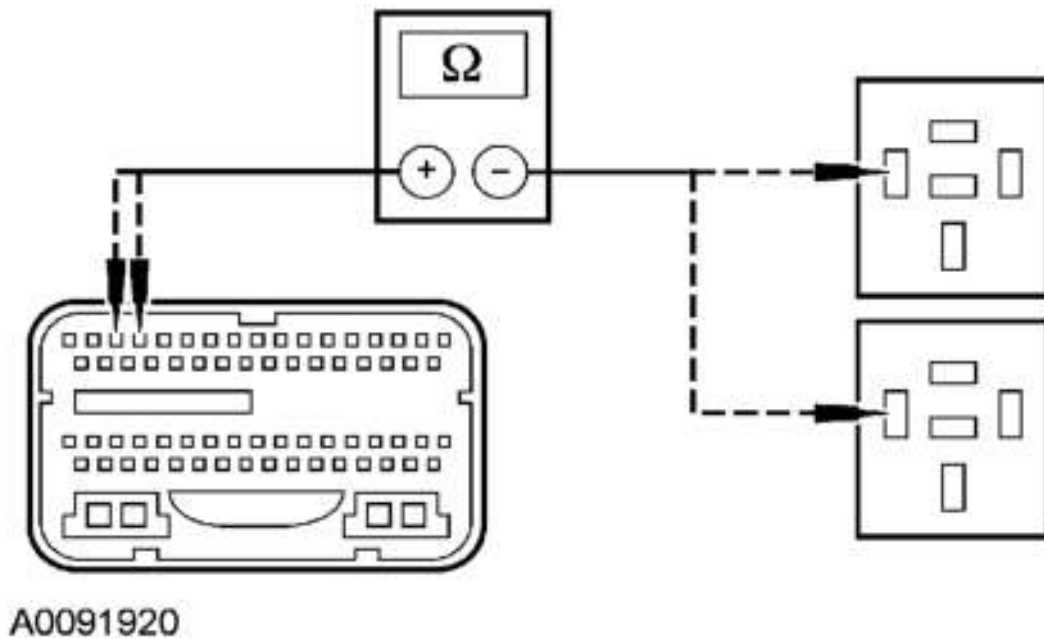


Fig. 23: Measuring Resistance Between 4X4 Module (PCM) C175B-14, Circuit 975 (BN/YE) And CW Motor Relay C1129-1, Circuit 975 (BN/YE)
Courtesy of FORD MOTOR CO.

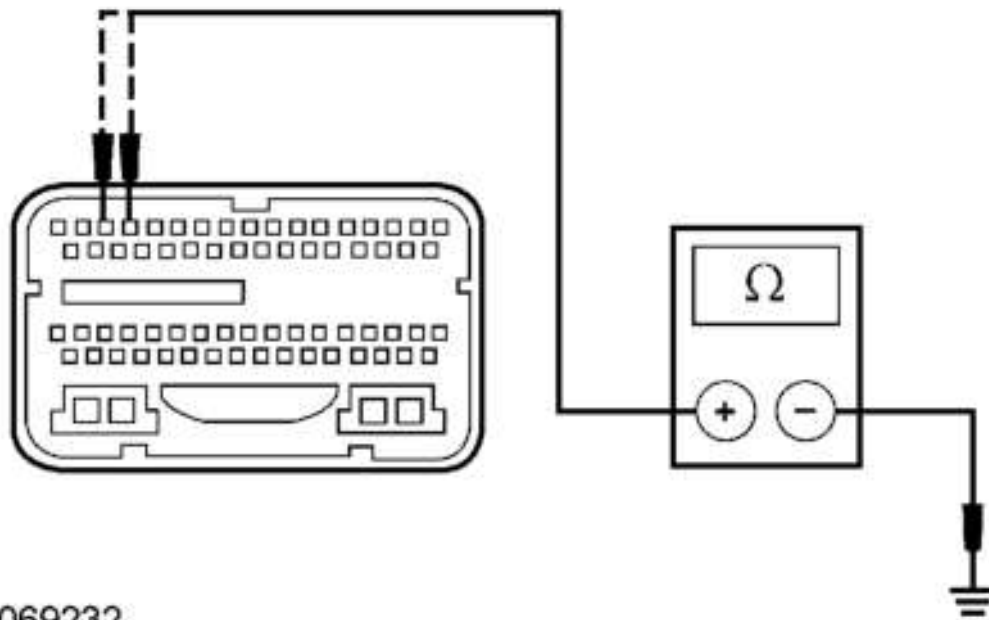
- Are the resistances less than 5 ohms?

Yes : GO to C27.

No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

C27 CHECK CIRCUIT 975 (BN/YE) AND CIRCUIT 976 (OG) FOR A SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between 4x4 module (PCM) C175b-14 circuit 975 (BN/YE), harness side and ground; and between 4x4 module (PCM) C175b-15, circuit 976 (OG), harness side and ground.



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Fig. 24: Measuring Resistance Between 4X4 Module (PCM) C175B-14 Circuit 975 (BN/YE), Harness Side And Ground
 Courtesy of FORD MOTOR CO.

- Are the resistances greater than 10,000 ohms?

Yes : GO to C28.

No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

C28 CHECK CIRCUIT 975 (BN/YE) AND CIRCUIT 976 (OG) FOR A SHORT TO POWER

- Key in ON position.
- Measure the voltage between 4x4 module (PCM) C175b-14, circuit 975 (BN/YE), harness side and ground; and between 4x4 module (PCM) C175b-15, circuit 976 (OG), harness side and ground.

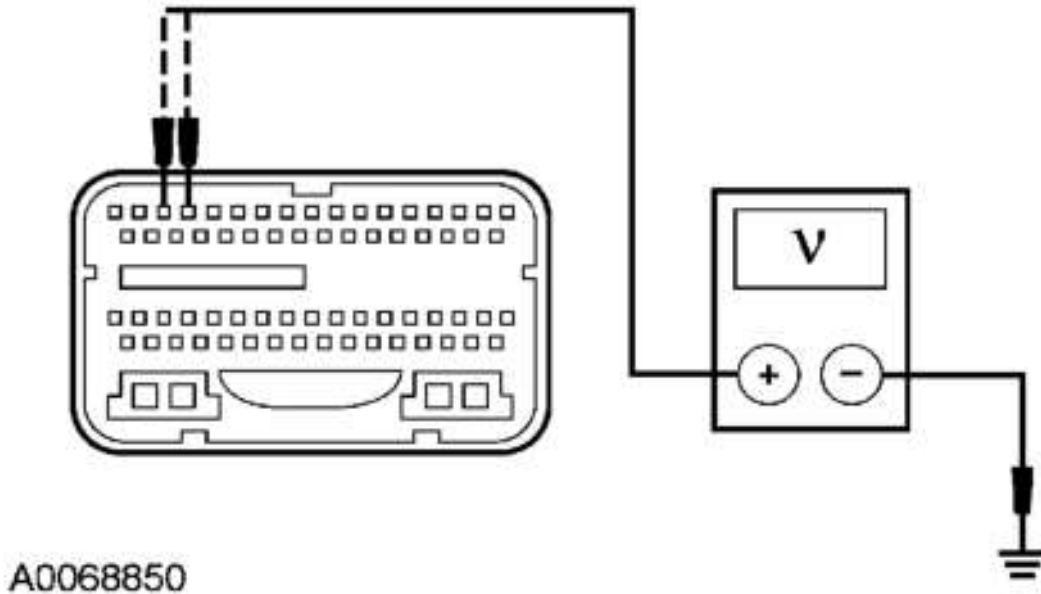


Fig. 25: Measuring Voltage Between 4X4 Module (PCM) C175B-14, Circuit 975 (BN/YE), Harness Side And Ground
 Courtesy of FORD MOTOR CO.

• **Is the voltage greater than 9 volts?**

Yes : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

No : GO to C29.

C29 ATTEMPT TO DUPLICATE THE CONCERN

- Inspect and, if necessary, clean the 4x4 module (PCM) and CW/CCW relays and connectors.
- Drive the vehicle and attempt to duplicate the concern.

• **Is the concern still present?**

Yes : INSTALL a new 4x4 module (PCM). REFER to **FUEL CHARGING & CONTROLS**. REPEAT the self test.

No : CLEAR the DTC(s). REPEAT the self test.

C30 SHIFT THE TRANSFER CASE TO 4H MANUALLY

- Remove the transfer case shift motor from the transfer case.
- Using a suitable wrench, rotate the shift cam to the 4H position.
- Rotate the rear driveshaft and watch the front driveshaft.
- **Does the transfer case shift to 4H and the front driveshaft rotates?**

Yes : GO to C31.

No : REPAIR the transfer case. REFER to **TRANSFER CASE - AUTOMATIC SHIFT**.

C31 CHECK THE TORQUE REQUIRED TO SHIFT THE TRANSFER CASE

- Rotate the shift cam by hand through 4L, N and 4H positions.
- Measure the torque required to perform the shift.
- **Is the torque required to shift 45 Nm (33 lb-ft) or less?**

Yes : GO to C32.

No : REPAIR the transfer case. REFER to TRANSFER CASE - AUTOMATIC SHIFT .

C32 SHIFT THE TRANSFER CASE TO 2H MANUALLY

- Rotate the shift cam to the 2H position.
- Rotate the rear driveshaft and watch the front driveshaft.
- **Does the transfer case shift to 2H and the front driveshaft does not rotate?**

Yes : GO to C33.

No : REPAIR the transfer case. REFER to in TRANSFER CASE - AUTOMATIC SHIFT .

C33 SHIFT THE TRANSFER CASE TO 4L MANUALLY

- Rotate the shift cam by hand to the 4L position.
- Rotate the rear driveshaft and watch the front driveshaft.
- **Does the transfer case shift to 4L and the front driveshaft rotates?**

Yes : INSTALL a new 4x4 shift motor, then GO to C29.

No : REPAIR the transfer case. REFER to TRANSFER CASE - AUTOMATIC SHIFT .

Pinpoint Test D: The Vehicle Does Not Shift Between 4H And 4L Modes Correctly

Normal Operation

The high-low shift occurs when the reduction shift fork moves the high-low collar to lock the planetary gear set to the output shaft. The torque transmitted through the sun gear from the input shaft turns the front planetary gear set assembly. The front planetary gear set assembly, now engaged, provides transfer case speed reduction. Certain criteria, such as vehicle speed, transmission range selection and brake applied must be met before this shift can occur. Systematically check the necessary inputs and outputs of the 4x4 module (PCM), components of the transfer case, IWE components and half shafts.

Possible Causes

- Transmission neutral switch
- Brake ON/OFF switch (BOO)
- ABS wheel speed inputs
- CAN communication network
- Transfer case
- 4x4 module (PCM)

Testing

D1 CHECK THE A4WD TO 4H SHIFT

- Drive the vehicle and shift from A4WD to 4H.
- **Does the vehicle shift between 2WD and 4WD correctly?**

Yes : GO to D2.

No : Go to PINPOINT TEST C.

D2 CHECK THE 4H TO 4L SHIFT

- Drive the vehicle and shift MSS from 4H to 4L.
- **Does the transfer case shift from 4H to 4L correctly and the complaint is related to a**

clunk noise during the shift?

Yes : Transmission neutral drag is excessive. REFER to **AUTOMATIC TRANSMISSION - 4R70E/4R75E** for transmission diagnosis.

No : GO to D3

D3 CHECK THE TRANSMISSION, BRAKE ON/OFF (BOO) AND WHEEL SPEED PIDS

- Connect the diagnostic tool.
- Key in ON position.
- A. Monitor the 4x4 module (PCM) transmission neutral PID while shifting the transmission through gear ranges.
- B. Monitor the brake ON/OFF (BOO) switch PID while pressing and releasing the brake pedal.
- C. Monitor the wheel speed PID.
-
- A. **Does the 4x4 module (PCM) transmission neutral PID indicate NEUTRAL when the transmission is shifted to NEUTRAL?**
- B. **Does the BOO switch PID agree with the actual brake pedal positions?**
- C. **Do the wheel speed PIDs indicate 0 km/h (0 mph)?**

Yes : If all three PIDS are accurate, Go to **Pinpoint Test C.**

No :

A. REFER to **AUTOMATIC TRANSMISSION - 4R70E/4R75E** for further diagnosis of the TR sensor and the CAN communication network.

B. REFER to **ANTI-LOCK CONTROL** for further diagnosis of the brake pedal position switch and the CAN communication network.

C. REFER to **ANTI-LOCK CONTROL** for further diagnosis of the ABS system and the CAN communication network.

Pinpoint Test E: 4WD Does Not Engage At Speed Correctly

Normal Operation

When the operator selects 4WD the 4x4 module (PCM) engages a clutch for approximately 5 seconds to synchronize the front and rear driveshafts allowing a mechanical engagement of the transfer case. The 4x4 module (PCM) also removes the ground path from the IWE solenoid, which removes vacuum from the IWEs, allowing them to engage the front axle shaft. Systematically check the necessary inputs and outputs at the 4x4 module (PCM), internal components of the transfer case, IWE components and drive axles.

Possible Causes

- Transfer case clutch coil
- Transfer case
- 4x4 module (PCM)
- Front axle assembly
- Circuit 779 (BN)
- Circuit 92 (LB/YE)

Testing

E1 RETRIEVE DTCs

- Connect the diagnostic tool.
- Carry out the 4x4 module (PCM) self test.
- **Are any DTCs retrieved?**

Yes : If DTC 1826, GO to E13. If DTC 1824 and/or 1827, GO to E10. For all other DTCs, GO to **SYMPTOM CHART**.

No : GO to E2.

E2 CHECK 4H ENGAGEMENT AT REST

- Switch the MSS from 2H to 4H.
- While on the road, drive the vehicle in turns and check for wind-up.
- **Does 4H engage at rest correctly?**

Yes : GO to E3.

No : Go to **PINPOINT TEST C**.

E3 CHECK 2H TO 4H SHIFT AT SPEED

- Switch the MSS to 2H.
- Key in ON position.
- Drive the vehicle and carry out a 2H to 4H shift while driving approximately at 16 km/h (10 mph).
- Stop the vehicle, shift to 2H, drive the vehicle and carry out a 2H to 4H shift while driving at approximately 64 km/h (40 mph).
- **Does 4H engage correctly (or much better) at 16 km/h (10 mph) than at 64 km/h (40 mph)?**

Yes : Go to **PINPOINT TEST B**.

No : GO to E4.

E4 CHECK THE TRANSFER CASE CLUTCH COIL LOCKUP

- Connect the diagnostic tool.
- Key in ON position.
- Switch the MSS to A4WD.
- Using the diagnostic tool, command the transfer case clutch to 98 percent.
- Raise and support the vehicle on a hoist. Refer to **JACKING & LIFTING** .
- Rotate the rear driveshaft while observing the front driveshaft.
- **Does the front driveshaft rotate when the rear driveshaft is rotated?**

Yes : GO to E5.

No : GO to E8.

E5 CHECK THE TRANSFER CASE CLUTCH COIL RELEASE

- Using the diagnostic tool, command the transfer case clutch to 0 percent.
- Rotate the rear driveshaft while observing the front driveshaft.
- **Does the front driveshaft rotate when the rear driveshaft is rotated?**

Yes : GO to E14.

No : GO to E6.

E6 CHECK THE TRANSFER CASE SYNCHRONIZATION (ON A HOIST)

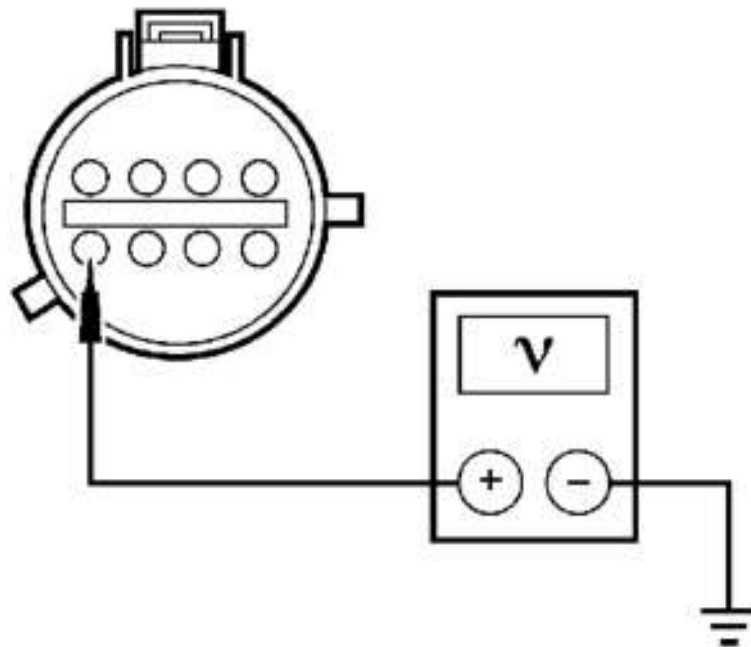
- Start the engine, shift the MSS to 2H.
- Place the transmission range (TR) selector in DRIVE and increase speed to between 16 km/h (10 mph) and 24 km/h (15 mph).
- While observing the front driveshaft, switch the MSS to 4H.
- **Did the front driveshaft start to spin?**
Yes : GO to E7.
No : GO to E14.

E7 CHECK THE TRANSFER CASE DISENGAGEMENT

- Shift to 2H.
- Rotate the rear driveshaft while observing the front driveshaft.
- **Did the front driveshaft rotate?**
Yes : GO to E14.
No : Go to **PINPOINT TEST B.**

E8 CHECK CIRCUIT 779 (BN) FOR VOLTAGE

- Disconnect: Transfer Case C350.
- While still active commanding 98 percent, measure the voltage between transfer case C350-8, circuit 779 (BN), harness side and the transfer case housing.



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Fig. 26: Measuring Voltage Between Transfer Case C350-8, Circuit 779 (BN), Harness Side And Transfer Case Housing
 Courtesy of FORD MOTOR CO.

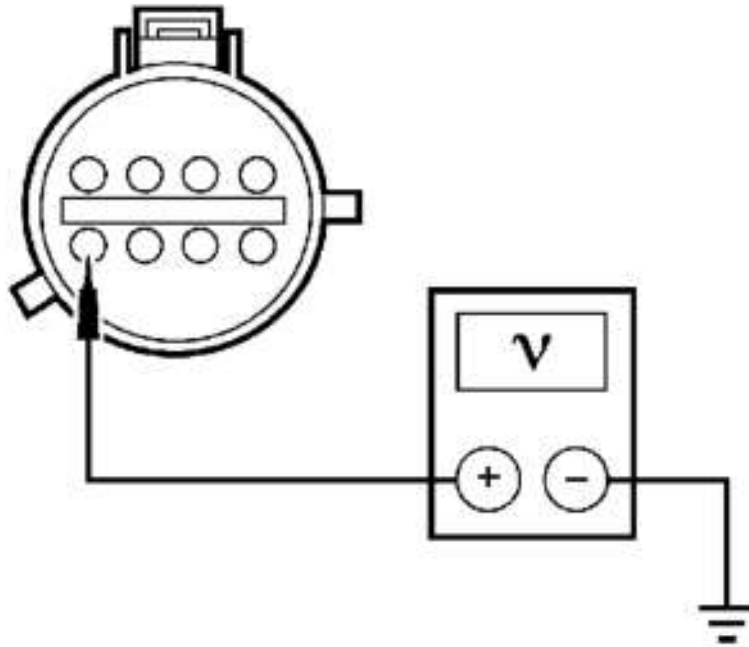
- **Is the voltage greater than 9 volts?**

Yes : End the active command. INSTALL a new transfer case synchronization clutch. REFER to TRANSFER CASE - AUTOMATIC SHIFT . CLEAR the DTC(s). REPEAT the self test.

No : GO to E9.

E9 CHECK THE TRANSFER CASE CHASSIS GROUND

- While still in active command 98 percent, measure the voltage between transfer case D350-8, circuit 779 (BN), harness side and chassis ground.



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Fig. 27: Measuring Voltage Between Transfer Case D350-8, Circuit 779 (BN), Harness Side And Chassis Ground
 Courtesy of FORD MOTOR CO.

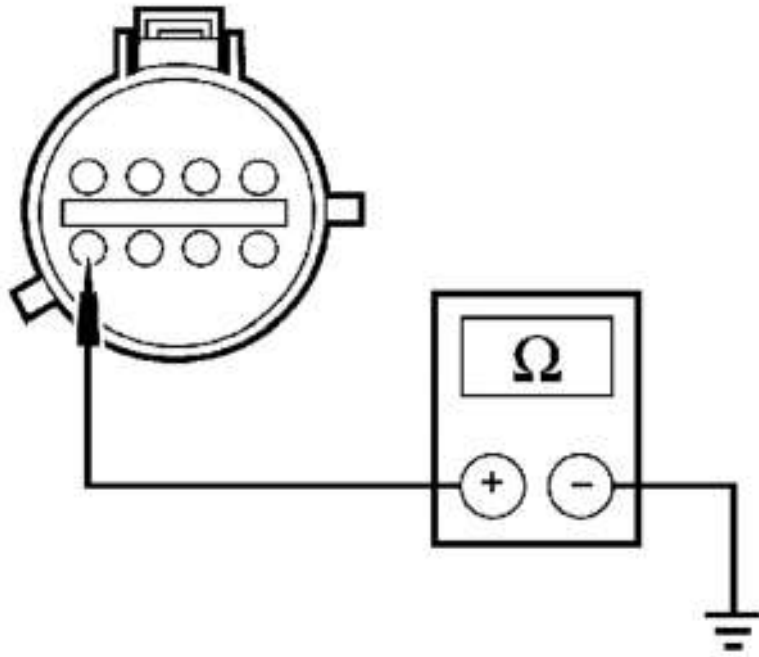
- **Is the voltage greater than 9 volts?**

Yes : End the active command. REPAIR the transfer case ground connection between the transfer case and the chassis. CLEAR the DTC(s). REPEAT the self test.

No : End the active command. GO to E10.

E10 CHECK CIRCUIT 779 (BN) FOR A SHORT TO GROUND

- Disconnect: 4x4 Module (PCM) C175t.
- Measure the resistance between transfer case C350-8, circuit 779 (BN) and ground.



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Fig. 28: Measuring Resistance Between Transfer Case C350-8, Circuit 779 (BN) And Ground

Courtesy of FORD MOTOR CO.

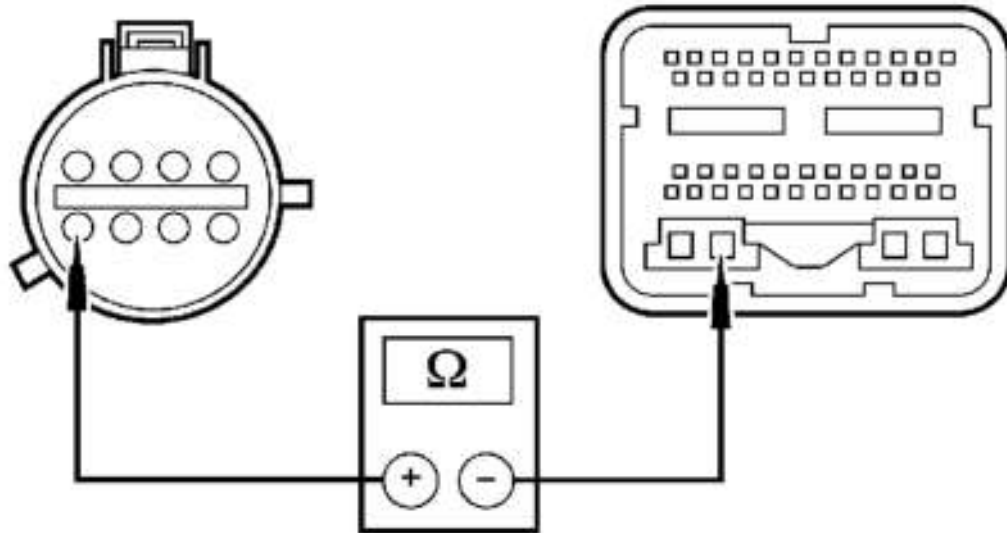
- Is the resistance greater than 10,000 ohms?

Yes : GO to E11.

No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

E11 CHECK CIRCUIT 779 (BN) FOR AN OPEN

- Measure the resistance between transfer case C350-8, circuit 779 (BN), harness side and the 4x4 module (PCM) C175t-49, circuit 779 (BN), harness side.



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Fig. 29: Measuring Resistance Between Transfer Case C350-8, Circuit 779 (BN) And 4X4 Module (PCM) C175T-49, Circuit 779 (BN)
 Courtesy of FORD MOTOR CO.

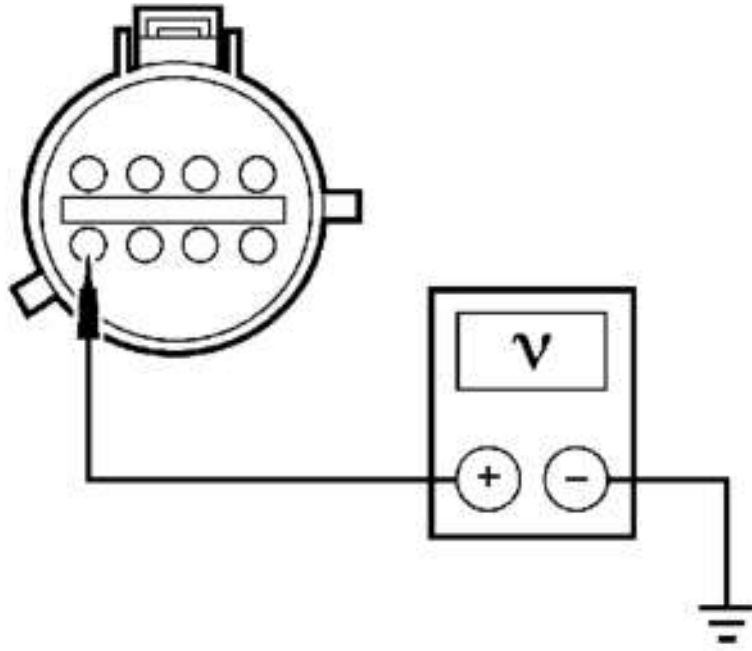
- **Is the resistance less than 5 ohms?**

Yes : GO to E12.

No : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

E12 CHECK CIRCUIT 779 (BN) FOR VOLTAGE

- While in active command greater than 10%, measure the voltage between transfer case C350-8, circuit 779 (BN), harness side and ground.



N0035858

Fig. 30: Measuring Voltage Between Transfer Case C350-8, Circuit 779 (BN), Harness Side And Ground

Courtesy of FORD MOTOR CO.

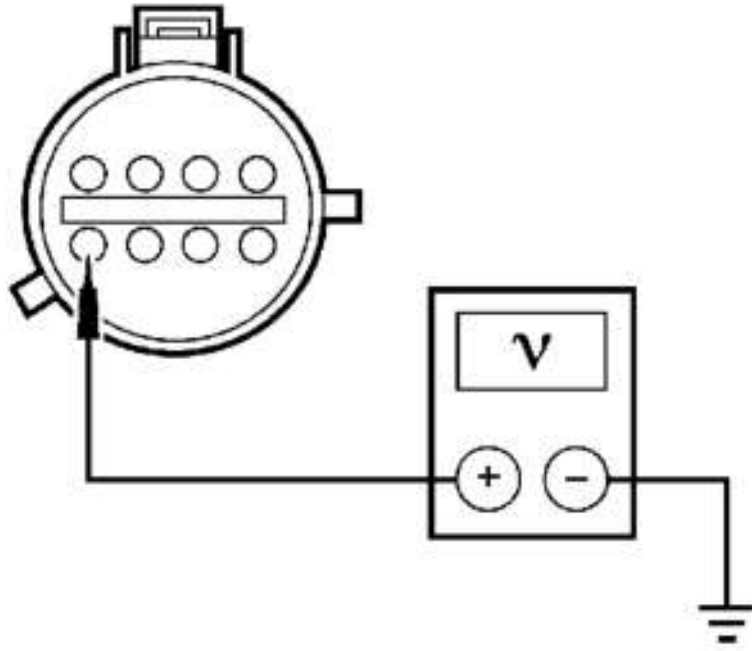
- **Is voltage present?**

Yes : End active command. GO to E13.

No : End active command. INSTALL a new transfer case synchronization clutch. REFER to **TRANSFER CASE - AUTOMATIC SHIFT** . CLEAR the DTC(s). REPEAT the self test.

E13 CHECK CIRCUIT 779 (BN) FOR A SHORT TO POWER

- While in active command 0%, measure the voltage between transfer case C350-8, circuit 779 (BN), harness side and ground.



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Fig. 31: Measuring Voltage Between Transfer Case C350-8, Circuit 779 (BN), Harness Side And Ground
 Courtesy of FORD MOTOR CO.

- **Is voltage present?**

Yes : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self test.

No : GO to E14.

E14 CHECK FOR CORRECT 4x4 MODULE OPERATION

- Disconnect all 4x4 module (PCM) connectors.
- Check for:
 - corrosion
 - pushed-out pins
- Connect all 4x4 module (PCM) connectors and make sure they are seated correctly.
- Operate the system and verify the concern is still present.
- **Is the concern still present?**

Yes : INSTALL a new 4x4 module (integral to PCM). REFER to **ELECTRONIC ENGINE CONTROLS** . REPEAT the self test.

No : The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. CLEAR the DTC(s). REPEAT the self test.

Pinpoint Test F: The 4x4 System Jumps Out Of Gear

Normal Operation

Once the 4x4 system engages the user selected mode, that mode should be maintained. If the 4x4 system does not stay in the selected position systematically check the 4x4 system components.

Possible Causes

- IWE vent line(s)
- Mode select switch
- Transfer case

Testing

F1 CHECK FOR OBSTRUCTED IWE VENT LINES

- Raise and support the vehicle on a hoist. REFER to **JACKING & LIFTING** .

NOTE: **The IWE vent port is the smaller of the 2 vacuum ports.**

- Disconnect the LH IWE line from the vent port.
- Attach a vacuum pump to the IWE vent line.
- Attempt to draw and hold a vacuum. Repeat Steps 1, 2 and 3 for the RH side of the vehicle.
- **Can a vacuum be held on either IWE vent line?**
Yes : INSTALL new IWE vent lines as necessary.
No : GO to F2.

F2 VERIFY THE CONCERN

- Drive the vehicle and attempt to duplicate the concern.
- **Is the concern an uncommanded range shift (in or out of low range)?**
Yes : GO to F5.
No : GO to F3.

F3 CHECK THE MODE SELECT SWITCH (MSS) POSITION PIDS

- Key in OFF position.
- Connect the diagnostic tool.
- Key in ON position.
- Drive the vehicle.
- Dynamically monitor the MSS PID while driving the vehicle in each shift position.
- **Does the MSS PID always agree with the switch position?**
Yes : GO to F4.
No : Go to **PINPOINT TEST C**.

F4 CHECK FOR DTCs

- Carry out the on-demand self test.
- **Are DTCs present?**
Yes : REFER to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** .
No : Go to **PINPOINT TEST H**.

F5 CHECK THE 4x4 INDICATORS

- Stop the vehicle.

- Transmission in NEUTRAL.
- Depress the brake pedal.
- Observe the 4x4 indicators in the instrument cluster while cycling through each MSS position.
- **Do the 4x4 indicators match MSS switch positions?**

Yes : GO to F3.

No : GO to F6.

F6 CHECK FOR DTCs

- Transmission in PARK.
- Release the brake pedal.
- Carry out the on-demand self test.
- **Are DTCs present?**

Yes : REFER to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** .

No : CHECK the transfer case fluid level. REFER to **TRANSFER CASE - AUTOMATIC SHIFT** . If the fluid level is okay, CHECK for internal transfer case faults. REFER to **TRANSFER CASE - AUTOMATIC SHIFT** .

Pinpoint Test G: Straightline Driveline Wind-up

Normal Operation

In order for the 4WD system to function correctly, tires and wheels must be the same size, be in good condition, and the front and rear axle ratios must match.

Possible Causes

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

Testing

NOTE: **4x4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.**

G1 VERIFY THE CONCERN

- Drive the vehicle and shift from 2H to 4H. There should be minimal wind-up in 4H mode during straight line maneuvers, (wind-up in turns is normal; 4x4 high/low is not intended for driving on hard/dry surfaces).
- **Is excessive wind-up present?**

Yes : GO to G2.

No : RETURN the vehicle to the customer. ADVISE about correct 4x4 system operation and normal vehicle behavior.

G2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

- Check the wheel and tire sizes.
- **Do the 4 wheel and tire sizes match?**

Yes : GO to G3.

No : ADVISE the customer that 4x4 systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

G3 CHECK TIRE WEAR

- Check each of the 4 tires for wear.
- **Are the 4 tires worn evenly?**

Yes : GO to G4.

No : ADVISE the customer that 4x4 systems require 4 matched, correctly inflated, correctly rotated tires to operate correctly.

G4 CHECK TIRE INFLATION PRESSURE

- Check the inflation pressure in each tire. Refer to vehicle certification label.
- **Are the tire inflation pressures correct?**

Yes : GO to G5.

No : ADJUST the tire pressure as necessary. TEST the vehicle for normal operation. ADVISE the customer that 4x4 systems require 4 matched, correctly inflated, correctly maintained tires to operate correctly.

G5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match. Refer to **FRONT DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR** .
- **Do the front and rear axle ratios match?**

Yes : RETURN the vehicle to the customer and ADVISE about correct 4x4 usage and normal vehicle behavior.

No : CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to **DRIVELINE SYSTEM-GENERAL INFORMATION** .

Pinpoint Test H: Torque On-Demand Functional Test

Normal Operation

When operating in 4-wheel drive, the transfer case and both IWEs are locked. When in 4x4 low (4L), the transfer case low range gear set provides an additional 2.64 gear reduction. When operating in 2WD, the transfer case and both IWEs are unlocked.

Possible Causes

- Transfer case and related components
- IWE and related components
- Wheel/tire assemblies

Testing

NOTE: **4x4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.**

H1 CHECK FOR 4x4 INDICATOR PROVE OUT

- Key in OFF position.
- Key in ON position.

- **Do the 4x4 indicators illuminate at prove out?**

Yes : GO to H2.

No : CHECK the instrument cluster for faults. REFER to **INSTRUMENT CLUSTER** .

H2 CHECK 2WD OPERATION

- Stop the vehicle.
- Transmission in NEUTRAL.
- Depress the brake pedal.
- Switch the MSS to 2H.
- **Do the 4WD indicators turn off?**

Yes : GO to H5.

No : GO to H3.

H3 CHECK FOR DTCs

- Transmission in PARK.
- Release the brake pedal.
- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs retrieved?**

Yes : REFER to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** for diagnosis.

No : GO to H4.

H4 CHECK FOR WIND-UP IN 2WD

- Drive the vehicle on a dry, hard surface while executing turns.
- **Is wind-up present in turns?**

Yes : Go to **PINPOINT TEST D**.

No : Go to **PINPOINT TEST I**.

H5 CHECK FOR WIND-UP IN 2WD

- Drive the vehicle on a dry, hard surface while executing turns.
- **Is wind-up present in turns?**

Yes : REPAIR the transfer case. REFER to **TRANSFER CASE - AUTOMATIC SHIFT** .

No : GO to H6.

H6 CHECK A4WD OPERATION

- Switch the MSS to A4WD.
- **Are the 4WD indicators off?**

Yes : GO to H9.

No : GO to H7.

H7 CHECK FOR DTCs

- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs present?**

Yes : REFER to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** for diagnosis.

No : GO to H8.

H8 CHECK FOR WIND-UP IN A4WD

- Drive the vehicle on a dry, hard surface in turns.
- **Is wind-up present in turns?**

Yes : GO to H9.

No : GO to H10.

H9 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record.
- Monitor the transfer case clutch duty cycle (pulse width modulated [PWM]) PID.
- **Does the PID indicate two to 4 percent clutch application at closed throttle?**

Yes : GO to H10.

No : GO to H11.

H10 CHECK FOR WIND-UP IN A4WD WITH 100 PERCENT CLUTCH

- Using the diagnostic tool, command the clutch duty cycle to 100 percent.
- **Drive the vehicle on a dry, hard surface in turns.**
- **Is wind-up present in turns?**

Yes : GO to H11.

No : CHECK the transfer case. REFER to **TRANSFER CASE - AUTOMATIC SHIFT** .

H11 CHECK SHAFT SPEED PIDs

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record.
- Monitor the transfer case front and rear shaft speeds.
- Drive the vehicle 30 km/h (18 mph).
- Record and compare the front wheel speed and rear wheel speed.
- **Do the front shaft speed and rear shaft speed values match within 1.5 km/h (1 mph)?**

Yes : GO to H12.

No : CHECK anti-lock brake system (ABS). REFER to **ANTI-LOCK CONTROL** and VERIFY the four road tire sizes match.

H12 CHECK THE THROTTLE POSITION PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record.
- Monitor the throttle position PID from the 4x4 module.
- Key on, engine off.
- Slowly move throttle from closed throttle to WOT and observe the 4x4 module throttle sensor PID.
- **Does the PID value vary between 0 percent at closed throttle and 100 percent at WOT?**

Yes : GO to H13.

No : CHECK the throttle position sensor and or PCM. See **INTRODUCTION - GASOLINE** article .

H13 CHECK 4H OPERATION

- Switch the MSS to 4H.
- **Does the 4H indicator illuminate correctly?**

Yes : GO to H16.

No : GO to H14.

H14 CHECK FOR DTCs

- Transmission in PARK.
- Release the brake pedal.
- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs retrieved?**

Yes : REFER to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** for diagnosis.

No : GO to H15.

H15 CHECK FOR WIND-UP IN 4H

- Drive the vehicle on a dry, hard surface while executing turns.
- **Is wind-up present in turns?**

Yes : Go to **PINPOINT TEST I.**

No : Go to **PINPOINT TEST C.**

H16 CHECK FOR 4H WIND-UP

- Drive the vehicle on a dry, hard surface.
- **Is straightline wind-up present?**

Yes : Go to **PINPOINT TEST G.**

No : GO to H17.

H17 CHECK 4H WIND-UP IN TURNS

- Drive the vehicle in 4H while turning.
- **Is wind-up present in turns?**

Yes : GO to H18.

No : Go to **PINPOINT TEST C.**

H18 CHECK 4L OPERATION

- Bring the vehicle to a stop with the brake applied, transmission in NEUTRAL, switch the MSS to 4L.
- **Does the 4WD low indicator illuminate correctly?**

Yes : GO to H21.

No : GO to H19.

H19 CHECK FOR DTCs

- Transmission in PARK.
- Release the brake pedal.
- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs retrieved?**

Yes : REFER to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** for diagnosis.

No : GO to H20.

H20 CHECK FOR WIND-UP IN 4L

- Drive the vehicle on a dry, hard surface while executing turns.

- **Is wind-up present in turns?**

Yes : Go to **PINPOINT TEST I.**

No : Go to **PINPOINT TEST D.**

H21 CHECK FOR 4L WIND-UP IN TURNS

- Drive the vehicle on a dry, hard surface while executing turns.

- **Is wind-up present and 4L functioning?**

Yes : GO to H22.

No : CHECK for 4x4 module (PCM) DTC(s). Refer to the **INSPECTION AND VERIFICATION PROCEDURE.** If no DTC(s) are present, Go to **PINPOINT TEST D.**

H22 CHECK 4L TO 2H SHIFT

- With the vehicle at a stop, brake applied and transmission in NEUTRAL, switch the MSS from 4L to 2H.

- **Do the 4WD indicators turn OFF?**

Yes : GO to H25.

No : GO to H23.

H23 CHECK FOR DTCs

- Transmission in PARK.
- Release the brake pedal.
- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs retrieved?**

Yes : REFER to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** for diagnosis.

No : GO to H24.

H24 CHECK FOR WIND-UP IN 2WD

- Drive the vehicle on a dry, hard surface while executing turns.

- **Is wind-up present in turns?**

Yes : Go to **PINPOINT TEST D.**

No : Go to **PINPOINT TEST I.**

H25 CHECK FOR TRANSFER CASE DISENGAGEMENT

- Raise and support the vehicle on a hoist. Refer to **JACKING & LIFTING .**
- Rotate the rear driveshaft while observing the front driveshaft.
- **Does the front driveshaft rotate?**

Yes : REFER to **TRANSFER CASE - AUTOMATIC SHIFT .**

No : GO to H26.

H26 CHECK FOR LH AND RH IWE DISENGAGEMENT

NOTE: **The engine must be at idle during the following steps to supply vacuum for IWE engagement/disengagement.**

- Start the engine and allow to idle.

- Rotate the left front tire one revolution forward and one revolution backward while observing the left front halfshaft and universal joint.
- Rotate the right front tire one revolution forward and one revolution backward while observing the right front halfshaft and universal joint.
- **Does the LH or RH front halfshaft rotate?**

Yes : Go to **PINPOINT TEST B.**

No : GO to H27.

H27 CHECK FOR IWE VACUUM LEAKS

- Key in OFF position.
- Disconnect both vacuum lines from the IWE solenoid.
- Using a vacuum pump, apply 508 mm (20 in) Hg of vacuum to the IWE apply vacuum circuit.
- Observe the vacuum reading.
- **Did the vacuum drop more than 25 mm (1 in) Hg per minute?**

Yes : CHECK the IWE and related components for leaks. Go to **PINPOINT TEST B.**

No : GO to H28.

H28 CHECK 2H TO 4H SHIFT AT SPEED ABOVE 32 KM/H (20 MPH)

- Switch the MSS to 2H.
- Drive the vehicle on the road and shift from 2H to 4H while driving above 32 km/h (20 mph).
- **Does the transfer case shift to 4H satisfactorily?**

Yes : The 4x4 system is functioning correctly.

No : Go to **PINPOINT TEST E.**

Pinpoint Test I: The Instrument Cluster 4L And 4H Indicators Do Not Operate Correctly/Do Not Operate/Flash

Normal Operation

The 4x4 high indicator status is transmitted to the instrument cluster from the 4x4 module (PCM) through the controller area network (CAN), circuits 1827 (WH/LG) and 1828 (PK/LG). A steady indicator displays whether the vehicle is in 4x4 LOW or 4x4 HIGH, according to the driver selection. Flashing 4x4 high and 4x4 low indicators is an indication that the instrument cluster has lost communication with the 4x4 module (PCM). For information about CAN, refer to **MODULE COMMUNICATIONS NETWORK** .

Possible Causes

- 4x4 system fault
- CAN circuits:
 - 1827 (WH/LG)
 - 1828 (PK/LG)
- 4x4 module (PCM)
- Instrument cluster
- Transfer case

Testing

I1 CHECK THE 4x4 INDICATOR PROVE-OUT

- Key in OFF position.
- Key in ON position.
- **Do the 4x4 indicators prove out correctly?**

Yes : GO to I2.

No : CHECK the instrument cluster for faults. REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** .

I2 CHECK FOR DTCs

- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs present?**

Yes : REFER to the **4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index** for diagnosis.

No : GO to I3.

I3 CHECK THE INDICATORS IN 2H

- Switch the MSS to 2H.
- **Do any of the 4x4 indicator(s) illuminate?**

Yes : GO to I5.

No : GO to I4.

I4 CHECK THE INDICATORS IN 4H

- Switch the MSS to 4H.
- Monitor the 4H instrument cluster indicator.
- **Does only the 4H instrument cluster indicator illuminate?**

Yes : GO to I6.

No : GO to I7.

I5 CHECK THE PIDS IN 2H

NOTE: If it is difficult to read the motor position, use the active command to energize the transfer case motor contact plate position return circuit.

- Monitor the IWE solenoid state PID and transfer case shift motor contact plate PIDS in 2H.

MODE SELECT SWITCH POSITION

Mode Select Switch Position	Contact Plate Position			
	1 (A)	2 (B)	3 (C)	4 (D)
2H/A4WD	CLOSED	OPEN	CLOSED	CLOSED
4H	OPEN	CLOSED	CLOSED	OPEN
4L	OPEN	CLOSED	OPEN	CLOSED

- **Do the PIDs indicate that IWE solenoid is energized (or ON) and that the motor is in the 2H position?**

Yes : CHECK the instrument cluster for faults. REFER to **INSTRUMENT CLUSTER** .

No : Go to **PINPOINT TEST C**.

I6 CHECK THE INDICATORS IN 4L

- With the vehicle at a stop, brake applied and transmission in NEUTRAL, switch the MSS to 4L.
- Monitor the 4L instrument cluster indicator.
- **Does only the 4L instrument cluster indicator illuminate?**
Yes : The 4x4 indicators are operating correctly. CARRY OUT the electronic shift on the fly (ESOF) functional TEST. Go to **PINPOINT TEST H.**
No : GO to I8.

I7 CHECK THE PIDS IN 4H

- Switch the MSS to 4H.

NOTE: If it is difficult to read the motor position, use the active command to energize the transfer case motor contact plate position return circuit.

- Monitor the IWE solenoid state PID and transfer case shift motor contact plate PIDS in 4H.

MODE SELECT SWITCH POSITION

Mode Select Switch Position	Contact Plate Position			
	1 (A)	2 (B)	3 (C)	4 (D)
2H/A4WD	CLOSED	OPEN	CLOSED	CLOSED
4H	OPEN	CLOSED	CLOSED	OPEN
4L	OPEN	CLOSED	OPEN	CLOSED

- **Do the PIDs indicate that IWE solenoid is de-energized (or OFF) and that the motor is in 4H position?**

Yes : CHECK the instrument cluster for faults. REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** .

No : Go to **PINPOINT TEST C.**

I8 CHECK THE PIDS IN 4L

NOTE: If it is difficult to read the motor position, use the active command to energize the transfer case motor contact plate position return circuit.

- Monitor the IWE solenoid state PID and the transfer case shift motor contact plate PIDs in 4L.

MODE SELECT SWITCH POSITION

Mode Select Switch Position	Contact Plate Position			
	1 (A)	2 (B)	3 (C)	4 (D)
2H/A4WD	CLOSED	OPEN	CLOSED	CLOSED
4H	OPEN	CLOSED	CLOSED	OPEN
4L	OPEN	CLOSED	OPEN	CLOSED

- **Do the PIDs indicate that IWE solenoid is de-energized (or OFF)?**

Yes : CHECK the instrument cluster for faults. REFER to **INSTRUMENT CLUSTER AND**

PANEL ILLUMINATION .

No : Go to PINPOINT TEST D.

Pinpoint Test J: The Vehicle Binds In Turns/Resists Turning/Pulsates/Shudders In a Straight Line in A4WD Mode

Normal Operation

When the vehicle is operating in A4WD (4H/4L), all four wheels receive the same amount of torque and rotate at the same speed. The amount of traction the vehicle can achieve depends on the amount of traction each tire can establish with the road surface. In order for the 4WD system to function correctly, each tire must be in good condition and the front and rear axle ratios must match.

Possible Causes

- Unmatched tire sizes
- Unequal amounts of tire wear
- Unequal tire inflation pressures
- Unmatched front and rear axle ratios

Testing

NOTE: **4x4 high/low (4H/4L) is not intended for driving on hard/dry surfaces.**

J1 VERIFY THE CONCERN

- Test drive the vehicle on a straight stretch of road in A4WD mode.
- Drive the vehicle through turns and parking lot maneuvers.
- **Does the vehicle bind, pulsate or shudder?**

Yes : If the problem occurs in A4WD mode, GO to J2; If 4x4 high mode or 4x4 low mode, binding is a normal condition.

No : Go to PINPOINT TEST G.

J2 CHECK THE 4x4 INDICATORS

- Review the test drive notes.
- **Did any of the instrument cluster 4x4 indicators illuminate or flash?**

Yes : If the 4x4 high or 4x4 low indicators flashed, GO to J4. If the 4x4 high or 4x4 low indicators stayed illuminated, GO to J3.

No : GO to J5.

J3 VERIFY THE FAULT

- Review the test drive notes.
- **Was 4x4 High or 4x4 Low selected when the 4x4 indicators were illuminated?**

Yes : The system is functioning correctly.

No : The fault may have been caused by an intermittent, uncommanded or autolock shift. TEST the system for normal operation, Go to PINPOINT TEST G.

J4 CHECK FOR DTCs

- Connect the diagnostic tool.
- Carry out the on-demand self-test.

- **Are DTCs retrieved?**

Yes : REFER to the 4x4 Module (PCM) Diagnostic Trouble Code (DTC) Index for diagnosis.

No : GO to J5.

J5 VERIFY THE CONCERN

- Disconnect: Transfer Case C350.
- Test drive the vehicle on a straight stretch of road and in turns, and shift the transfer case through each mode. Record any fault conditions.
- **Is the concern present?**

Yes : Vehicles with limited slip rear differential: The condition may be normal and no repair action is necessary. CHECK the rear axle to verify. REFER to DRIVELINE SYSTEM-GENERAL INFORMATION .

Vehicles without limited slip rear differential: INSPECT the driveline components for damage or wear. REFER to INSPECTION AND VERIFICATION PROCEDURE.

No : GO to J6.

J6 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID

- Connect: Transfer Case C350.
- CLEAR the DTCs.
- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record.
- Monitor the transfer case clutch duty cycle (pulse width modulated-(PWM)) PID at closed throttle, engine off, key ON.
- **Is the clutch duty cycle greater than 10%?**

Yes : GO to J7.

No : CHECK the transfer case. REFER to TRANSFER CASE - AUTOMATIC SHIFT .

J7 CHECK THE 4WD SHAFT SPEED PIDs

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record.
- While driving the vehicle at 30 km/h (18 mph), monitor the shaft speed PIDs.
- Compare the speedometer reading to the wheel speed PIDs.
- **Do the wheel speed PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**

Yes : GO to J8.

No : VERIFY that the four road wheels are the same size and have similar tread depth. CHECK the ABS system for faults. REFER to ANTI-LOCK CONTROL .

J8 CHECK THE 4WD THROTTLE POSITION PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record.
- Slowly move throttle from closed throttle to WOT and observe the 4WD throttle position PID.
- **Does the value vary between 0% at closed throttle and 100% at WOT?**

Yes : GO to J9.

No : CHECK the throttle position sensor and/or PCM for faults. See INTRODUCTION - GASOLINE article .

J9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT

- Raise the vehicle on a hoist. Refer to JACKING & LIFTING .

- Rotate the front driveshaft by hand.
- **Does the front driveshaft rotate freely (does it require less than 45 Nm (33 lb-ft) to rotate)?**

Yes : INSTALL a new 4x4 module. REFER to **ELECTRONIC ENGINE CONTROLS** .
REPEAT the self-test. TEST the system for normal operation.

No : CHECK the transfer case. REFER to **TRANSFER CASE - AUTOMATIC SHIFT** .
TEST the system for normal operation.

REMOVAL AND INSTALLATION

FOUR-WHEEL DRIVE (4WD) CONTROL MODULE

Removal and Installation

NOTE: **The 4-wheel drive (4WD) control module is integral to the powertrain control module (PCM) and is not serviced separately.**

For additional information, refer to **ELECTRONIC ENGINE CONTROLS** .