

2007 TRANSMISSIONS

Four Wheel Drive (4WD) Systems - Explorer, Explorer Sport Trac & Mountaineer

SPECIFICATIONS

MATERIAL

Material

Item	Specification	Fill Capacity
Motorcraft Transfer Case Fluid XL-12	-	1.4L (3.0 pt)
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B	-
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4	-

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nm	lb-ft	lb-in
4X4 control module screws	5	-	44
Transfer case shift motor bolts	10	-	89
Transfer case shift motor heat shield bolts	16	12	-

DESCRIPTION AND OPERATION

FOUR WHEEL DRIVE (4WD) SYSTEMS

There are 3 types of 4WD operating systems:

- All wheel drive (AWD)
- One-speed torque-on-demand (TOD)
- Two-speed TOD

All Wheel Drive (AWD)

The AWD system utilizes the following components:

- Transfer case
- Differential (internal to the transfer case)

1-Speed Torque-On-Demand (TOD)

The one-speed TOD system utilizes the following components:

- Transfer case
- Electromagnetic clutch (internal to the transfer case)

- 4X4 control module
- Message center, used to select between AUTO and LOCKED modes.

2-Speed Torque-On-Demand (TOD)

The automatic 4WD system is a 2-speed TOD design that utilizes the following components:

- Transfer case
- Electromagnetic clutch (internal to the transfer case)
- 4X4 control module
- Mode select switch (MSS), used to select between 4X4 AUTO, 4X4 HIGH and 4X4 LOW modes
- Transfer case shift motor
- Encoder assembly (part of the transfer case shift motor)
- Shift motor sense plate (part of the encoder assembly)

DIAGNOSTIC TESTS

FOUR WHEEL DRIVE (4WD) SYSTEMS - ALL WHEEL DRIVE (AWD)

Principles of Operation

The automatic, all wheel drive (AWD) transfer case has no external controls. A 2-piece aluminum case houses the assembly. The unit is chain-driven. A differential provides torque to the front and rear transfer case outputs. The differential transmits torque at the ratio of 40% to the front output and 60% to the rear output.

Torque flows through the input shaft to the front planetary gear assembly outward to the ring gear to the upper output shaft. Torque also flows through the front planetary gear assembly to the overdrive sun gear outward to the upper drive sprocket. The torque flow continues from the upper drive sprocket through the drive chain to the lower drive sprocket to the front output shaft. The differential provides the connection between the ring gear and the overdrive sun gear.

Inspection and Verification - All Wheel Drive (AWD)

NOTE: Driving habits as well as road and weather conditions should be noted.

1. Road test the vehicle to verify the concern, noting the road speed, engine speed and speed range where the vehicle problem is evident.
2. Raise the vehicle on the hoist and position suitable safety floor stands under the vehicle. Refer to **JACKING AND LIFTING**.
3. Run the vehicle at the road speed where the concern exists. Verify the concern:
 - Engine
 - Transmission
 - Front/rear driveline components
 - Front/rear drive axles
 - Front/rear brake systems
 - Front/rear wheels or tires

- Transfer case
4. Refer to the appropriate Owner's Literature for operating data. Verify the concern as driveline or torsional windup before repairing the transfer case.
 5. Check the tires and vehicle load if the problem is clearly driveline windup and not broken parts.
 6. If the concern is not visually evident, go to **Symptom Chart - All Wheel Drive (AWD)**.

Symptom Chart - All Wheel Drive (AWD)


Symptom Chart - All Wheel Drive (AWD)




Condition	Possible Sources	Action
<ul style="list-style-type: none"> • The transfer case makes noise 	<ul style="list-style-type: none"> • Tire inflation pressure • Tire and wheel size • Tire tread wear • Internal components • Fluid level 	<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 tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again. • 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 TRANSAXLE/TRANSMISSION - 5R55S</u> . If there is noise in all gears, DISASSEMBLE the transfer case. REFER to <u>TRANSFER CASE</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</u> .
<ul style="list-style-type: none"> • Wheel/tire bounce, vehicle skip 	<ul style="list-style-type: none"> • Tire and wheel size • Internal components • Tire tread wear 	<ul style="list-style-type: none"> • MAKE SURE that all tires and wheels are the same size and that inflation pressures are correct. REFER to <u>SUSPENSION SYSTEM - GENERAL INFORMATION</u> . • 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 TRANSAXLE/TRANSMISSION - 5R55S</u> . If there is noise in all gears, DISASSEMBLE the transfer case. REFER to <u>TRANSFER CASE</u> . CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new

<ul style="list-style-type: none"> Leaking automatic transmission fluid from vent Leaking automatic transmission fluid from transfer case housing 	<ul style="list-style-type: none"> Transfer case Vent tube Transfer case housing bolts Sealant Fluid Transfer case gasket 	<p>parts as necessary.</p> <ul style="list-style-type: none"> DRAIN the fluid to the correct level. REFER to <u>TRANSFER CASE</u> . REPAIR or INSTALL a new vent tube. REFER to <u>TRANSFER CASE</u> . TIGHTEN the bolts to specification. REFER to <u>SPECIFICATIONS</u>. REBUILD with black non-acid cure silicone gasket and sealant. REFER to <u>TRANSFER CASE</u> . DRAIN fluid and FILL with automatic transmission fluid. REFER to <u>TRANSFER CASE</u> . INSTALL a new transfer case gasket. REFER to <u>TRANSFER CASE</u> .
<ul style="list-style-type: none"> Leaking automatic transmission fluid output shaft seals The front axle does not engage correctly 	<ul style="list-style-type: none"> The vent is plugged Output shaft seals Front axle Transfer case clutch Internal components 	<ul style="list-style-type: none"> REPAIR the plugged vent. INSTALL a new output shaft seal. REFER to <u>TRANSFER CASE</u> . REFER to <u>DRIVELINE SYSTEM - GENERAL INFORMATION</u> . DISASSEMBLE the transfer case. REFER to <u>TRANSFER CASE</u> . CHECK the planetary gears, the bearings, the upper and lower drive sprockets and drive chain for damage. INSTALL new parts as necessary.

FOUR WHEEL DRIVE (4WD) SYSTEMS - 1-SPEED TORQUE-ON-DEMAND

Special Tools

Illustration	Tool Name	Tool Number
 <p>ST2834-A</p>	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	

	73III Automotive Meter	105-R00057 or equivalent
	88 Digital Multimeter or equivalent	105-R0053
	Flex Probe Kit	105-R025B

Principles of Operation

The one-speed torque-on-demand (TOD) transfer case modes are controlled through the 4X4 control module.

The modes are:

- All wheel drive (AWD) AUTO - torque is supplied to the front and rear driveshaft as needed to maintain traction. AWD mode can be changed to AWD LOCKED mode by pressing the message center SETUP button; the message AWD AUTO will be displayed, press RESET within 4 seconds, then the message AWD LOCKED will be displayed and the 4x4 indicator will be illuminated.
- AWD locked - torque is supplied to the front and rear driveshaft constantly and the 4x4 indicator will stay illuminated in the instrument cluster (IC). This mode is not recommended for use on dry pavement or hard surfaces. AWD mode can be changed to AWD AUTO mode by pressing the message center SETUP button; the message AWD LOCKED will be displayed, press RESET within 4 seconds, the message AWD AUTO will be displayed and the 4x4 indicator will turn off.

If the transfer case begins to overheat, the system will default to the Auto Lock mode. The 4x4 indicator will illuminate in the IC. This condition may clear without any action being taken by the driver. The 4x4 indicator will turn off when the system cools down.

When a problem is detected in the AWD system, the powertrain malfunction indicator (wrench indicator) in the IC will illuminate.

Inspection and Verification

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"> • Power distribution box

<ul style="list-style-type: none"> • Axle shafts and CV joints • Driveshaft and universal joints • Fluid leaks • Matching tire sizes 	<p>(PDB) fuse:</p> <ul style="list-style-type: none"> ○ 26 (20A) <ul style="list-style-type: none"> • Smart junction box (SJB) fuses: <ul style="list-style-type: none"> ○ 4 (20A) ○ 18 (10A) • 4X4 control module • Wiring harness • Connector(s) • Circuitry
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3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:

- check the VCM connection to the vehicle.
- check the scan tool connection to the VCM.
- refer to MODULE COMMUNICATIONS NETWORK , No Power To The Scan Tool, to diagnose no communication with the scan tool.

NOTE: Before carrying out the self-test, make sure:

- the ignition key is in the ON position.
- to diagnose no response from the powertrain control module (PCM), refer to CHARGING SYSTEM - GENERAL INFORMATION .

6. If the scan tool does not communicate with the vehicle:

- verify the ignition key is in the ON position.
- verify the scan tool operation with a known good vehicle.
- refer to MODULE COMMUNICATIONS NETWORK to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.

- If the scan tool responds with no communication for one or more modules, refer to MODULE COMMUNICATIONS NETWORK .
- If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the DTCs and carry out the self-test diagnostics for the 4X4 control module.

NOTE: Before carrying out the on-demand self-test, make sure that:

- the ignition is in RUN.
- all doors are closed.
- the brake pedal is not pressed.
- the transmission is not in NEUTRAL.

9. If the DTCs retrieved are related to the concern, go to the 4X4 Control Module DTC Chart. For all other DTCs, refer to MULTIFUNCTION ELECTRONIC MODULES.

10. If no DTCs related to the concern are retrieved, go to Symptom Chart - Four Wheel Drive (4WD).

4X4 Control Module DTC Chart

4X4 CONTROL MODULE DTC CHART

DTC	Description	Source	Action
B1317	Battery Voltage HIGH	4X4 Control Module	REFER to <u>CHARGING SYSTEM - GENERAL INFORMATION</u> .
B1318	Battery Voltage LOW	4X4 Control Module	REFER to <u>CHARGING SYSTEM - GENERAL INFORMATION</u> .
B1342	ECU is Defective	4X4 Control Module	CLEAR the DTCs. REPEAT the 4X4 control module self-test. If DTC B1342 is retrieved, INSTALL a new 4X4 control module. REFER to <u>4X4 Control Module</u> . CLEAR the DTCs. REPEAT the self-test.
B1555	Ignition Run/Start Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test B</u> .
P1824	4-Wheel Drive Clutch Relay Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test B</u> .
P1825	4-Wheel Drive Low Clutch Relay Open Circuit	4X4 Control Module	Go to <u>Pinpoint Test B</u> .
P1826	4-Wheel Drive Low Clutch Relay Short Circuit to Battery	4X4 Control Module	Go to <u>Pinpoint Test B</u> .
P1827	4-Wheel Drive Low Clutch Relay Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test B</u> .
P183B	Transfer Case Shift Motor Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test B</u> .
U1900	CAN Communication BUS Fault	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK</u> .
U2023	External Node Fault	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK</u> .
U2050	Application Not Programmed	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK</u> .

Symptom Chart - Four Wheel Drive (4WD)

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the 4X4 control module 	<ul style="list-style-type: none"> Scan tool Power distribution box (PDB) fuse: <ul style="list-style-type: none"> 26 (20A) Power supply: <ul style="list-style-type: none"> SBB26 (YE/RD) hot at all times A_CPP18 (GY/OG) run/start Smart junction box (SJB) fuses: <ul style="list-style-type: none"> 4 (20A) (OBD II) 18 (10A) Ground circuit: <ul style="list-style-type: none"> GD145 (BK/BU) 4X4 control module Charging system 4x4 indicator 4X4 control module Power distribution box (PDB) fuse: <ul style="list-style-type: none"> 26 (20A) Circuit RCF13 (GY/BK) Transfer case clutch Powertrain control module (PCM) CAN communication network Instrument cluster (IC) 	<ul style="list-style-type: none"> Go to <u>Pinpoint Test A.</u>
<ul style="list-style-type: none"> The vehicle does not shift between AWD AUTO and AWD LOCKED correctly 		<ul style="list-style-type: none"> Go to <u>Pinpoint Test B.</u>

<ul style="list-style-type: none"> • The 4x4 indicator does not operate correctly/does not operate 	<ul style="list-style-type: none"> • IC • 4WD system fault • CAN communication network • 4X4 control module • Ignition switch and/or circuitry 	<ul style="list-style-type: none"> • Go to <u>Pinpoint Test C.</u>
<ul style="list-style-type: none"> • Straight Line driveline wind-up 	<ul style="list-style-type: none"> • Unmatched tire sizes • Unequal amounts of tire wear • Unequal tire inflation pressures • Unmatched front and rear axle ratios 	<ul style="list-style-type: none"> • Go to <u>Pinpoint Test D.</u>
<ul style="list-style-type: none"> • The transfer case makes noise 	<ul style="list-style-type: none"> • Tire inflation pressure • Tire and wheel size • Tire tread wear • Internal components 	<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 tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again. • 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 TRANSAXLE/TRANSMISSION - 5R55S</u> . If there is noise in all gears, DISASSEMBLE the transfer case. REFER to <u>TRANSFER CASE</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

	<ul style="list-style-type: none"> • Fluid level 	<p>fluid. REFER to <u>TRANSFER CASE</u> .</p>
<ul style="list-style-type: none"> • The vehicle binds in turns/resists turning/pulsates/shudders in a straight line 	<ul style="list-style-type: none"> • Unmatched tire sizes • Unequal amounts of tire wear • Unequal tire inflation pressures • Unmatched front and rear axle ratios 	<ul style="list-style-type: none"> • Go to <u>Pinpoint Test F.</u>
<ul style="list-style-type: none"> • Unable to duplicate customer concern 	<ul style="list-style-type: none"> • 4x4 indicator • 4X4 control module • Transfer case and related components • Wheel/tire assemblies 	<ul style="list-style-type: none"> • CARRY OUT the AWD System Functional Test. Go to <u>Pinpoint Test E.</u>

Pinpoint Tests

Pinpoint Test A: No Communication With the 4X4 Control Module

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

In order for the 4X4 control module to communicate with the scan tool, the operating voltage required to supply the 4X4 control module is in a range between 9 and 16 volts. Voltage is supplied at all times by circuit SBB26 (YE/RD). Run/Start voltage is supplied by circuit A_CBP18 (GY/OG).

Possible Causes

- CAN communication
- Scan tool
- Smart junction box (SJB) fuses:
 - 4 (20A)
 - 18 (10A)
- Power distribution box (PDB) fuse:
 - 26 (20A)
- Power supply:
 - Circuit SBB26 (YE/RD)
 - Circuit A_CBP18 (GY/OG)

- Ground circuit GD145 (BK/BU)
- 4X4 control module
- Charging system

PINPOINT TEST A: NO COMMUNICATION WITH THE 4X4 CONTROL MODULE

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

A1 CHECK CAN COMMUNICATION

NOTE: To distinguish between a loss of CAN communication to the 4X4 control module and a loss of CAN communication with the entire vehicle, the ABS module CAN communication is verified because it uses CAN for diagnostics.

- Verify CAN communication with the anti-lock brake system (ABS) module.
 - If using the scan tool, follow the directions and carry out the network test.
 - If using VCM, verify that the vehicle and engine selection information are correct.

- **Does the scan tool communicate with the ABS module?**

YES : Go to A2.

NO : REFER to the appropriate scan tool manual for further diagnosis.

A2 CHECK THE FUSES

- Check SJB fuse 18 (10A), SJB fuse 4 (20A) and PDB fuse 26 (20A).

- **Are the fuses okay?**

YES : Go to A3.

NO : REPAIR as necessary. REPEAT the self-test.

A3 CHECK FOR BATTERY VOLTAGE FROM THE FUSE CAVITIES

- Key in ON position.
- Measure the voltage between SJB input side fuse cavity 18 and ground.
- Measure the voltage between SJB input side fuse cavity 4 and ground.
- Measure the voltage between PDB input side fuse cavity 26 and ground.

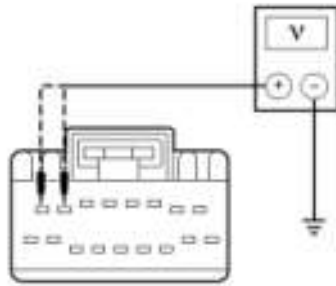
- **Are the voltages greater than 9 volts?**

YES : Go to A4.

NO : REPAIR or INSTALL new components as necessary. REPEAT the self-test.

A4 CHECK FOR VOLTAGE INPUT TO THE 4X4 CONTROL MODULE

- Disconnect: 4X4 Control Module C281b
- Key in ON position.



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Fig. 1: Checking For Voltage Input To 4WD Control Module
 Courtesy of FORD MOTOR CO.

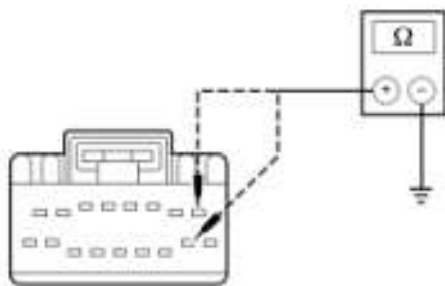
- Measure the voltage between 4X4 control module C281b circuits, harness side and ground as follows:

C281b Pin	Circuit
7	A_CBP18 (GY/OG)
8	SBB26 (YE/RD)

- Are the voltages greater than 9 volts?
 YES : Go to A5.
 NO : REPAIR the affected circuit(s). REPEAT the self-test.

A5 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.



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Fig. 2: Measuring Resistance Between 4X4 Control Module C281A Circuits, Harness Side & Ground
 Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281a circuits, harness side and ground as follows:

C281a Pin	Circuit
1	GD138

	(BK/WH)
10	GD145 (BK/BU)

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

YES : Go to A6.

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

A6 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 : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

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

Pinpoint Test B: The Vehicle Does Not Shift Between AWD AUTO and AWD LOCKED Correctly

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

With the key in the ON position, the 4X4 control module receives the operator's choice of all wheel drive selection from the message center. The 4X4 control module then controls the electric clutch. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4X4 control module.

Possible Causes

- 4x4 indicator
- Transfer case
- 4X4 control module
- Circuit:
 - CCFO3 (GY/BN)
- Transfer case clutch
- Ignition switch and/or circuitry
- CAN communication network
- Instrument cluster (IC)

PINPOINT TEST B: THE VEHICLE DOES NOT SHIFT BETWEEN AWD AUTO AND AWD LOCKED CORRECTLY

B1 CHECK 4x4 INDICATOR PROVE-OUT

- Key in OFF position.
- Start the vehicle while observing the 4x4 indicator prove-out.
- **Did the 4x4 indicator prove out?**

YES : Go to B2.

NO : CHECK the instrument cluster (IC) for faults. REFER to **INSTRUMENT CLUSTER** .

B2 CHECK THE POWERTRAIN MALFUNCTION INDICATOR

- Start the engine.
- Observe the powertrain malfunction indicator.
- **Does the powertrain malfunction indicator illuminate?**

YES : Go to B3.

NO : Go to B5.

B3 CARRY OUT THE ON-DEMAND SELF TEST

- Connect the diagnostic tool.
- Carry out the 4X4 control module on-demand self test.
- **Does the self-test execute correctly?**

YES : Go to B4.

NO : Go to **Pinpoint Test A**.

B4 VERIFY THE DTCs

- Review the on-demand self test results.
- **Did the 4X4 control module on-demand self test yield any DTCs.**

YES : Go to B5.

NO : CHECK the IC for faults. REFER to **INSTRUMENT CLUSTER** .

B5 CHECK FOR 4x4 INDICATOR ILLUMINATION

- Select AWD LOCKED.
- **Does the 4x4 indicator illuminate?**

YES : Go to B6.

NO : Go to B18.

B6 CHECK FOR WIND-UP IN AWD LOCKED MODE

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

YES : Go to B11.

NO : Go to B7.

B7 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID

- Key in ON position.
- 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 wide open throttle (WOT), with the transfer case in AWD LOCKED mode, engine off, key on.
- **Does the clutch duty cycle PID indicate 98% clutch at WOT?**

YES : Go to B8.

NO : Go to B10.

B8 CHECK FOR VOLTAGE ON CLUTCH POWER CIRCUIT CCF03 (GY/BN)

- Carefully back-probe transfer case C350-16 (early build vehicles) or C3146-2 (late build vehicles), circuit CCF03 (GY/BN).
- Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter.

- Use the scan tool active commands to cycle the transfer case clutch to 98 percent.
- **Is the voltage greater than 8.5 volts?**
YES : END the active command. CHECK the transfer case. REFER to **TRANSFER CASE** .
NO : END the active command. Go to B9 .

B9 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Transfer Case C350 (Early build vehicles) or Transfer Case C3146 (Late build vehicles)
- Disconnect: 4X4 Control Module C281a

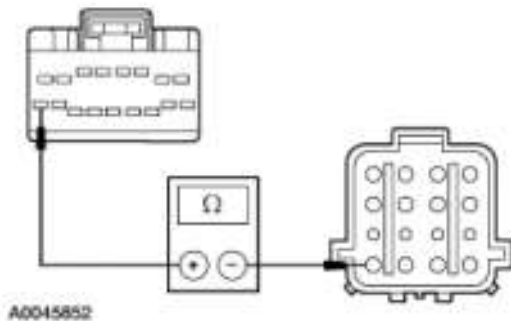


Fig. 3: Checking Circuit CCF03 (GY/BN) For Open (1 Of 2)
 Courtesy of FORD MOTOR CO.

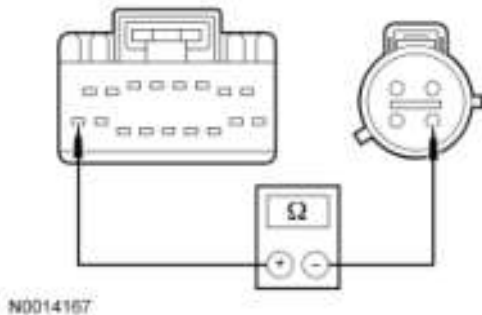


Fig. 4: Checking Circuit CCF03 (GY/BN) For Open (2 Of 2)
 Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-16 (early build vehicles) or C3146-2 (late build vehicles) harness side, and 4X4 control module C281a-17 harness side, circuit CCF03 (GY/BN).
- **Is the resistance less than 5 ohms?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. CHECK the system for normal operation.
NO : REPAIR the circuit. CHECK the system for normal operation.

B10 CHECK THE THROTTLE POSITION OUTPUT PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record from 4X4 control module menu
- Monitor the throttle position output PID.
- Slowly move throttle from closed throttle to WOT and observe the throttle position output PID.

- **Does the value vary between 0 percent at closed throttle and 100 percent at WOT?**

YES : Go to B8.

NO : CHECK the throttle position sensor and/or PCM. REFER to the **Introduction - Gasoline Engines** .

B11 CHECK THE 4x4 INDICATOR IN AWD AUTO MODE

- Select AWD AUTO.
- **Does the 4x4 indicator turn off?**

YES : Go to B12.

NO : Go to **Pinpoint Test C**.

B12 CHECK FOR WIND-UP IN 4x4 AUTO MODE

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

YES : Go to B13.

NO : The AWD drive system is operating correctly.

B13 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 at closed throttle, engine off, key on.
- **Does the PID indicate 2 to 4 percent clutch application at closed throttle?**

YES : Go to B14.

NO : Go to B16.

B14 CHECK VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN)

- Use the scan tool active commands to energize the transfer case clutch to 4 percent.
- Back-probe transfer case C350-16 (early build vehicles) or C3146-2 (late build vehicles), circuit CCF03 (GY/BN).
- Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter.
- **Is the voltage approximately 0.48 volt?**

YES : END the active command. CHECK the transfer case. REFER to **TRANSFER CASE** .

NO : END the active command. Go to B15 .

B15 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Transfer Case C350 (Early build vehicles) or Transfer Case C3146 (Late build vehicles)
- Disconnect: 4X4 Control Module C281a

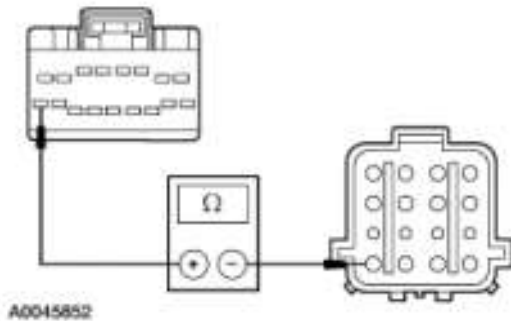


Fig. 5: Checking Circuit CCF03 (GY/BN) For Open (1 Of 2)
 Courtesy of FORD MOTOR CO.

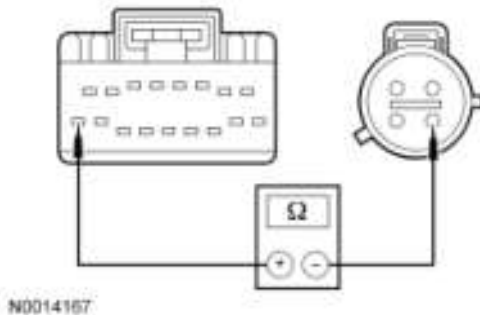


Fig. 6: Checking Circuit CCF03 (GY/BN) For Open (2 Of 2)
 Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-16 (early build vehicles) or C3146-2 (late build vehicles) harness side, and 4X4 control module C281a-17 harness side, circuit CCF03 (GY/BN).
- **Is the resistance less than 5 ohms?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. CHECK the system for normal operation.
NO : REPAIR the circuit. CHECK the system for normal operation.

B16 CHECK THE WHEEL 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 wheel 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 B17.
NO : CHECK the ABS system for faults. REFER to **VEHICLE DYNAMIC SYSTEMS**.

B17 CHECK THE THROTTLE POSITION SENSOR 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 throttle position sensor voltage PID.
- **Does the value vary between 0 percent at closed throttle and 100 percent at WOT?**
YES : INSTALL a new 4X4 control module. REFER to **ELECTRONIC ENGINE CONTROLS**. CHECK the system for normal operation.

NO : CHECK the throttle position sensor and/or PCM for faults. REFER to the **Introduction - Gasoline Engines** .

B18 CHECK THE IGNITION SWITCH STATUS PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Key in ON position.
- Monitor the ignition switch status PID.
- **Does the ignition switch position correspond with the ignition status PID?**

YES : Go to B19.

NO : CHECK the ignition switch circuit(s) and CAN communication network. REFER to **STARTING SYSTEM** and **MODULE COMMUNICATIONS NETWORK** .

B19 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID WITH AWD LOCKED MODE SELECTED

- Monitor the clutch duty cycle PID while switching to AWD LOCKED.
- **Does the clutch duty cycle value equal 10 percent?**

YES : CHECK the IC. REFER to **INSTRUMENT CLUSTER AND PANEL ILLUMINATION** .

NO : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

Pinpoint Test C: The 4x4 Indicator Does Not Operate Correctly/Does Not Operate

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

The four wheel drive (4WD) system status is transmitted to the instrument cluster (IC) from the 4X4 control module through the controller area network (CAN) to the powertrain malfunction indicator. A steady indicator displays if the vehicle is in AWD LOCKED mode, according to the driver selection. A 4WD system fault condition will illuminate the powertrain malfunction indicator. The powertrain malfunction indicator includes other general powertrain system failures. For information about CAN, refer to **MODULE COMMUNICATIONS NETWORK** .

Possible Causes

- Instrument cluster (IC)
- 4WD system fault
- CAN circuits
- 4X4 control module

PINPOINT TEST C: THE 4x4 INDICATOR DOES NOT OPERATE CORRECTLY/DOES NOT OPERATE

C1 CHECK THE 4x4 INDICATOR PROVE-OUT

- Key in ON position.
- Observe the 4x4 indicator in the instrument cluster (IC).
- **Does the 4x4 indicator prove out correctly?**

YES : Go to C2.

NO : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

C2 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC index for diagnosis.

NO : Go to C3.

C3 CHECK FOR INCORRECT 4x4 INDICATOR ILLUMINATION

- Select AWD AUTO.
- Observe the IC.
- **Does the 4x4 indicator illuminate?**

YES : Go to C4.

NO : Go to C5.

C4 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 clutch duty cycle PID read 2 percent at closed throttle?**

YES : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

NO : Go to **Pinpoint Test B**.

C5 CHECK THE 4x4 INDICATOR

- Select AWD LOCKED.
- Observe the IC.
- **Does the 4WD indicator illuminate?**

YES : CHECK the AWD system. Go to **Pinpoint Test E**.

NO : Go to **Pinpoint Test B**.

Pinpoint Test D: Straight Line Driveline Wind-up

Normal Operation

In order for the all wheel drive (AWD) 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

PINPOINT TEST D: STRAIGHT LINE DRIVELINE WIND-UP

NOTE: **AWD LOCKED mode is not intended for driving on hard/dry surfaces.**

D1 VERIFY THE CONCERN

- Drive the vehicle and switch from AWD AUTO to AWD LOCKED. There should be minimal wind-up in AWD LOCKED mode during straight line maneuvers (wind-up in turns is normal; AWD LOCKED is not intended for driving on hard/dry surfaces).

- **Is excessive wind-up present?**

YES : Go to D2.

NO : RETURN the vehicle to the customer. ADVISE about correct AWD system operation and normal vehicle behavior.

D2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

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

YES : Go to D3.

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

D3 CHECK TIRE WEAR

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

YES : Go to D4.

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

D4 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 D5.

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

D5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match. Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** .
- **Do the front and rear axle ratios match?**

YES : RETURN the vehicle to the customer and ADVISE about correct AWD usage and normal vehicle behavior.

NO : CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to **REAR DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR** and **FRONT DRIVE AXLE/DIFFERENTIAL - DANA 30** .

Pinpoint Test E: All Wheel Drive (AWD) System Functional Test

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

When the vehicle is operating in all-wheel drive (AWD) LOCKED mode, the front and rear driveshaft 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 AWD system to operate correctly, each wheel/tire assembly must have matching sizes, and the front and rear axle ratios must match.

Possible Causes

- 4x4 indicator
- 4X4 control module
- Transfer case and related components
- Wheel/tire assemblies

PINPOINT TEST E: ALL WHEEL DRIVE (AWD) SYSTEM FUNCTIONAL TEST

NOTE: AWD LOCKED mode is not intended for driving on hard/dry surfaces.

E1 CHECK THE AWD LOCKED INDICATOR PROVE-OUT

- Key in ON position.
- **Does the AWD indicator illuminate at prove out?**
YES : Go to E2.
NO : CHECK the instrument cluster (IC). REFER to **INSTRUMENT CLUSTER** .

E2 CHECK THE AWD AUTO OPERATION

- Select AWD AUTO.
- **Is the 4x4 indicator off?**
YES : Go to E5.
NO : Go to E3.

E3 CHECK FOR DTCs

- Connect the diagnostic tool.
- Carry out the 4X4 control module on-demand self test.
- **Are DTCs present?**
YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.
NO : Go to E4.

E4 CHECK FOR WIND-UP IN AWD AUTO

- Drive the vehicle on a dry, hard surface in turns.
- **Is wind-up present in turns?**
YES : Go to **Pinpoint Test B**.
NO : Go to **Pinpoint Test C**.

E5 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 2 to 4 percent clutch application at closed throttle?**
YES : Go to E6.
NO : Go to **Pinpoint Test B**.

E6 CHECK THE 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 the rear wheel speed.
- **Do the front shaft speed and rear shaft speed values match within 1.5 km/h (1 mph)?**
YES : Go to E7.
NO : CHECK the ABS system. REFER to VEHICLE DYNAMIC SYSTEMS and VERIFY that the 4 road tire sizes match.

E7 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 control module.
- Key ON, engine OFF.
- Slowly move throttle from closed throttle to WOT and observe the 4X4 control module throttle sensor PID.
- **Does the PID value vary between 0 percent at closed throttle and 100 percent at WOT?**
YES : Go to E8.
NO : CHECK the throttle position sensor and/or PCM. REFER to the Introduction - Gasoline Engines .

E8 CHECK FOR WIND-UP IN TURNS ON THE THROTTLE

- Drive the vehicle on a dry, hard surface, executing turns while applying the throttle.
- **Is wind-up present?**
YES : CHECK the transfer case. REFER to TRANSFER CASE .
NO : Go to E9.

E9 CHECK THE AWD LOCKED OPERATION

- Select AWD LOCKED.
- **Does the 4x4 indicator illuminate correctly?**
YES : Go to E10.
NO : Go to E11.

E10 CHECK FOR AWD LOCKED WIND-UP

- Drive the vehicle on a dry, hard surface in turns.
- **Is wind-up present in turns?**
YES : Go to E13.
NO : Go to Pinpoint Test B.

E11 CHECK FOR DTCs

- Connect the diagnostic tool.
- Carry out the 4X4 control module on-demand self test.
- **Are DTCs present?**
YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.
NO : Go to E12.

E12 CHECK FOR WIND-UP IN AWD LOCKED ON THE THROTTLE

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.

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

YES : Go to **Pinpoint Test C.**

NO : Go to **Pinpoint Test B.**

E13 CHECK THE AWD AUTO OPERATION

- Select AWD AUTO.
- **Does the 4x4 indicator turn off?**
YES : The AWD system is operating correctly.
NO : Go to E14.

E14 CHECK FOR DTCs

- Carry out the on-demand self test.
- **Are DTCs retrieved?**
YES : REFER the 4X4 Control Module DTC Chart.
NO : Go to E15.

E15 CHECK FOR WIND-UP IN AWD AUTO

- Drive the vehicle on a dry, hard surface in turns.
- **Is wind-up present in turns?**
YES : Go to **Pinpoint Test C.**
NO : Go to **Pinpoint Test B.**

Pinpoint Test F: The Vehicle Binds in Turns/Resists Turning/Pulsates/Shudders in a Straight Line

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

When the vehicle is operating in all wheel drive locked (AWD) LOCKED mode, the front and rear driveshaft 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 AWD system to operate correctly, each wheel/tire assembly must have matching sizes 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

PINPOINT TEST F: THE VEHICLE BINDS IN TURNS/RESISTS TURNING/PULSATES/SHUDDERS IN A STRAIGHT LINE

NOTE: **AWD LOCKED mode is not intended for driving on hard/dry surfaces.**

F1 VERIFY THE CONCERN

- Test drive the vehicle on a straight stretch of road in AWD AUTO mode.

- Drive the vehicle through turns and parking lot maneuvers.

- **Does the vehicle bind, pulsate or shudder?**

YES : If the problem occurs in AWD AUTO mode, go to F2 ; in AWD LOCKED mode, binding is a normal condition.

NO : Go to **Pinpoint Test E**.

F2 CHECK THE 4x4 INDICATOR

- Review the test drive notes.

- **Did the 4x4 indicator or the powertrain malfunction indicator illuminate?**

YES : If the powertrain malfunction indicator is illuminated, go to F4 . If the 4x4 indicator stayed illuminated, go to F3 .

NO : Go to F5.

F3 VERIFY THE FAULT

- Review the test drive notes.

- **Was AWD LOCKED selected when the indicators were illuminated?**

YES : The system is functioning correctly.

NO : The fault may have been caused by an intermittent, un-commanded or auto lock shift. TEST the system for normal operation. Go to **Pinpoint Test E**.

F4 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to F5.

F5 VERIFY THE CONCERN

- Disconnect: Transfer Case C350 (Early build vehicles) or Transfer Case C3146 (Late build vehicles)
- 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 **REAR DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR** .

Vehicles without limited slip rear differential: INSPECT the driveline components for damage or wear. REFER to **Inspection and Verification**.

NO : Go to F6.

F6 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID

- Connect: Transfer Case C350 (Early build vehicles) or Transfer Case C3146 (Late build vehicles)
- 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 percent?**

YES : Go to F7.

NO : CHECK the transfer case. REFER to **TRANSFER CASE** .

F7 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 shaft speed PIDs.
- **Do the wheel speed PIDs and speedometer speeds match within 1.5 km/h (1 mph)?**

YES : Go to F8.

NO : VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the ABS system for faults. REFER to **VEHICLE DYNAMIC SYSTEMS** .

F8 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 percent at closed throttle and 100 percent at WOT?**

YES : Go to F9.

NO : CHECK the throttle position sensor and/or PCM for faults. REFER to the **Introduction - Gasoline Engines** .

F9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT



- Raise the vehicle on a hoist. Refer to **JACKING AND LIFTING** .
- Rotate the front driveshaft by hand.
- **Does the front driveshaft rotate freely (does it require less than 45 N.m (33 lb-ft) to rotate)?**



YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. REPEAT the self-test. TEST the system for normal operation.

NO : CHECK the transfer case. REFER to **TRANSFER CASE** . TEST the system for normal operation.

FOUR WHEEL DRIVE (4WD) SYSTEMS - 2-SPEED TORQUE-ON-DEMAND, EARLY BUILD EXPLORER SPORTTRAC

Special Tools

Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent

 ST1177-A	88 Digital Multimeter or equivalent	105-R0053
 ST2574-A	Flex Probe Kit	105-R025B

Principles of Operation

The vehicle is equipped with an automatic electronic-shift system that allows the operator to choose between 3 different four wheel drive (4WD) modes. The operator can switch between 4x4 AUTO and 4x4 HIGH modes at any speed below 88 km/h (55 mph). The operator can switch between 4x4 AUTO and 4x4 HIGH at any speed. To engage or disengage 4x4 LOW mode, the vehicle speed must be less than 3 km/h (2 mph) and the transmission must be in NEUTRAL.

Wheel slip is sensed by monitoring the average front and rear wheel speeds. Based on steering wheel angle (SWA), accelerator pedal position and wheel slip, a pulse width modulated (PWM) signal is transmitted to the transfer case as torque is required.

The 4X4 control module will provide the anti-lock brake system (ABS) with current clutch duty cycle and whether or not ABS may command the clutch duty cycle.

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

- Occurrences of brake events and failures. Refer to **VEHICLE DYNAMIC SYSTEMS** .
- Steering wheel angle status. Refer to **VEHICLE DYNAMIC SYSTEMS** .
- Wheel speeds. Refer to **VEHICLE DYNAMIC SYSTEMS** .

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

The accelerator pedal position output signal is provided to the 4X4 control module from the powertrain control module (PCM). This signal is used by the 4X4 control module in controlling the transfer case clutch. The transfer case shift motor sense plate, an integral part of the assembly, informs the 4X4 control module of the transfer case position.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the range fork within the transfer case between the HIGH range (4x4 AUTO and 4x4 HIGH modes) and low range (4x4 LOW) positions.

The 4X4 control module varies the torque sent to the front driveline by controlling the transfer case clutch. At rest and under cruising conditions, the 4X4 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 driveshaft which normally occurs when negotiating a corner on dry pavement. Under any of the following conditions, the 4X4 control module will increase the duty cycle in order to prevent or control slip:

- Slip is detected
- Transfer case shift motor contact plate position inputs A, B, C, D

Feature inputs:

- Mode select switch (MSS)
- SWA
- Transmission range indicator (transmitted from the transmission control module [TCM])
- Wheel speed (transmitted from the ABS module)
- Accelerator pedal position information (transmitted from the PCM)

Feature outputs:

- PWM signal to transfer case clutch
- 4WD message center indicators
- Transfer case shift motor outputs

Shifts between 4x4 AUTO mode and 4x4 HIGH modes can be made at any speed. Listed below are the inputs and outputs needed by the 4X4 control module to execute a change between these modes.

Feature inputs:

- Accelerator pedal position information (transmitted from the PCM)
- MSS
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed (transmitted from ABS module)

Feature outputs:

- Transfer case shift motor outputs
- 4WD message center indicators
- PWM signal to transfer case clutch

When shifting into or out of 4x4 LOW mode, the 4X4 control module requires that the vehicle speed is less than 3 km/h (2 mph) and the transmission is in NEUTRAL.

Feature inputs:

- Accelerator pedal position information (transmitted from the PCM)
- MSS
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed (transmitted from ABS module)

Feature outputs:

- Transfer case shift motor outputs

- 4WD message center indicators
- PWM signal to transfer case clutch

Neutral Tow

The neutral tow feature is a program embedded in the 4X4 control module, which must be activated by a dealer technician. The neutral tow feature disengages the wheels from the powertrain by shifting the transfer case to the NEUTRAL position. This allows the vehicle to be towed with all 4 wheels on the ground. To activate the neutral tow feature, the dealer technician must access the 4X4 control module through the scan tool and data link connector. Once communication is achieved, the technician can request the neutral tow feature be enabled. The technician must also install the neutral tow indicator lamp (and neutral position sensor for vehicles equipped with 4.6L), in order for the feature to be activated.

Inspection and Verification

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"> • Axle shafts and CV joints • Driveshaft and universal joints • Fluid leaks • Matching tire sizes • Transfer case shift motor 	<ul style="list-style-type: none"> • Power distribution box (PDB) fuses: <ul style="list-style-type: none"> ○ 23 (20A) ○ 26 (20A) • Smart junction box (SJB) fuses: <ul style="list-style-type: none"> ○ 4 (20A) ○ 18 (10A) • 4X4 control module • Wiring harness • Encoder contact plate • Connector(s) • Circuitry • Mode select switch (MSS)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:

- check the VCM connection to the vehicle.
- check the scan tool connection to the VCM.
- refer to **MODULE COMMUNICATIONS NETWORK** , No Power To The Scan Tool, to diagnose no communication with the scan tool.

NOTE: Before carrying out the self-test, make sure:

- the ignition key is in the ON position.
- to diagnose no response from the powertrain control module (PCM). Refer to **CHARGING SYSTEM - GENERAL INFORMATION** .

6. If the scan tool does not communicate with the vehicle:

- verify the ignition key is in the ON position.
- refer to **MODULE COMMUNICATIONS NETWORK** to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.

- If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** .
- If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the DTCs and carry out the self-test diagnostics for the 4X4 control module.

NOTE: Before carrying out the on-demand self test, make sure that:

- the ignition is in RUN.
- all doors are closed.
- the brake pedal is not pressed.
- the transmission is not in NEUTRAL.

9. If the DTCs retrieved are related to the concern, go to the 4x4 Control Module DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** .

10. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Four Wheel Drive (4WD)**.

4X4 Control Module DTC Chart

4X4 CONTROL MODULE DTC CHART

DTC	Description	Source	Action
B1317	Battery Voltage High	4X4 Control Module	REFER to <u>CHARGING SYSTEM - GENERAL INFORMATION</u> .
B1318	Battery Voltage Low	4X4 Control Module	REFER to <u>CHARGING SYSTEM - GENERAL INFORMATION</u> .
B1319	Driver Door Ajar Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test M</u> .
B1322	Driver Door Ajar Circuit Short to Ground	4X4 Control Module	Go to <u>Pinpoint Test M</u> .

B1342	ECU is Defective	4X4 Control Module	CLEAR the DTCs. REPEAT the 4X4 control module self-test. If DTC B1342 is retrieved, INSTALL a new 4X4 control module. REFER to <u>4X4 Control Module</u> . CLEAR the DTCs. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test M.</u>
B1485	Brake Pedal Input Short to Battery	4X4 Control Module	Go to <u>Pinpoint Test M.</u>
B1555	Ignition Run/Start Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test H.</u>
C1729	Transfer Case Unable to Transition Between 4H and 4L	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
C1970	4WD Low Mode Switch LED Short to Battery	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
C1971	4WD Low Mode Switch LED Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
P1707	Transfer Case NEUTRAL or PARK/NEUTRAL Indication Circuit	4X4 Control Module	Go to <u>Pinpoint Test M.</u>
P1812	Transmission 4-Wheel Drive Mode Select Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
P1815	Transmission 4-Wheel Drive Mode Select Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
P1816	Transmission NEUTRAL Safety Switch Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test M.</u>
P1819	Transmission NEUTRAL Safety Switch Circuit Short to Ground	4X4 Control Module	Go to <u>Pinpoint Test M.</u>
P1824	4-Wheel Drive Clutch Relay Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test H.</u>
P1825	4-Wheel Drive Clutch Relay Open Circuit	4X4 Control Module	Go to <u>Pinpoint Test H.</u>
P1826	4-Wheel Drive Low Clutch Relay Short Circuit to Battery	4X4 Control Module	Go to <u>Pinpoint Test H.</u>
P1827	4-Wheel Drive Low Clutch Relay Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test H.</u>
P183B	4-Wheel Drive Clutch Coil Return Circuit Open	4X4 Control Module	Go to <u>Pinpoint Test H.</u>
P1849	Transfer Case Contact Plate A Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
P1853	Transfer Case Contact Plate B Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
P1857	Transfer Case Contact Plate C Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
P1861	Transfer Case Contact Plate D	4X4 Control	Go to <u>Pinpoint Test I.</u>

	Short Circuit to Ground	Module	
P1867	Transfer Case Contact Plate General Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
P1891	Transfer Case Contact Plate Ground Return Open Circuit	4X4 Control Module	Go to <u>Pinpoint Test I.</u>
U1900	CAN Communication BUS Fault	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK .</u>
U2023	External Node Fault	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK .</u>
U2050	Application Not Programmed	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK .</u>

Symptom Chart - Four Wheel Drive (4WD)

Symptom Chart - Four Wheel Drive (4WD)

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the 4X4 control module 	<ul style="list-style-type: none"> Scan tool Power distribution box (PDB) fuse: <ul style="list-style-type: none"> 26 (20A) Smart junction box (SJB) fuses: <ul style="list-style-type: none"> 4 (20A) (OBDII) 18 (10A) Power supply: <ul style="list-style-type: none"> SBB26 (YE/RD) hot at all times A_CBP18 (GY/OG) run/start Ground circuit GD145 (BK/BU) 4X4 control module Charging system 4x4 indicator(s) Transfer case Power distribution box (PDB) fuses: <ul style="list-style-type: none"> 23 (20A) 	<ul style="list-style-type: none"> Go to <u>Pinpoint Test G.</u>

- The vehicle does not shift between 4x4 AUTO and 4x4 HIGH correctly

- The vehicle does not shift between 4x4 AUTO and 4x4 LOW correctly

- The 4x4 indicators do not operate correctly/do not operate

- 26 (20A)
- Smart junction box (SJB) fuse 18 (10A)
- 4X4 control module
- Circuits:
 - RCF13 (WH/BN)
 - CCF13 (WH/BU)
 - A_CBP18 (GY/OG)
- Mode select switch (MSS)
- Transfer case clutch
- Powertrain control module
- Ignition switch and/or circuitry
- CAN communication network
- Instrument cluster (IC)
- Power distribution box (PDB) fuses:
 - 23 (20A)
 - 26 (20A)
- Circuit A_CBP18 (GY/OG)
- Ignition switch and/or circuitry
- Transfer case circuitry
- Instrument cluster
- Four wheel drive (4WD) system fault
- CAN circuits
- 4X4 control

- Go to **Pinpoint Test H.**

- Go to **Pinpoint Test I.**

- Go to **Pinpoint Test J.**

	<p>module</p> <ul style="list-style-type: none"> • Ignition switch and/or circuitry 	
<ul style="list-style-type: none"> • Straight Line driveline wind-up 	<ul style="list-style-type: none"> • Unmatched tire sizes • Unequal amounts of tire wear • Unequal tire inflation pressures • Unmatched front and rear axle ratios 	<ul style="list-style-type: none"> • Go to <u>Pinpoint Test K.</u>
<ul style="list-style-type: none"> • The neutral tow does not operate • The transfer case makes noise 	<ul style="list-style-type: none"> • Power distribution box (PDB) fuse 26 (20A) • 4X4 control module • Neutral tow system indicator • Digital transmission range (TR) sensor 4.0L • Neutral shifter position sensor (4.6L) • Brake ON/OFF (BOO) switch • Door ajar switch • Circuitry: <ul style="list-style-type: none"> • CCF21 (VT/WH) • SBB26 (YE/RD) • Ignition switch • Tire inflation pressure • Tire and wheel size • Tire tread wear 	<ul style="list-style-type: none"> • CARRY OUT the Neutral Tow Functional Test. Go to <u>Pinpoint Test M.</u> • 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 tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel.

	<ul style="list-style-type: none"> • Internal components • Fluid level 	<p>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 TRANSAXLE/TRANSMISSION - 5R55S</u> or <u>AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60</u> . If there is noise in all gears, DISASSEMBLE the transfer case. REFER to <u>TRANSFER CASE</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</u> .
<ul style="list-style-type: none"> • The vehicle binds in turns/resists turning/pulsates/shudders in a straight line 	<ul style="list-style-type: none"> • Unmatched tire sizes • Unequal amounts of tire wear • Unequal tire inflation pressures • Unmatched front and rear axle ratios 	<ul style="list-style-type: none"> • Go to <u>Pinpoint Test L.</u>
<ul style="list-style-type: none"> • Unable to duplicate customer concern 	<ul style="list-style-type: none"> • 4x4 indicators • 4X4 control module • Transfer case and related components • Wheel/tire assemblies 	<ul style="list-style-type: none"> • CARRY OUT the 4WD System Functional Test. Go to <u>Pinpoint Test N.</u>

Pinpoint Tests

Pinpoint Test G: No Communication With the 4X4 Control Module

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

In order for the 4X4 control module to communicate with the scan tool, the operating voltage required to supply the 4X4 control module is in a range between 9 and 16 volts. Voltage is supplied at all times by circuit SBB26 (YE/RD). Run/Start voltage is supplied by circuit A_CBP18 (GY/OG).

Possible Causes

- CAN communication
- Scan tool
- Smart junction box (SJB) fuses:
 - 4 (20A)
 - 18 (10A)
- Power distribution box (PDB) fuse:
 - 26 (20A)
- Power supply:
 - Circuit SBB26 (YE/RD)
 - Circuit A_CBP18 (GY/OG)
- Ground circuit GD145 (BK/BU)
- 4X4 control module
- Charging system

PINPOINT TEST G: NO COMMUNICATION WITH THE 4X4 CONTROL MODULE

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

G1 CHECK THE CAN COMMUNICATION

NOTE: To distinguish between a loss of CAN communication to the 4X4 control module and a loss of CAN communication with the entire vehicle, the ABS module CAN communication is verified because it uses CAN for diagnostics.

- Verify CAN communication with the anti-lock brake system (ABS) module.
 - If using the scan tool, follow the directions and carry out the network test.
 - If using VCM, verify that the vehicle and engine selection information are correct.
- **Does the scan tool communicate with the ABS module?**
 - YES :** Go to G2.
 - NO :** REFER to the appropriate scan tool manual for further diagnosis.

G2 CHECK THE FUSES

- Check SJB fuse 18 (10A), SJB fuse 4 (20A) and PDB fuse 26 (20A).
- **Are the fuses okay?**
 - YES :** Go to G3.
 - NO :** REPAIR as necessary. REPEAT the self-test.

G3 CHECK FOR BATTERY VOLTAGE FROM THE FUSE CAVITIES

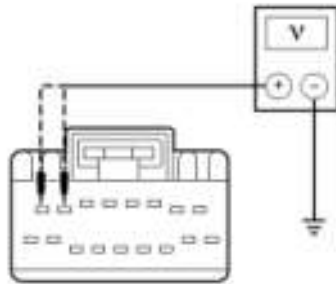
- Key in ON position.
- Measure the voltage between SJB input side fuse cavity 18 and ground.
- Measure the voltage between SJB input side fuse cavity 4 and ground.
- Measure the voltage between PDB input side fuse cavity 26 and ground.
- **Are the voltages greater than 9 volts?**

YES : Go to G4.

NO : REPAIR or INSTALL new components as necessary. REPEAT the self-test.

G4 CHECK FOR VOLTAGE INPUT TO THE 4X4 CONTROL MODULE

- Disconnect: 4X4 Control Module C281b
- Key in ON position.



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Fig. 7: Checking For Voltage Input To 4WD Control Module
Courtesy of FORD MOTOR CO.

- Measure the voltage between 4X4 control module C281b circuits, harness side and ground as follows:

C281b Pin	Circuit
7	A_CBP18 (GY/OG)
8	SBB26 (YE/RD)

- **Are the voltages greater than 9 volts?**

YES : Go to G5.

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

G5 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.

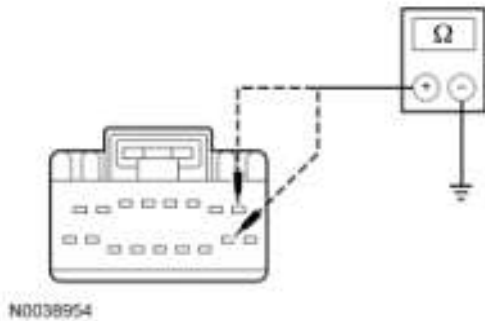


Fig. 8: Measuring Resistance Between 4X4 Control Module C281A Circuits, Harness Side & Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281a circuits, harness side and ground as follows:

C281a Pin	Circuit
1	GD138 (BK/WH)
10	GD145 (BK/BU)

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

YES : Go to G6.

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

G6 CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING

- Key in START position.
- Measure the battery voltage at the positive battery terminal.
- **Is the voltage greater than 9 volts?**

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

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

Pinpoint Test H: The Vehicle Does Not Shift Between 4x4 AUTO and 4x4 HIGH Correctly

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

With the key in the ON position, the 4X4 control module receives the operator's choice of 4WD selection from the mode select switch (MSS). The 4X4 control module then controls the electric clutch and transfer case shift motor. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4X4 control module.

Possible Causes

- 4WD indicators
- Transfer case
- 4X4 control module
- Circuits:
 - RCF13 (WH/BN)
 - CCF03 (GY/BN)
 - CCF13 (WH/BU)
- Transfer case clutch
- Ignition switch and/or circuitry
- CAN communication network
- Instrument cluster (IC)

PINPOINT TEST H: THE VEHICLE DOES NOT SHIFT BETWEEN 4x4 AUTO AND 4x4 HIGH CORRECTLY

H1 CHECK 4x4 INDICATORS PROVE-OUT

- Key in OFF position.
- Start the vehicle while observing the 4x4 indicators prove-out.
- **Did the indicators prove out?**

YES : Go to H2.

NO : CHECK the instrument cluster (IC). REFER to **INSTRUMENT CLUSTER** .

H2 CHECK THE POWERTRAIN MALFUNCTION INDICATOR

- Start the engine.
- Observe the powertrain malfunction indicator.
- **Does the powertrain malfunction indicator illuminate?**

YES : Go to H3.

NO : Go to H4.

H3 CARRY OUT THE 4X4 CONTROL MODULE ON-DEMAND SELF TEST

- Connect the diagnostic tool.
- Carry out the 4X4 control module on-demand self test.
- **Did the self test complete?**

YES : Go to H4.

NO : Go to **Pinpoint Test G**.

H4 REVIEW THE ON-DEMAND SELF TEST

- Review the on-demand self test results.
- **Were DTCs retrieved?**

YES : Go to H5.

NO : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

H5 CHECK FOR 4x4 INDICATOR ILLUMINATION

- Select 4x4 HIGH.
- **Does the 4x4 indicator illuminate?**

YES : Go to H6.

NO : Go to H18.

H6 CHECK FOR WIND-UP IN 4x4 HIGH

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

YES : Go to H11.

NO : Go to H7.

H7 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID

- Key in ON position.
- 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 wide open throttle (WOT), with the transfer case in 4x4 HIGH, engine off, key on.
- **Does the clutch duty cycle PID indicate 98 percent clutch at WOT?**

YES : Go to H8.

NO : Go to H10.

H8 CHECK FOR VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN) DURING ACTIVE COMMAND

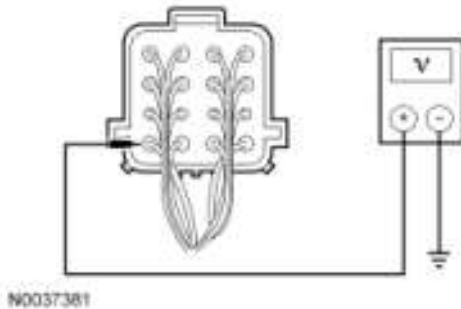


Fig. 9: Checking Voltage On Clutch Power Circuit CCF03 (GY/BN) During Active Command
Courtesy of FORD MOTOR CO.

- Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).
- Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter.
- Use the scan tool active commands to cycle the transfer case clutch to 98 percent.
- **Is the voltage greater than 8.5 volts?**

YES : END the active command. CHECK the transfer case. REFER to **TRANSFER CASE** .

NO : END the active command. Go to H9 .

H9 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Transfer Case C350
- Disconnect: 4X4 Control Module C281a

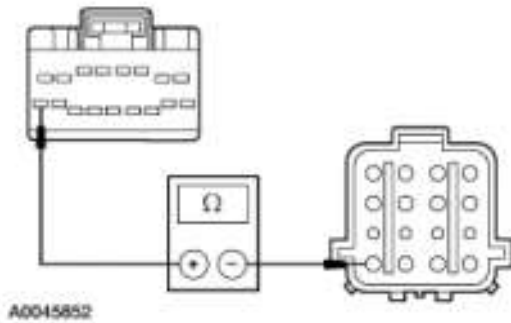


Fig. 10: Checking Circuit CCF03 (GY/BN) For Open (1 Of 2)
 Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-16 harness side, and 4X4 control module C281a-17 harness side, circuit CCF03 (GY/BN).
- **Is the resistance less than 5 ohms?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.
NO : REPAIR the circuit. CHECK the system for normal operation.

H10 CHECK THE THROTTLE POSITION OUTPUT PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record from 4X4 control module menu
- Monitor the throttle position output PID.
- Slowly move throttle from closed throttle to WOT and observe the throttle position output PID.
- **Does the value vary between 0 percent at closed throttle and 100 percent at WOT?**
YES : Go to H8.
NO : CHECK the throttle position sensor and/or PCM. REFER to the **Introduction - Gasoline Engines** .

H11 CHECK THE 4x4 INDICATOR IN 4x4 AUTO

- Select 4x4 AUTO.
- **Does the 4x4 indicator turn off?**
YES : Go to H12.
NO : Go to **Pinpoint Test J**.

H12 CHECK FOR WIND-UP IN 4x4 AUTO

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.
- **Is wind-up present in turns?**
YES : Go to H13.
NO : The 4WD drive system is operating correctly.

H13 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 at closed throttle, engine off, key on.
- **Does the PID indicate 2 to 4 percent clutch application at closed throttle?**
YES : Go to H14.
NO : Go to H16.

H14 CHECK VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN)

- Use the scan tool active commands to energize the transfer case clutch to 4 percent.

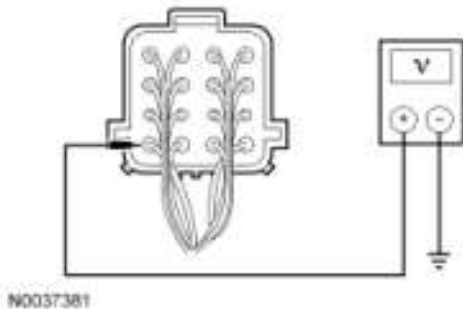


Fig. 11: Checking Voltage On Clutch Power Circuit CCF03 (GY/BN) During Active Command

Courtesy of FORD MOTOR CO.

- Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).
- Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter.
- **Is the voltage approximately 0.48 volt?**
YES : END the active command. CHECK the transfer case. REFER to **TRANSFER CASE** .
NO : END the active command. Go to H15 .

H15 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN

- Disconnect: Transfer Case C350
- Disconnect: 4X4 Control Module C281a

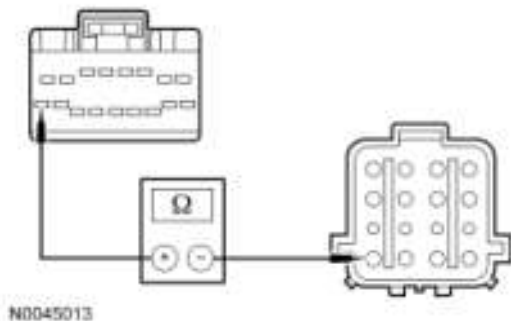


Fig. 12: Measuring Resistance Between Transfer Case C350-16 Harness Side, 4X4 Control Module C281A-17 & CCF03 (GY/BN)

Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-16 harness side, and 4X4 control module C281a-17 harness side, circuit CCF03 (GY/BN).
- **Is the resistance less than 5 ohms?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.
NO : REPAIR the circuit. CHECK the system for normal operation.

H16 CHECK THE WHEEL 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 wheel 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 H17.

NO : CHECK the ABS system for faults. REFER to **VEHICLE DYNAMIC SYSTEMS** .

H17 CHECK THE THROTTLE POSITION SENSOR 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 throttle position sensor voltage PID.

- **Does the value vary between 0 percent at closed throttle and 100 percent at WOT?**

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

NO : CHECK the throttle position sensor and/or PCM for faults. REFER to the **Introduction - Gasoline Engines** .

H18 CHECK THE IGNITION SWITCH STATUS PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Key in ON position.
- Monitor the ignition switch status PID.

- **Does the ignition switch position correspond with the ignition status PID?**

YES : Go to H19.

NO : CHECK the ignition switch circuit(s) and CAN communication network. REFER to **STARTING SYSTEM** and **MODULE COMMUNICATIONS NETWORK** .

H19 CHECK THE MSS PID IN 4x4 HIGH

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Monitor the MSS PID while switching to 4x4 HIGH.

- **Do the MSS PID indicate 4x4 HIGH?**

YES : Go to H20.

NO : Go to H21.

H20 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID WITH THE MSS IN 4x4 HIGH

- Monitor the clutch duty cycle PID while switching to 4x4 HIGH.

- **Does the clutch duty cycle value equal 10 percent?**

YES : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

NO : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

H21 CHECK THE MSS

- Key in OFF position.
- Disconnect: MSS C284

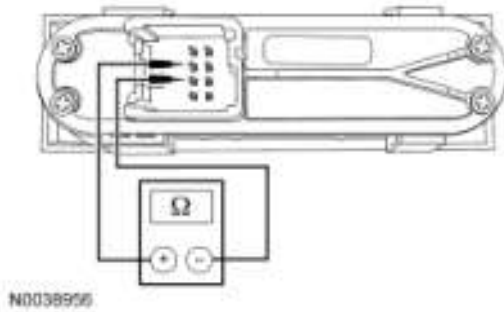


Fig. 13: Measuring Resistance Between MSS C284-2, Component Side & C284-3
 Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2, component side and C284-3, component side. Refer to the following chart:

MSS Position	Resistance (± 1 percent)
4x4 AUTO	39 ohms
4x4 HIGH	237 ohms
4x4 LOW	536 ohms

- **Are the resistances within the specified values?**

YES : Go to H22.

NO : INSTALL a new MSS. REFER to **Mode Select Switch (MSS)**.

H22 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN

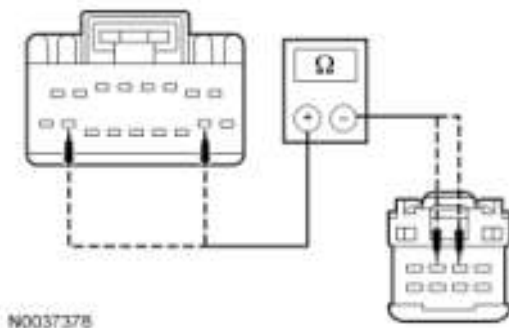


Fig. 14: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Open
 Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2 harness side and 4X4 control module C281b-10 harness side, circuit RCF13 (WH/BN); measure the resistance between MSS C284-3 harness side and 4X4 control module C281b-16 harness side, circuit CCF13 (BU/BK).
 - **Are the resistances less than 5 ohms?**
- YES :** Go to H23.

NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

H23 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO VOLTAGE

- Key in ON position.

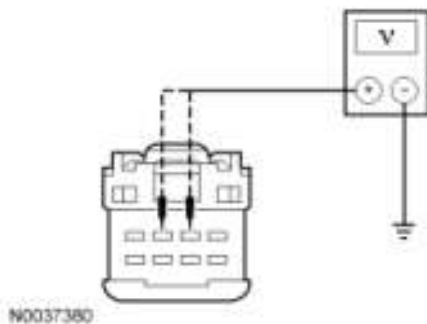


Fig. 15: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Short To Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-2, circuit RCF13 (WH/BN) and ground; measure the voltage between MSS C284-3, circuit CCF13 (WH/BU) and ground.

- **Is voltage present?**

YES : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

NO : Go to H24.

H24 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO GROUND

- Key in OFF position.

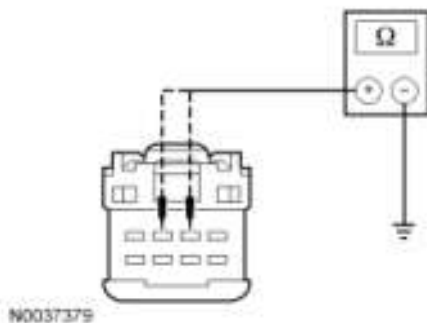


Fig. 16: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2, circuit RCF13 (WH/BN) and ground; measure the resistance between MSS C284-3, circuit CCF13 (WH/BU) and ground.

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

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test I: The Vehicle Does Not Shift Between 4x4 AUTO and 4x4 LOW Correctly

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

With the key in the ON position, the 4X4 control module receives the operator's choice of four wheel drive selection from the mode select switch (MSS). The 4X4 control module then controls the electric clutch and transfer case shift motor. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4X4 control module.

Possible Causes

- Power distribution box (PDB) fuses:
 - 23 (20A) - transfer case shift motor
 - 26 (20A) - 4X4 control module
- Smart junction box (SJB) fuse 18 (10A)
- 4x4 LOW indicator
- 4x4 LOW LED
- Mode select switch (MSS)
- Transfer case
- Transfer case shift motor
- 4X4 control module
- ABS module
- Circuit CCF03 (GY/BN)
- CAN

PINPOINT TEST I: THE VEHICLE DOES NOT SHIFT BETWEEN 4x4 AUTO AND 4x4 LOW CORRECTLY

I1 CHECK FOR DTCs

- Key in ON position.
- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs retrieved?**

YES : If C1729, go to I27 . If C1970, go to I15 . If C1971, go to I16 . If P1812, go to I9 . If P1815, go to I12 . If P1849, P1853, P1857 or P1861, go to I26 . If P1867 or P1891, Go to I24 .

NO : Go to I2.

I2 MONITOR THE 4x4 LOW LED SWITCH

- Select 4x4 LOW:
 - press the brake pedal.
 - vehicle at rest.
 - transmission in NEUTRAL.
- Monitor the 4x4 LOW LED.
- **Does the 4x4 LOW LED blink then stay illuminated?**

YES : Go to I3.

NO : Go to I4.

I3 VERIFY THE 4x4 LOW LED STATE

- Monitor the 4x4 LOW LED.
- **Does the 4x4 LOW LED continue blinking?**

YES : Go to I4.

NO : Go to I8.

I4 VERIFY THE 4x4 LOW LED STATE

- Monitor the 4x4 LOW LED.
- **Does the 4x4 LOW LED illuminate constantly?**

YES : Go to I5.

NO : Go to I17.

I5 MONITOR THE 4x4 LOW INDICATOR (CLUSTER)

- Monitor the 4x4 LOW instrument cluster (IC) indicator.
- **Is the 4x4 LOW IC indicator illuminated?**

YES : Go to I6.

NO : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

I6 CHECK FOR WIND-UP IN TURNS ON THROTTLE

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

YES : Go to I7.

NO : Go to I18.

I7 CHECK FOR GEAR REDUCTION

- While driving the vehicle, monitor the engine rpm and vehicle speed.
- **Does the engine rpm and vehicle speed indicate that the vehicle is in 4x4 LOW (high rpm at low vehicle speed)?**

YES : The system is functioning correctly.

NO : Go to I22.

I8 CHECK THE IGNITION STATUS PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Key in ON position.
- Monitor the ignition status PID.
- **Does the ignition switch position correspond with the ignition status PID?**

YES : Go to I9.

NO : CHECK the ignition switch circuit(s) and CAN communication network. REFER to **MODULE COMMUNICATIONS NETWORK** .

I9 CHECK THE MSS

- Key in OFF position.
- Disconnect: MSS C284

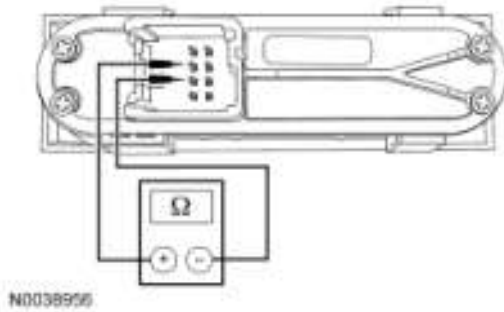


Fig. 17: Measuring Resistance Between MSS C284-2, Component Side & C284-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2, component side and C284-3, component side. Refer to the following chart:

MSS Position	Resistance (± 1 percent)
4x4 AUTO	39 ohms
4x4 HIGH	237 ohms
4x4 LOW	536 ohms

- Are the resistances within the specified values?

YES : Go to I10.

NO : INSTALL a new MSS. REFER to **Mode Select Switch (MSS)**.

I10 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN

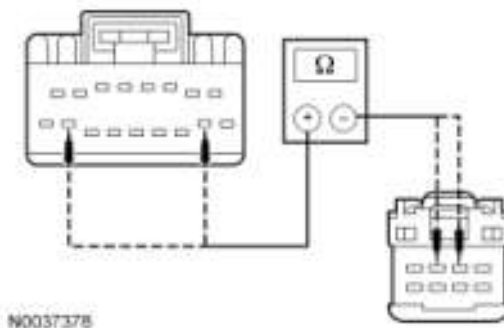


Fig. 18: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2 and 4X4 control module C281b-10, circuit RCF13 (WH/BN); measure the resistance between MSS C284-3 and 4X4 control module C281b-16, circuit CCF13 (WH/BU).
- Are the resistances less than 5 ohms?
YES : Go to I11.

NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

I11 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO VOLTAGE

- Key in ON position.

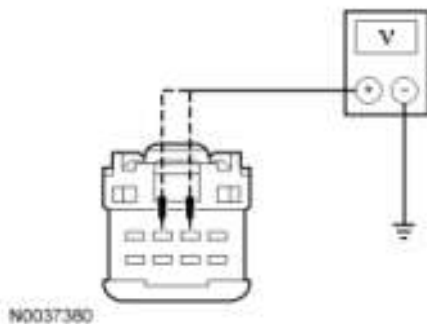


Fig. 19: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Short To Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-2, circuit RCF13 (WH/BN) and ground; measure the voltage between MSS C284-3, circuit CCF13 (WH/BU) and ground.

- **Is voltage present?**

YES : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

NO : Go to I12.

I12 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO GROUND

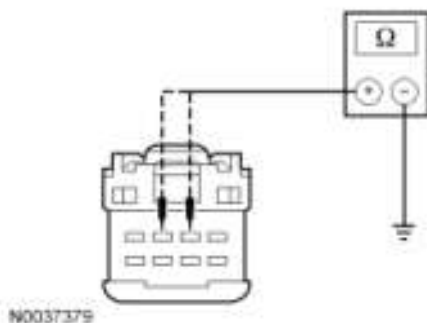


Fig. 20: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2, circuit RCF13 (WH/BN) and ground; measure the resistance between MSS C284-3, circuit CCF13 (WH/BU) and ground.

- **Are the resistances greater than 10,000 ohms?**

YES : Go to I13.

NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

I13 CHECK MSS LED CIRCUIT A_CB P18 (GY/OG) FOR VOLTAGE

- Key in ON position.

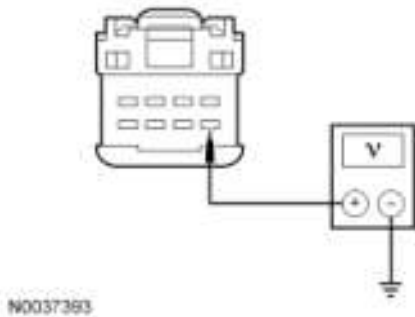


Fig. 21: Checking MSS LED Circuit A CBP18 (GY/OG) For Voltage
 Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-5, circuit A_CBP18 (GY/OG) and ground.
- **Is the voltage greater than 8 volts?**
 YES : Go to I14.
 NO : REPAIR the circuit. TEST the system for normal operation.

I14 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR AN OPEN

- Key in OFF position.

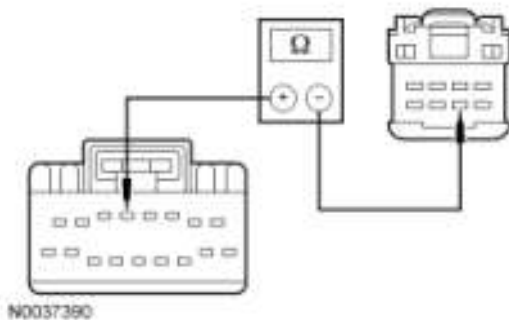


Fig. 22: Checking MSS LED Circuit CCF06 (BU/GN) For Open
 Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-6 and 4X4 control module C281b-5, circuit CCF06 (BU/GN).
- **Is the resistance less than 5 ohms?**
 YES : Go to I15.
 NO : REPAIR the circuit. TEST the system for normal operation.

I15 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR A SHORT TO VOLTAGE

- Key in ON position.

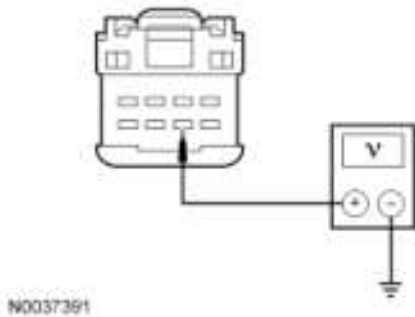


Fig. 23: Checking MSS LED Circuit CCF06 (BU/GN) For Short To Voltage
 Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-6, circuit CCF06 (BU/GN) and ground.
- **Is voltage present?**
YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
NO : Go to I16.

I16 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR A SHORT TO GROUND

- Key in ON position.

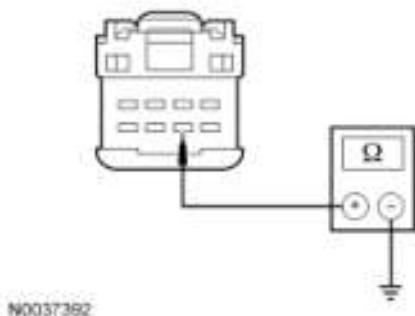


Fig. 24: Checking MSS Led Circuit CCF06 (BU/GN) For Short To Ground
 Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-6, circuit CCF06 (BU/GN) and ground.
- **Is the resistance greater than 10,000 ohms?**
YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
NO : INSTALL a new MSS. REFER to **Mode Select Switch (MSS)**. CLEAR the DTCs. REPEAT the self test.

I17 CHECK THE TRANSMISSION RANGE (TR), BRAKE ON/OFF (BOO) AND SHAFT SPEED PIDs DURING 4x4 LOW SHIFT

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- A. Monitor the 4X4 control module transmission range (TR) sensor status PID while shifting the transmission through gear ranges.
- B. Monitor the 4X4 control module brake ON/OFF (BOO) switch PID while pressing and releasing the brake pedal.
- C. Monitor the 4X4 control module shaft speed PIDs.

- **A.** Does the 4X4 control module transmission range (TR) sensor 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 shaft speed PIDs indicate 0 km/h (0 mph)?

YES : If all 3 PIDs are accurate, go to I24 .

NO : **A.** REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 5R55S** or **AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60** for further diagnosis of the TR sensor and the CAN communication network.

B. REFER to **VEHICLE DYNAMIC SYSTEMS** for further diagnosis of the BOO switch and the CAN communication network.

C. REFER to **VEHICLE DYNAMIC SYSTEMS** for further diagnosis of the ABS system and the CAN communication network.

I18 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID

- Key in ON position.
- 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 wide open throttle (WOT), with the transfer case in 4x4 LOW, engine off, key on.
- **Does the clutch duty cycle PID indicate 98 percent clutch application at WOT?**

YES : Go to I19.

NO : Go to I21.

I19 CHECK FOR VOLTAGE ON THE CLUTCH POWER CIRCUIT CCF03 (GY/BN)

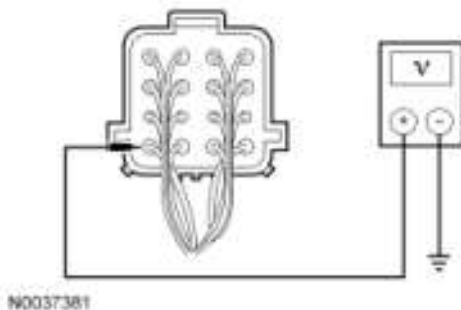


Fig. 25: Checking Voltage On Clutch Power Circuit CCF03 (GY/BN) During Active Command
 Courtesy of FORD MOTOR CO.

- Carefully back-probe the transfer case connector C350-16, circuit CCF03 (GY/BN).
- Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter.
- Use the scan tool active commands to cycle the transfer case clutch to 98 percent.
- **Is the voltage greater than 9 volts?**

YES : End the active command. CHECK the transfer case. REFER to **TRANSFER CASE** .

NO : End the active command. Go to I20 .

I20 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN

- Disconnect: Transfer Case C350
- Disconnect: 4X4 Control Module C281a

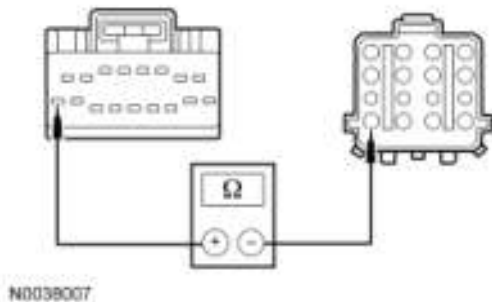


Fig. 26: Checking Circuit CCF03 (GY/BN) For Open
 Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case connector C350-16 harness side, and 4X4 control module C281-17 harness side, circuit CCF03 (GY/BN).
- **Is the resistance less than 5 ohms?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.
NO : REPAIR the circuit. CHECK the system for normal operation.

I21 CHECK THE 4X4 CONTROL MODULE THROTTLE POSITION OUTPUT PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Monitor the 4X4 control module throttle position output PID.
- Slowly move throttle from closed throttle to WOT and observe the throttle position sensor PID.
- **Does the value vary between 0 percent at closed throttle and 100 percent at WOT?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.
NO : CHECK the CAN communication network. REFER to the **Introduction - Gasoline Engines** .

I22 CHECK THE CONTACT PLATE ENCODER PIDs IN 4x4 LOW

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- With the MSS in 4x4 LOW, monitor the contact plate position PIDs. Refer to the following chart:

Contact Plate Position PID	MSS PID 4WD AUTO/4H	MSS PID 4L
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- Do the contact plate position PIDs indicate that the transfer case shift motor is in 4x4 LOW?

YES : Go to I23.

NO : Go to I24.

I23 CHECK THE TRANSFER CASE SHIFT MOTOR

- Remove the transfer case shift motor from the transfer case.
- Rotate the shift cam through all positions.
- Does the transfer case shift cam rotate with difficulty (is the force required to rotate the cam greater than 45 N.m [33 lb-ft])?

YES : REPAIR the transfer case. REFER to TRANSFER CASE . CLEAR the DTCs. REPEAT the self-test.

NO : INSTALL a new transfer case shift motor. REFER to Transfer Case Shift Motor. CLEAR the DTCs. REPEAT the self-test.

I24 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR AN OPEN

- Key in OFF position.
- Disconnect: Transfer Case C350
- Disconnect: 4X4 Control Module C281a

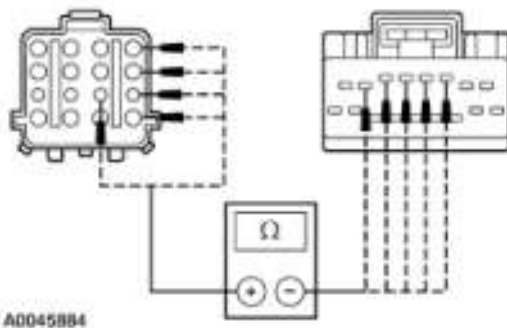


Fig. 27: Measuring Resistance Of Circuits Between 4X4 Control Module C281A, Harness Side & Transfer Case C350

Courtesy of FORD MOTOR CO.

- Measure the resistance of the following circuits between 4X4 control module C281a, harness side and transfer case C350, harness side:

Circuit	C281a	C350
RCF09 (BN/WH)	3	10
CCF17 (WH/OG)	4	13
CCF16 (VT/GN)	5	9
CCF15 (BN/YE)	6	1
CCF14 (GN/OG)	7	5

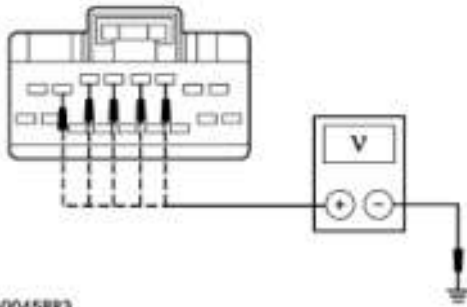
- Are the resistances less than 5 ohms?

YES : Go to I25.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I25 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR A SHORT TO VOLTAGE

- Key in ON position.



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Fig. 28: Measuring Voltage Between Circuits At 4X4 Control Module C281A, Harness Side & Ground
 Courtesy of FORD MOTOR CO.

- Measure the voltage between the following circuits at the 4X4 control module C281a, harness side and ground:

Circuit	C281a
RCF09 (BN/WH)	3
CCF17 (WH/OG)	4
CCF16 (VT/GN)	5
CCF15 (BN/YE)	6
CCF14 (GN/OG)	7

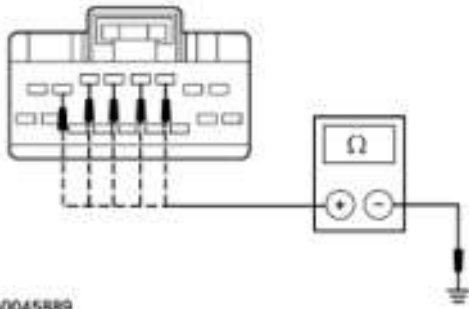
- Is voltage present?

YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

NO : Go to I26.

I26 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR A SHORT TO GROUND

- Key in OFF position.



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Fig. 29: Measuring Resistance Between Circuits At 4X4 Control Module C281A, Harness Side & Ground
 Courtesy of FORD MOTOR CO.

- Measure the resistance between the following circuits at 4X4 control module C281a, harness side and ground:

Circuit	C281a
RCF09 (BN/WH)	3
CCF17 (WH/OG)	4
CCF16 (VT/GN)	5
CCF15 (BN/YE)	6
CCF14 (GN/OG)	7

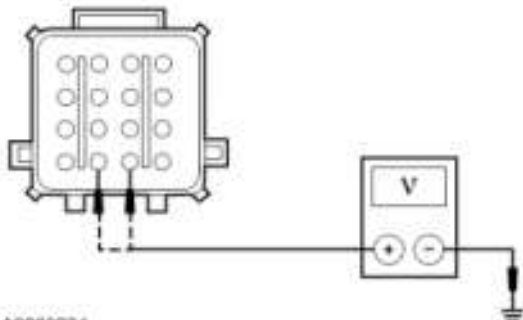
- Are the resistances greater than 10,000 ohms?

YES : Go to I27.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I27 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR POWER DURING ACTIVE COMMANDS

- Connect: 4X4 Control Module C281a
- Enter the following diagnostic mode on the diagnostic tool: Access Active Commands



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Fig. 30: Measuring Voltage Between Transfer Case C350-15 & C350-14, Circuit CCF07 (GN/RD) & CCF08 (GY/OG)

Courtesy of FORD MOTOR CO.

- Enter the clockwise transfer case shift motor active command ON and OFF and measure the voltage between transfer case C350-15, circuit CCF07 (GN/RD) harness side and ground. Enter the counterclockwise transfer case shift motor active command ON and OFF and measure the voltage between transfer case C350-14, circuit CCF08 (GY/OG) harness side and ground.
- **Are the voltages 10 volts or greater while the corresponding active commands are on?**
YES : INSTALL a new transfer case shift motor. CLEAR the DTCs. REPEAT the self-test.
NO : Go to I28.

I28 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR AN OPEN

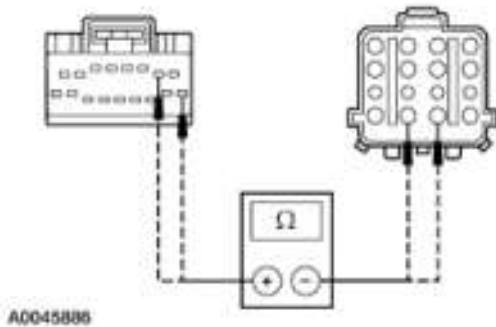


Fig. 31: Checking Circuits CCF08 (GY/OG) And CCF07 (BN/GN) For Open
Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-14, circuit and 4X4 control module C281a-2, harness side, circuit CCF08 (GY/OG).
- Measure the resistance between transfer case C350-15, circuit and 4X4 control module C281a-9, harness side, circuit CCF07 (BN/GN).
- **Are the resistances less than 5 ohms?**
YES : Go to I29.
NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. Go to **Pinpoint Test N**.

I29 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR A SHORT TO VOLTAGE

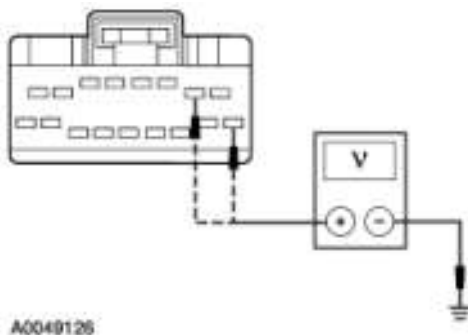


Fig. 32: Checking Circuits CCF08 (GY/OG) And CCF07 (BN/GN) For Short To Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between 4X4 control module C281a-2, circuit CCF08 (GY/OG), harness side and ground.

- Measure the resistance between 4X4 control module C281a-9, circuit CCF07 (BN/GN), harness side and ground.
- **Is voltage present?**
YES : Go to I30.
NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. Go to **Pinpoint Test N**.

I30 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR A SHORT TO GROUND

- Measure the resistance between 4X4 control module C281a-2, circuit CCF08 (GY/OG) harness side and ground.

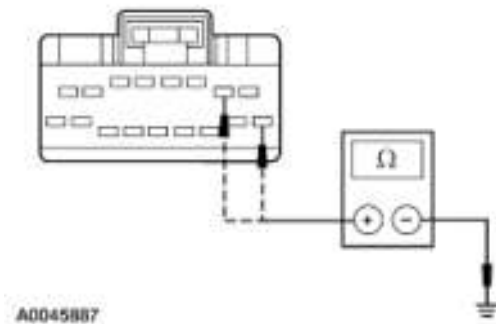


Fig. 33: Checking Circuits CCF08 (GY/OG) And CCF07 (BN/GN) For Short To Ground
 Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281a-9, circuit CCF07 (BN/GN) harness side and ground.
- **Are the resistances greater than 10,000 ohms?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. Go to **Pinpoint Test N**.
NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. Go to **Pinpoint Test N**.

Pinpoint Test J: The 4x4 Indicators Do Not Operate Correctly/Do Not Operate

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive System for schematic and connector information.

Normal Operation

The 4x4 HIGH indicator status is transmitted to the instrument cluster (IC) from the 4X4 control module through the controller area network (CAN). A steady indicator displays whether the vehicle is in 4x4 LOW or 4x4 HIGH, according to the driver selection. A 4WD system fault will cause the powertrain malfunction indicator to illuminate when a 4WD system fault condition has been detected. This light also indicates other general powertrain failures.

Possible Causes

- Instrument cluster (IC)
- 4WD system fault
- CAN circuits
- 4X4 control module

PINPOINT TEST J: THE 4x4 INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE

J1 CHECK THE 4x4 INDICATOR PROVE-OUT

- Key in ON position.
- Observe the 4x4 LOW and 4x4 indicators in the instrument cluster (IC).
- **Do the 4x4 LOW and 4x4 indicators prove out correctly?**

YES : Go to J2.

NO : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

J2 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to J3.

J3 CHECK FOR INCORRECT 4x4 INDICATOR ILLUMINATION

- Select 4x4 AUTO with transmission in NEUTRAL, vehicle at rest, brake pressed and engine running.
- Observe the IC.
- **Do any 4WD IC indicators illuminate?**

YES : Go to J4.

NO : Go to J6.

J4 CHECK THE CONTACT PLATE ENCODER PIDs

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Monitor the contact plate position PIDs. Refer to the following chart:

Contact Plate Position PID	MSS PID 4WD AUTO/4H	MSS PID 4L
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- **Does the contact plate position PID indicate that the transfer case shift motor is in 4WD Auto?**

YES : Go to J5.

NO : Go to **Pinpoint Test I** .

J5 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 clutch duty cycle PID read 2 percent at closed throttle?**

YES : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

NO : Go to **Pinpoint Test H.**

J6 CHECK THE 4x4 INDICATOR

- Select 4x4 HIGH.
- Observe the IC.
- **Does the 4x4 indicator illuminate?**

YES : Go to J7.

NO : Go to **Pinpoint Test H.**

J7 CHECK THE 4x4 INDICATORS

- Observe the IC.
 - **Are other 4x4 indicators illuminated?**
- YES** : CHECK the IC. REFER **INSTRUMENT CLUSTER** .

NO : Go to J8.

J8 CHECK THE 4x4 LOW INDICATOR

- Select 4x4 LOW:
 - vehicle stationary.
 - press the brake.
 - shift the transmission to NEUTRAL.
 - select 4x4 LOW.
 - wait for the 4x4 LOW indicator to illuminate in the IC indicating that the shift is complete.
- **Does the 4x4 LOW indicator illuminate?**

YES : Go to J10.

NO : Go to J9.

J9 CHECK THE 4x4 INDICATORS

- Observe the IC.
 - **Are other 4x4 indicators illuminated?**
- YES** : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

NO : The indicators are working correctly. Go to **Pinpoint Test N.**

J10 CHECK THE CONTACT PLATE ENCODER AND TRANSFER CASE CLUTCH DUTY CYCLE PIDs

- 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.
- Monitor the contact plate encoder PIDs. Refer to the following chart:

Contact Plate PID	MSS PID 4WD AUTO/4H	MSS PID 4L
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- **Does the clutch duty cycle PID read 10 percent with closed throttle and the contact plate position PID indicate that the transfer case shift motor is in 4x4 LOW?**

YES : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

NO : CHECK the four wheel drive (4WD) system. Go to **Pinpoint Test I**.

Pinpoint Test K: Straight Line Driveline Wind-Up

Normal Operation

In order for the four wheel drive (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

PINPOINT TEST K: STRAIGHT LINE DRIVELINE WIND-UP

NOTE: **4x4 HIGH/4x4 LOW is not intended for driving on hard/dry surfaces.**

K1 VERIFY THE CONCERN

- Drive the vehicle and shift from 4x4 AUTO to 4x4 HIGH. There should be minimal wind-up in 4x4 HIGH 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 K2.

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

K2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

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

YES : Go to K3.

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

K3 CHECK TIRE WEAR

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

YES : Go to K4.

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

K4 CHECK THE TIRE INFLATION PRESSURE

- Check the inflation pressure in each tire. Refer to vehicle certification label.

- **Are the tire inflation pressures correct?**

YES : Go to K5.

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

K5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match. Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** .

- **Do the front and rear axle ratios match?**

YES : RETURN the vehicle to the customer and ADVISE about correct 4WD usage and normal vehicle behavior.

NO : CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to **REAR DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR** and **FRONT DRIVE AXLE/DIFFERENTIAL - DANA 30** .

Pinpoint Test L: The Vehicle Binds in Turns/Resists Turning/Pulsates/Shudders in a Straight Line

Normal Operation

When the vehicle is operating in 4x4 AUTO, all 4 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 four wheel drive (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

PINPOINT TEST L: THE VEHICLE BINDS IN TURNS/RESISTS TURNING/PULSATES/SHUDDERS IN A STRAIGHT LINE

NOTE: **4x4 HIGH/4x4 LOW is not intended for driving on hard/dry surfaces.**

L1 VERIFY THE CONCERN

- Test drive the vehicle on a straight stretch of road in 4x4 AUTO mode.
- Drive the vehicle through turns and parking lot maneuvers.
- **Does the vehicle bind, pulsate or shudder?**

YES : If the problem occurs in 4x4 AUTO mode, go to L2 ; in 4x4 HIGH mode or 4x4 LOW mode, binding is a normal condition.

NO : Go to **Pinpoint Test N**.

L2 CHECK THE INDICATORS

- Review the test drive notes.
- **Did any of the instrument cluster (IC) 4x4 indicators or the powertrain malfunction indicator illuminate?**

YES : If the 4x4 or 4x4 LOW indicators stayed illuminated, go to L3 . If the powertrain malfunction indicator stayed illuminated, go to L4 .

NO : Go to L5.

L3 VERIFY THE FAULT

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

YES : The system is functioning correctly.

NO : The fault may have been caused by an intermittent, un-commanded or auto lock shift.

TEST the system for normal operation. Go to **Pinpoint Test N**.

L4 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to L5.

L5 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 **REAR DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR** .

Vehicles without limited slip rear differential: INSPECT the driveline components for damage or wear. REFER to Inspection and Verification.

NO : Go to L6.

L6 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 percent?**

YES : Go to L7.

NO : CHECK the transfer case. REFER to **TRANSFER CASE** .

L7 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 L8.

NO : VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the ABS system for faults. REFER to VEHICLE DYNAMIC SYSTEMS .

L8 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 percent at closed throttle and 100 percent at WOT?**

YES : Go to L9.

NO : CHECK the throttle position sensor and/or PCM for faults. REFER to the Introduction - Gasoline Engines .

L9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT

- Raise the vehicle on a hoist. Refer to JACKING AND LIFTING .
- Rotate the front driveshaft by hand.
- **Does the front driveshaft rotate freely (does it require less than 45 N.m (33 lb-ft) to rotate)?**

YES : INSTALL a new 4X4 control module. REFER to 4X4 Control Module. TEST the system for normal operation.

NO : CHECK the transfer case. REFER to TRANSFER CASE . TEST the system for normal operation.

Pinpoint Test M: Neutral Tow Functional Test

Normal Operation

Neutral tow is a dealer-installed option that allows the vehicle to be towed with the 4 road wheels without damaging the transmission. Neutral tow operates by disengaging the transmission from the rear differential.

Possible Causes

- Neutral tow indicator
- CAN circuits
- Vehicle security module (VSM)
- **4.0L** digital transmission range (TR) sensor
- **4.6L** neutral shifter position sensor
- Brake ON/OFF (BOO) switch
- Door ajar switch
- Ignition switch/circuitry

PINPOINT TEST M: NEUTRAL TOW FUNCTIONAL TEST

M1 CHECK NEUTRAL TOW INDICATOR PROVE-OUT

- Key in ON position.
- Key in OFF position.
- **Does the neutral tow indicator prove out?**

YES : Go to M2.

NO : Go to M7.

M2 CHECK NEUTRAL TOW ACTIVATION

- Activate neutral tow:
 - press and hold the brake pedal.
 - transmission in NEUTRAL.
 - key in OFF position.
 - press the 4x4 AUTO and hold it for 5 seconds.
- **Does neutral tow activate?**
 - YES : Go to M3.
 - NO : Go to M9.

M3 CHECK FOR NEUTRAL TOW INDICATOR TIME-OUT

- Close the driver door.
- Monitor the neutral tow indicator.
- **Does the indicator turn off after 20 seconds?**
 - YES : Go to M4.
 - NO : CHECK the module configuration. REFER to MODULE CONFIGURATION .

M4 CHECK NEUTRAL TOW INDICATION

- Open the driver's door.
- Monitor the neutral tow indicator.
- **Does the neutral tow indicator illuminate?**
 - YES : Go to M5.
 - NO : CHECK the module configuration. REFER to MODULE CONFIGURATION .

M5 CHECK NEUTRAL TOW DEACTIVATION BY IGNITION SWITCH

- Key in ON position.
- **Does neutral tow deactivate?**
 - YES : Go to M6.
 - NO : Go to M9.

M6 CHECK NEUTRAL TOW REACTIVATION

- Reactivate neutral tow:
 - press and hold the brake pedal.
 - transmission in NEUTRAL.
 - key in OFF position.
 - press the 4x4 AUTO and hold it for 5 seconds.
- Deactivate neutral tow by shifting the transmission out of NEUTRAL.
- **Does neutral tow reactivate then deactivate?**
 - YES : The neutral tow system is operating correctly.
 - NO : Go to M10.

M7 CHECK NEUTRAL TOW SYSTEM INSTALLATION

- Verify that the neutral tow system components are installed correctly.
- **Are the neutral tow system components installed correctly?**
 - YES : Go to M8.

NO : INSTALL the neutral tow system components as necessary, then REPEAT the Neutral Tow Functional Test.

M8 CHECK THE NEUTRAL TOW INDICATOR OPERATION

- Connect the diagnostic tool.
- Follow the scan tool directions to activate neutral tow system.
- Monitor the neutral tow indicator.
- Key ON, then key OFF.
- **Does the neutral tow indicator prove out correctly?**

YES : Go to M2.

NO : CHECK and REPAIR neutral tow system wiring as necessary, then REPEAT the Neutral Tow Functional Test.

M9 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION BY ACTIVATING 4x4 LOW

- Key in ON position.
- Select 4x4 LOW:
 - vehicle stationary.
 - press the brake.
 - shift the transmission to NEUTRAL.
 - select 4x4 LOW.
 - wait for the 4x4 LOW indicator to illuminate in the instrument cluster (IC) indicating that the shift is complete.
- **Does the 4x4 LOW indicator illuminate?**

YES : Go to M10.

NO : Go to **Pinpoint Test I**.

M10 CHECK THE NEUTRAL SAFETY SWITCH, BRAKE ON/OFF (BOO) AND IGNITION STATE PIDs

- Connect the scan tool.
- Key in OFF position.
- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- A. Monitor the transmission neutral safety switch status 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 ignition state PID.
- A. Does the 4X4 control module transmission neutral safety switch position PID indicate NEUTRAL when the transmission is shifted to NEUTRAL?

B. Does the BOO switch PID agree with the actual brake pedal positions?

C. Does the ignition state PID indicate OFF?

YES : If all 3 PIDs are accurate, INSTALL a new 4X4 control module, then REPEAT the Neutral Tow Functional Test.

NO : A. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 5R55S** or **AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60** for further diagnosis of the neutral

safety switch.

B. REFER to VEHICLE DYNAMIC SYSTEMS for further diagnosis of the BOO switch.

C. REFER to INSTRUMENT CLUSTER for further diagnosis of the ignition switch.

Pinpoint Test N: Four Wheel Drive (4WD) System Functional Test

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

When the vehicle is operating in 4x4 HIGH or 4x4 LOW, (4H/4L), all 4 wheels 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 operate correctly, each wheel/tire assembly must have matching sizes and the front and rear axle ratios must match.

Possible Causes

- 4x4 indicators
- 4X4 control module
- Transfer case and related components
- Wheel/tire assemblies

PINPOINT TEST N: FOUR WHEEL DRIVE (4WD) SYSTEM FUNCTIONAL TEST

NOTE: 4x4 HIGH/4x4 LOW are not intended for driving on hard/dry surfaces.

N1 CHECK THE 4x4 INDICATOR PROVE-OUT

- Key in ON position.
- **Do the 4x4 indicators illuminate at prove out?**

YES : Go to N2.

NO : CHECK the instrument cluster (IC). REFER to **INSTRUMENT CLUSTER** .

N2 CHECK THE 4x4 AUTO OPERATION

- If in 4x4 LOW, switch the MSS to 4x4 AUTO.
- **Are the 4x4 indicators off?**

YES : Go to N5.

NO : Go to N3.

N3 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to N4.

N4 CHECK FOR WIND-UP IN 4x4 AUTO

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

YES : Go to **Pinpoint Test H.**

NO : Go to **Pinpoint Test I.**

N5 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 2 to 4 percent clutch application at closed throttle?**

YES : Go to N7.

NO : Go to N6.

N6 CHECK THE CONTACT PLATE ENCODER PIDs

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Monitor the contact plate position PIDs. Refer to the following chart:

Contact Plate Position PID	MSS PID 4WD AUTO/4H	MSS PID 4L
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- **Does the contact plate position PID indicate that the transfer case shift motor is in 4x4 Auto?**

YES : Go to **Pinpoint Test H.**

NO : Go to **Pinpoint Test I.**

N7 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 the rear wheel speed.
- **Do the front shaft speed and rear shaft speed values match within 1.5 km/h (1 mph)?**

YES : Go to N8.

NO : CHECK the ABS system. REFER to **VEHICLE DYNAMIC SYSTEMS** and VERIFY that the 4 road tire sizes match.

N8 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 control module.
- Key ON, engine OFF.
- Slowly move throttle from closed throttle to WOT and observe the 4X4 control module throttle sensor PID.
- **Does the PID value vary between 0 percent at closed throttle and 100 percent at WOT?**

YES : Go to N9.

NO : CHECK the throttle position sensor and/or PCM. REFER to the **Introduction - Gasoline Engines** .

N9 CHECK FOR WIND-UP IN TURNS ON THROTTLE

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

YES : CHECK the transfer case. REFER to **TRANSFER CASE** .

NO : Go to N10.

N10 CHECK 4x4 HIGH OPERATION

- Select 4x4 HIGH.
- **Does the 4x4 HIGH indicator illuminate correctly?**

YES : Go to N11.

NO : Go to N12.

N11 CHECK FOR 4x4 HIGH WIND-UP

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

YES : Go to N14.

NO : Go to **Pinpoint Test H.**

N12 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to N13.

N13 CHECK FOR WIND-UP IN 4x4 HIGH ON THROTTLE

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

YES : Go to **Pinpoint Test I.**

NO : Go to **Pinpoint Test H.**

N14 CHECK 4x4 LOW OPERATION

- Select 4x4 LOW:
 - vehicle stationary.
 - press the brake.
 - shift the transmission to NEUTRAL.
 - select 4x4 LOW.
 - wait for the 4x4 LOW indicator to illuminate in the instrument cluster (IC) indicating that the shift is complete.
- **Does the 4x4 LOW indicator illuminate?**

YES : Go to N15.

NO : Go to N16.

N15 CHECK FOR WIND-UP IN 4x4 LOW

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.

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

YES : Go to N19.

NO : Go to N17.

N16 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to N18.

N17 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to **Pinpoint Test H.**

N18 CHECK FOR WIND-UP IN 4x4 LOW

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.

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

YES : Go to **Pinpoint Test H.**

NO : Go to **Pinpoint Test H.**

N19 CHECK 4x4 AUTO OPERATION

- Switch the MSS to 4x4 AUTO.
- **Do the 4x4 indicators turn off?**

YES : The 4WD system is operating correctly.

NO : Go to N20.

N20 CHECK FOR DTCs

- Carry out the on-demand self test.
- **Are DTCs retrieved?**

YES : REFER the 4X4 Control Module DTC Chart.

NO : Go to N21.

N21 CHECK FOR WIND-UP IN 4x4 AUTO

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

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





YES : Go to **Pinpoint Test I.**

NO : Go to **Pinpoint Test H.**

FOUR WHEEL DRIVE (4WD) SYSTEMS - 2-SPEED TORQUE-ON-DEMAND, EXPLORER AND LATE BUILD EXPLORER SPORTTRAC

Special Tools

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Illustration	Tool Name	Tool Number
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool	
 ST1137-A	73III Automotive Meter	105-R0057 or equivalent
 ST1177-A	88 Digital Multimeter or equivalent	105-R0053
 ST2574-A	Flex Probe Kit	105-R025B

Principles of Operation

The vehicle is equipped with an automatic electronic-shift system that allows the operator to choose between 3 different four wheel drive (4WD) modes. The operator can switch between 4x4 AUTO and 4x4 HIGH modes at any speed below 88 km/h (55 mph). The operator can switch between 4x4 AUTO and 4x4 HIGH at any speed. To engage or disengage 4x4 LOW modes, the vehicle speed must be less than 3 km/h (2 mph) and the transmission must be in NEUTRAL.

Wheel slip is sensed by monitoring the average front and rear wheel speeds. Based on steering wheel angle (SWA), accelerator pedal position and wheel slip, a pulse width modulated (PWM) signal is transmitted to the transfer case as torque is required.

The 4X4 control module will provide the anti-lock brake system (ABS) with current clutch duty cycle and whether or not ABS may command the clutch duty cycle.

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

- Occurrences of brake events and failures. Refer to **VEHICLE DYNAMIC SYSTEMS** .
- Steering wheel angle status. Refer to **VEHICLE DYNAMIC SYSTEMS** .
- Wheel speeds. Refer to **VEHICLE DYNAMIC SYSTEMS** .

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

The accelerator pedal position output signal is provided to the 4X4 control module from the powertrain control module (PCM). This signal is used by the 4X4 control module in controlling the transfer case clutch. The transfer case shift motor sense plate, an integral part of the assembly, informs the 4X4 control module

of the transfer case position.

The electric shift motor is mounted externally to the transfer case. It drives a rotary cam which moves the range fork within the transfer case between the HIGH range (4x4 AUTO and 4x4 HIGH modes) and low range (4x4 LOW) positions.

The 4X4 control module varies the torque sent to the front driveline by controlling the transfer case clutch. At rest and under cruising conditions, the 4X4 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 driveshaft which normally occurs when negotiating a corner on dry pavement. Under any of the following conditions, the 4X4 control module will increase the duty cycle in order to prevent or control slip.

- Slip is detected
- Transfer case shift motor contact plate position inputs A, B, C, D

Feature inputs:

- Mode select switch (MSS)
- SWA
- Transmission range indicator (transmitted from the transmission control module [TCM])
- Wheel speed (transmitted from the ABS module)
- Accelerator pedal position information (transmitted from the PCM)

Feature outputs

- PWM signal to transfer case clutch
- 4WD message center indicators
- Transfer case shift motor outputs

Shifts between 4x4 AUTO mode and 4x4 HIGH modes can be made at any speed. Listed below are the inputs and outputs needed by the 4X4 control module to execute a change between any of these modes.

Feature inputs:

- Accelerator pedal position information (transmitted from the PCM)
- MSS
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed (transmitted from ABS module)

Feature outputs:

- Transfer case shift motor outputs
- 4WD message center indicators
- PWM signal to transfer case clutch

When shifting into or out of 4x4 LOW mode, the 4X4 control module requires that the vehicle speed is less than 3 km/h (2 mph) and the transmission is in NEUTRAL.

Feature inputs:

- Accelerator pedal position information (transmitted from the PCM)
- MSS
- Transfer case shift motor encoder contact plate position inputs A, B, C, D
- Wheel speed signal (transmitted from ABS module)

Feature outputs:

- Transfer case shift motor outputs
- 4WD message center indicators
- PWM signal to transfer case clutch

Neutral Tow

The neutral tow feature is a program embedded in the 4X4 control module, which must be activated by a dealer technician. The neutral tow feature disengages the wheels from the powertrain by shifting the transfer case to the NEUTRAL position. This allows the vehicle to be towed with all 4 wheels on the ground. To activate the neutral tow feature, the dealer technician must access the 4X4 control module through the scan tool and data link connector. Once communication is achieved, the technician can request the neutral tow feature be enabled. The technician must also install the neutral tow indicator lamp (and neutral position sensor for vehicles equipped with 4.6L), in order for the feature to be activated.

Inspection and Verification

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">• Axle shafts and CV joints• Driveshaft and universal joints• Fluid leaks• Matching tire sizes• Transfer case shift motor	<ul style="list-style-type: none">• Power distribution box (PDB) fuses:<ul style="list-style-type: none">○ 23 (20A)○ 26 (20A)• Smart junction box (SJB) fuses:<ul style="list-style-type: none">○ 4 (20A)○ 18 (10A)• 4X4 control module• Wiring harness• Encoder contact plate• Connector(s)• Circuitry• Mode select switch (MSS)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

NOTE: Make sure to use the latest scan tool software release.

4. If the cause is not visually evident, connect the scan tool to the data link connector (DLC).

NOTE: The vehicle communication module (VCM) LED prove out confirms power and ground from the DLC are provided to the VCM.

5. If the scan tool does not communicate with the VCM:

- check the VCM connection to the vehicle.
- check the scan tool connection to the VCM.
- refer to **MODULE COMMUNICATIONS NETWORK** , No Power To The Scan Tool, to diagnose no communication with the scan tool.

NOTE: Before carrying out the self-test, make sure that:

- **verify the ignition key is in the ON position.**
- **refer to MODULE COMMUNICATIONS NETWORK to diagnose no response from the powertrain control module (PCM).**

6. If the scan tool does not communicate with the vehicle:

- verify the ignition key is in the ON position.
- refer to **MODULE COMMUNICATIONS NETWORK** to diagnose no response from the powertrain control module (PCM).

7. Carry out the network test.

- If the scan tool responds with no communication for one or more modules, refer to **MODULE COMMUNICATIONS NETWORK** .
- If the network test passes, retrieve and record continuous memory diagnostic trouble codes (DTCs).

8. Clear the DTCs and carry out the self-test diagnostics for the 4X4 control module.

NOTE: Before carrying out the on-demand self test, make sure that:

- **the ignition is in RUN.**
- **all doors are closed.**
- **the brake pedal is not pressed.**
- **the transmission is not in NEUTRAL.**

9. If the DTCs retrieved are related to the concern, go to the 4x4 Control Module DTC Chart. For all other DTCs, refer to **MULTIFUNCTION ELECTRONIC MODULES** .

10. If no DTCs related to the concern are retrieved, go to **Symptom Chart - Four Wheel Drive (4WD)**.

4X4 CONTROL MODULE DTC CHART

DTC	Description	Source	Action
B1317	Battery Voltage High	4X4 Control Module	REFER to <u>CHARGING SYSTEM - GENERAL INFORMATION</u> .
B1318	Battery Voltage Low	4X4 Control Module	REFER to <u>CHARGING SYSTEM - GENERAL INFORMATION</u> .
B1319	Driver Door Ajar Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test U</u> .
B1322	Driver Door Ajar Circuit Short to Ground	4X4 Control Module	Go to <u>Pinpoint Test U</u> .
B1342	ECU is Defective	4X4 Control Module	CLEAR the DTCs. REPEAT the 4WD control module self test. If DTC B1342 is retrieved, INSTALL a new 4WD control module. REFER to 4X4 Control Module . CLEAR the DTCs. REPEAT the self-test.
B1483	Brake Pedal Input Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test U</u> .
B1485	Brake Pedal Input Short to Battery	4X4 Control Module	Go to <u>Pinpoint Test U</u> .
B1555	Ignition Run/Start Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test P</u> .
C1729	Transfer Case Unable to Transition Between 4H and 4L	4X4 Control Module	Go to <u>Pinpoint Test Q</u> .
C1970	4WD Low Mode Switch LED Short to Battery	4X4 Control Module	Go to <u>Pinpoint Test Q</u> .
C1971	4WD Low Mode Switch LED Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test Q</u> .
P1707	Transfer Case NEUTRAL or PARK/NEUTRAL Indication Circuit	4X4 Control Module	Go to <u>Pinpoint Test U</u> .
P1812	Transmission 4-Wheel Drive Mode Select Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test Q</u> .
P1815	Transmission 4-Wheel Drive Mode Select Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test Q</u> .
P1816	Transmission NEUTRAL Safety Switch Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test U</u> .
P1819	Transmission NEUTRAL Safety Switch Circuit Short to Ground	4X4 Control Module	Go to <u>Pinpoint Test U</u> .
P1824	4-Wheel Drive Clutch Relay Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test P</u> .
P1825	4-Wheel Drive Clutch Relay Open Circuit	4X4 Control Module	Go to <u>Pinpoint Test P</u> .
P1826	4-Wheel Drive Low Clutch Relay Short Circuit to Battery	4X4 Control Module	Go to <u>Pinpoint Test P</u> .
P1827	4-Wheel Drive Low Clutch Relay Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test P</u> .

P183B	4-Wheel Drive Clutch Coil Return Circuit Open	4X4 Control Module	Go to <u>Pinpoint Test P.</u>
P1849	Transfer Case Contact Plate A Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test Q.</u>
P1853	Transfer Case Contact Plate B Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test Q.</u>
P1857	Transfer Case Contact Plate C Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test Q.</u>
P1861	Transfer Case Contact Plate D Short Circuit to Ground	4X4 Control Module	Go to <u>Pinpoint Test Q.</u>
P1867	Transfer Case Contact Plate General Circuit Failure	4X4 Control Module	Go to <u>Pinpoint Test Q.</u>
P1891	Transfer Case Contact Plate Ground Return Open Circuit	4X4 Control Module	Go to <u>Pinpoint Test Q.</u>
U1900	CAN Communication BUS Fault	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK .</u>
U2023	External Node Fault	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK .</u>
U2050	Application Not Programmed	4X4 Control Module	REFER to <u>MODULE COMMUNICATIONS NETWORK .</u>

Symptom Chart - Four Wheel Drive (4WD)

Symptom Chart - Four Wheel Drive (4WD)

Condition	Possible Sources	Action
<ul style="list-style-type: none"> No communication with the 4X4 control module 	<ul style="list-style-type: none"> Scan tool Power distribution box (PDB) fuse: <ul style="list-style-type: none"> 26 (20A) Smart junction box (SJB) fuses: <ul style="list-style-type: none"> 4 (20A) (OBDII) 18 (10A) Power supply: <ul style="list-style-type: none"> SBB26 (YE/RD) hot at all times A CBP18 (GY/OG) run/start Ground circuit GD145 (BK/BU) 4X4 control module 	<ul style="list-style-type: none"> Go to <u>Pinpoint Test Q.</u>

- The vehicle does not shift between 4x4 AUTO and 4x4 HIGH correctly

- The vehicle does not shift between 4x4 AUTO and 4x4 LOW correctly

- Charging system
- 4x4 indicator(s)
- Transfer case
- Power distribution box (PDB) fuses:
 - 23 (20A)
 - 26 (20A)
- Smart junction box (SJB) fuse 18 (10A)
- 4X4 control module
- Circuits:
 - RCF13 (WH/BN)
 - CCF13 (WH/BU)
 - A_CBP18 (GY/OG)
- Mode select switch (MSS)
- Transfer case clutch
- Powertrain control module
- Ignition switch and/or circuitry
- CAN communication network
- Instrument cluster (IC)
- Power distribution box (PDB) fuses:
 - 23 (20A)
 - 26 (20A)
- Circuit A_CBP18 (GY/OG)
- Ignition switch and/or circuitry
- Transfer case circuitry

- Go to **Pinpoint Test P.**

- Go to **Pinpoint Test Q.**

<ul style="list-style-type: none"> • The 4x4 indicators do not operate correctly/do not operate 	<ul style="list-style-type: none"> • Instrument cluster (IC) • Four wheel drive (4WD) system fault • CAN circuits • 4X4 control module • Ignition switch and/or circuitry 	<ul style="list-style-type: none"> • Go to <u>Pinpoint Test R.</u>
<ul style="list-style-type: none"> • Straight Line driveline wind-up 	<ul style="list-style-type: none"> • Unmatched tire sizes • Unequal amounts of tire wear • Unequal tire inflation pressures • Unmatched front and rear axle ratios 	<ul style="list-style-type: none"> • Go to <u>Pinpoint Test S.</u>
<ul style="list-style-type: none"> • The neutral tow does not operate 	<ul style="list-style-type: none"> • Power distribution box (PDB) fuse 26 (20A) • 4X4 control module • Neutral tow system indicator • Digital transmission range (TR) sensor 4.0L • Neutral shifter position sensor (4.6L) • Brake ON/OFF (BOO) switch • Door ajar switch • Circuitry: <ul style="list-style-type: none"> • CCF21 (VT/WH) • SBB26 (YE/RD) • Ignition switch • Tire inflation 	<ul style="list-style-type: none"> • CARRY OUT the Neutral Tow Functional Test. Go to <u>Pinpoint Test U.</u> • MAKE SURE that all tires and

<ul style="list-style-type: none"> • The transfer case makes noise 	<p>pressure</p> <ul style="list-style-type: none"> • Tire and wheel size • Tire tread wear • Internal components • Fluid level 	<p>wheels are the same size and that the inflation pressures are correct.</p> <ul style="list-style-type: none"> • CHECK tire tread wear to see if there is more than 0.15 mm (0.06 in) difference in tread wear between front and rear. INTERCHANGE one front wheel and one rear wheel. ROAD TEST again. • 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 TRANSAXLE/TRANSMISSION - 5R55S</u> or <u>AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60</u> . If there is noise in all gears, DISASSEMBLE the transfer case. REFER to <u>TRANSFER CASE</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</u> .
<ul style="list-style-type: none"> • The vehicle binds in turns/resists turning/pulsates/shudders in a straight line 	<ul style="list-style-type: none"> • Unmatched tire sizes • Unequal amounts of tire wear • Unequal tire inflation pressures • Unmatched front and rear axle ratios 	<ul style="list-style-type: none"> • Go to <u>Pinpoint Test T.</u>
<ul style="list-style-type: none"> • Unable to duplicate customer concern 	<ul style="list-style-type: none"> • 4x4 indicators • 4X4 control module • Transfer case and related components • Wheel/tire assemblies 	<ul style="list-style-type: none"> • CARRY OUT the 4WD System Functional Test. Go to <u>Pinpoint Test V.</u>

Pinpoint Tests

Pinpoint Test O: No Communication With The 4X4 Control Module

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

In order for the 4X4 control module to communicate with the scan tool, the operating voltage required to supply the 4X4 control module is in a range between 9 and 16 volts. Voltage is supplied at all times by circuit SBB26 (YE/RD). Run/Start voltage is supplied by circuit A_CBP18 (GY/OG).

Possible Causes

- CAN communication
- Scan tool
- Smart junction box (SJB) fuses:
 - 4 (20A)
 - 18 (10A)
- Power distribution box (PDB) fuse:
 - 26 (20A)
- Power supply:
 - Circuit SBB26 (YE/RD)
 - Circuit A_CBP18 (GY/OG)
- Ground circuit GD145 (BK/BU)
- 4X4 control module
- Charging system

PINPOINT TEST O: NO COMMUNICATION WITH THE 4X4 CONTROL MODULE

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

O1 CHECK CAN COMMUNICATION

NOTE: To distinguish between a loss of CAN communication to the 4X4 control module and a loss of CAN communication with the entire vehicle, the ABS module CAN communication is verified because it uses CAN for diagnostics.

- Verify CAN communication with the anti-lock brake system (ABS) module.
 - If using the scan tool, follow the directions and carry out the network test.
 - If using VCM, verify that the vehicle and engine selection information are correct.
- **Does the scan tool communicate with the ABS module?**
YES : Go to O2.

NO : REFER to the appropriate scan tool manual for further diagnosis.

O2 CHECK THE FUSES

- Check SJB fuse 18 (10A), SJB fuse 4 (20A) and PDB fuse 26 (20A).
- **Are the fuses okay?**

YES : Go to O3.

NO : REPAIR as necessary. REPEAT the self-test.

O3 CHECK FOR BATTERY VOLTAGE FROM THE FUSE CAVITIES

- Key in ON position.
- Measure the voltage between SJB input side fuse cavity 18 and ground.
- Measure the voltage between SJB input side fuse cavity 4 and ground.
- Measure the voltage between PDB input side fuse cavity 26 and ground.
- **Are the voltages greater than 9 volts?**

YES : Go to O4.

NO : REPAIR or INSTALL new components as necessary. REPEAT the self-test.

O4 CHECK FOR VOLTAGE INPUT TO THE 4X4 CONTROL MODULE

- Disconnect: 4X4 Control Module C281a and C281b
- Key in ON position.

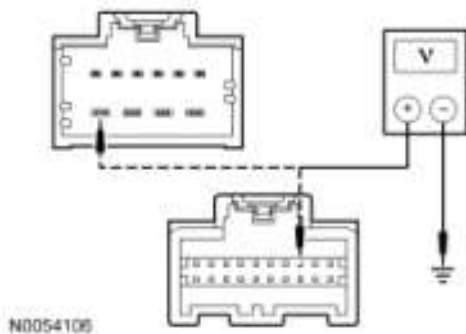


Fig. 34: Measuring Voltage Between 4X4 Control Module C281A & C281B Circuits, Harness Side & Ground

Courtesy of FORD MOTOR CO.

- Measure the voltage between 4X4 control module C281a and C281b circuits, harness side and ground as follows:

Pin	Circuit
C281a- 8	A_CBP18 (GY/OG)
C281b- 7	SBB26 (YE/RD)

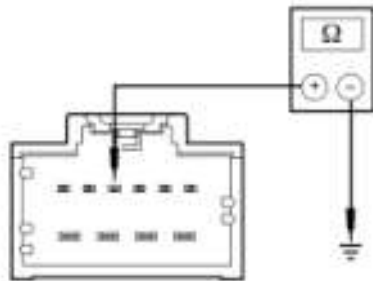
- **Are the voltages greater than 9 volts?**

YES : Go to O5.

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

O5 CHECK THE GROUND CIRCUIT FOR AN OPEN

- Key in OFF position.



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Fig. 35: Measuring Resistance Between 4X4 Control Module C281B-3 Circuit GD145 (BK/BU) & Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281b-3 circuit GD145 (BK/BU), harness side and ground.

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

YES : Go to O6.

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

O6 CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING

- Key in START position.
- Measure the battery voltage at the positive battery terminal.
- **Is the voltage greater than 9 volts?**

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

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

Pinpoint Test P: The Vehicle Does Not Shift Between 4x4 AUTO and 4x4 HIGH Correctly

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

With the key in the ON position, the 4X4 control module receives the operator's choice of 4WD selection from the mode select switch (MSS). The 4X4 control module then controls the electric clutch and transfer case shift motor. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4X4 control module.

Possible Causes

- 4x4 indicators
- Transfer case
- 4X4 control module
- Circuits:

- RCF13 (WH/BN)
- CCF03 (GY/BN)
- CCF13 (WH/BU)
- Transfer case clutch
- Ignition switch and/or circuitry
- CAN communication network
- Instrument cluster (IC)

PINPOINT TEST P: THE VEHICLE DOES NOT SHIFT BETWEEN 4x4 AUTO AND 4x4 HIGH CORRECTLY

P1 CHECK THE 4x4 INDICATORS PROVE-OUT

- Key in OFF position.
- Start the vehicle while observing the 4x4 indicators prove-out.
- **Did the indicators prove out?**

YES : Go to P2.

NO : CHECK the instrument cluster (IC). REFER to **INSTRUMENT CLUSTER** .

P2 CHECK THE POWERTRAIN MALFUNCTION INDICATOR

- Start the engine.
- Observe the powertrain malfunction indicator.
- **Does the powertrain malfunction indicator illuminate?**

YES : Go to P3.

NO : Go to P4.

P3 CARRY OUT THE 4X4 CONTROL MODULE ON-DEMAND SELF TEST

- Connect the diagnostic tool.
- Carry out the 4X4 control module on-demand self test.
- **Did the self test complete?**

YES : Go to P4.

NO : Go to **Pinpoint Test O**.

P4 REVIEW THE ON-DEMAND SELF TEST

- Review the on-demand self test results.
- **Were DTCs retrieved?**

YES : Go to P5.

NO : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

P5 CHECK FOR 4x4 INDICATOR ILLUMINATION

- Select 4x4 HIGH.
- **Does the 4x4 indicator illuminate?**

YES : Go to P6.

NO : Go to P18.

P6 CHECK FOR WIND-UP IN 4x4 HIGH

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

YES : Go to P11.

NO : Go to P7.

P7 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID

- Key in ON position.
- 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 wide open throttle (WOT), with the transfer case in 4x4 HIGH, engine off, key on.
- **Does the clutch duty cycle PID indicate 98 percent clutch at WOT?**

YES : Go to P8.

NO : Go to P10.

P8 CHECK FOR VOLTAGE ON CLUTCH POWER CIRCUIT CCF03 (GY/BN) DURING ACTIVE COMMAND

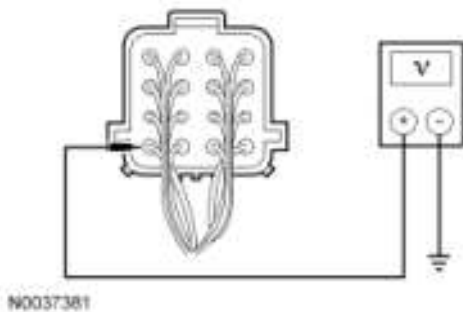


Fig. 36: Checking Voltage On Clutch Power Circuit CCF03 (GY/BN) During Active Command

Courtesy of FORD MOTOR CO.

- Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).
- Measure the voltage on circuit CCF03 (GY/BN) using a digital multi-meter.
- Use the scan tool active commands to cycle the transfer case clutch to 98 percent.
- **Is the voltage greater than 8.5 volts?**

YES : END the active command. CHECK the transfer case. REFER to **TRANSFER CASE** .

NO : End the active command. Go to P9 .

P9 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN

- Key in OFF position.
- Disconnect: Transfer Case C350
- Disconnect: 4X4 Control Module C281b

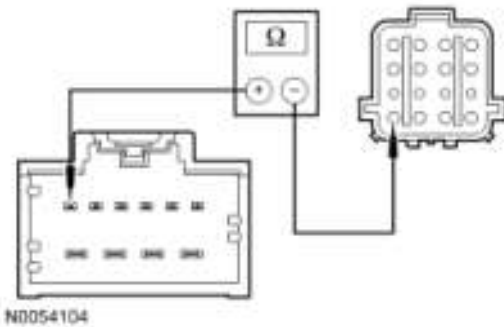


Fig. 37: Measuring Resistance Between Transfer Case C350-16, 4X4 Control Module C281B-1 & CCF03 (GY/BN)
 Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-16 harness side, and 4X4 control module C281b-1 harness side, circuit CCF03 (GY/BN).
- **Is the resistance less than 5 ohms?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.
NO : REPAIR the circuit. CHECK the system for normal operation.

P10 CHECK THE THROTTLE POSITION OUTPUT PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record from 4X4 control module menu.
- Monitor the throttle position output PID.
- Slowly move throttle from closed throttle to WOT and observe the throttle position output PID.
- **Does the value vary between 0 percent at closed throttle and 100 percent at WOT?**
YES : Go to P8.
NO : CHECK the throttle position sensor and/or PCM. REFER to the **Introduction - Gasoline Engines** .

P11 CHECK THE 4x4 INDICATOR IN 4x4 AUTO

- Select 4x4 AUTO.
- **Does the 4x4 indicator turn off?**
YES : Go to P12.
NO : Go to **Pinpoint Test R**.

P12 CHECK FOR WIND-UP IN 4x4 AUTO

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.
- **Is wind-up present in turns?**
YES : Go to P13.
NO : The 4WD drive system is operating correctly.

P13 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 at closed throttle, engine off, key on.
- **Does the PID indicate 2 to 4 percent clutch application at closed throttle?**
YES : Go to P14.

NO : Go to P16.

P14 CHECK THE VOLTAGE ON CLUTCH POWER CIRCUIT CCF03 (GY/BN)

- Use the scan tool active commands to energize the transfer case clutch to 4 percent.

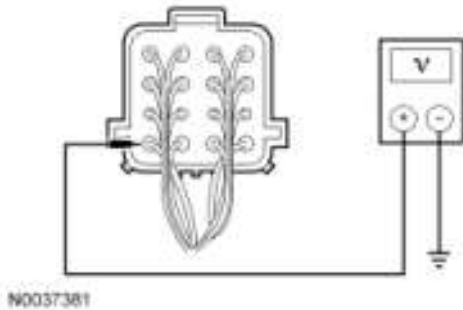


Fig. 38: Checking Voltage On Clutch Power Circuit CCF03 (GY/BN) During Active Command

Courtesy of FORD MOTOR CO.

- Carefully back-probe transfer case C350-16, circuit CCF03 (GY/BN).
- Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter.
- **Is the voltage approximately 0.48 volt?**

YES : END the active command. CHECK the transfer case. REFER to **TRANSFER CASE** .

NO : END the active command. Go to P15 .

P15 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN

- Disconnect: Transfer Case C350
- Disconnect: 4X4 Control Module C281a

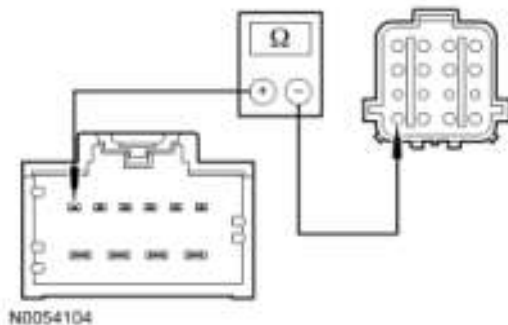


Fig. 39: Measuring Resistance Between Transfer Case C350-16, 4X4 Control Module C281B-1 & CCF03 (GY/BN)

Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-16 harness side, and 4X4 control module C281b-1 harness side, circuit CCF03 (GY/BN).
- **Is the resistance less than 5 ohms?**

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

NO : REPAIR the circuit. CHECK the system for normal operation.

P16 CHECK THE WHEEL 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 wheel 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 P17.

NO : CHECK the ABS system for faults. REFER to VEHICLE DYNAMIC SYSTEMS .

P17 CHECK THE THROTTLE POSITION SENSOR 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 throttle position sensor voltage PID.
- **Does the value vary between 0 percent at closed throttle and 100 percent at WOT?**

YES : INSTALL a new 4X4 control module. REFER to 4X4 Control Module. TEST the system for normal operation.

NO : CHECK the throttle position sensor and/or PCM for faults. REFER to the Introduction - Gasoline Engines .

P18 CHECK THE IGNITION SWITCH STATUS PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Key in ON position.
- Monitor the ignition switch status PID.
- **Does the ignition switch position correspond with the ignition status PID?**

YES : Go to P19.

NO : CHECK the ignition switch circuit(s) and CAN communication network. REFER to STARTING SYSTEM and MODULE COMMUNICATIONS NETWORK .

P19 CHECK THE MSS PID IN 4x4 HIGH

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Monitor the MSS PID while switching to 4x4 HIGH.
- **Do the MSS PID indicate 4x4 HIGH?**

YES : Go to P20.

NO : Go to P21.

P20 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID WITH THE MSS IN 4x4 HIGH

- Monitor the clutch duty cycle PID while switching to 4x4 HIGH.
- **Does the clutch duty cycle value equal 10 percent?**

YES : CHECK the IC. REFER to INSTRUMENT CLUSTER .

NO : INSTALL a new 4X4 control module. REFER to 4X4 Control Module. TEST the system for normal operation.

P21 CHECK THE MSS

- Key in OFF position.
- Disconnect: MSS C284

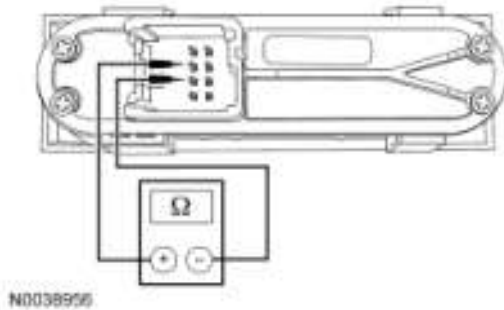


Fig. 40: Measuring Resistance Between MSS C284-2, Component Side & C284-3
 Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2, component side and C284-3, component side. Refer to the following chart:

MSS Position	Resistance (± 1 percent)
4x4 AUTO	39 ohms
4x4 HIGH	237 ohms
4x4 LOW	536 ohms

- Are the resistances within the specified values?

YES : Go to P22.

NO : INSTALL a new MSS. REFER to **Mode Select Switch (MSS)**.

P22 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN

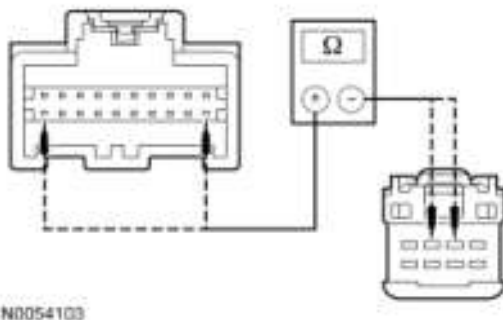


Fig. 41: Measuring Resistance Between MSS C284-2 & C284-3, C281A-20 & C281A-11, RCF13 (WH/BN) & CCF13 (BU/BK)

Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2 harness side and 4X4 control module C281a-20 harness side, circuit RCF13 (WH/BN); measure the resistance between MSS C284-3 harness side and 4X4 control module C281a-11 harness side, circuit CCF13 (BU/BK).
- Are the resistances less than 5 ohms?

YES : Go to P23.

NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

P23 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO VOLTAGE

- Key in ON position.

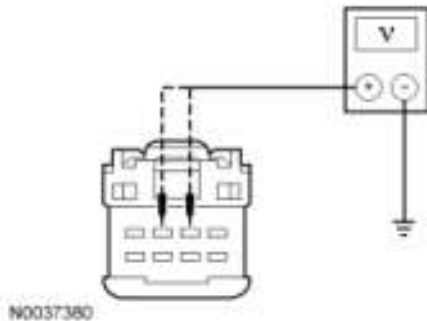


Fig. 42: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Short To Voltage

Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-2, circuit RCF13 (WH/BN) and ground; measure the voltage between MSS C284-3, circuit CCF13 (WH/BU) and ground.

- **Is voltage present?**

YES : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

NO : Go to P24.

P24 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO GROUND

- Key in OFF position.

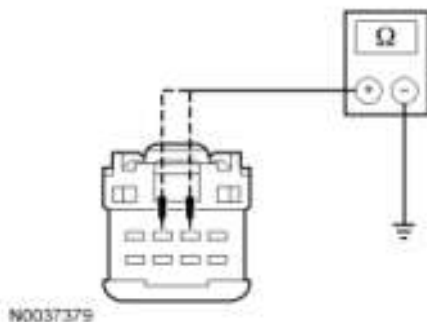


Fig. 43: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Short To Ground

Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2, circuit RCF13 (WH/BN) and ground; measure the resistance between MSS C284-3, circuit CCF13 (WH/BU) and ground.

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

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test Q: The Vehicle Does Not Shift Between 4x4 AUTO and 4x4 LOW Correctly

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

With the key in the ON position, the 4X4 control module receives the operator's choice of 4WD selection from the mode select switch (MSS). The 4X4 control module then controls the electric clutch and transfer case shift motor. If the transfer case is not responding to the operator's intentions, systematically check all inputs and outputs to the 4X4 control module.

Possible Causes

- Power distribution box (PDB) fuses:
 - 23 (20A) - transfer case shift motor
 - 26 (20A) - 4X4 control module
- Smart junction box (SJB) fuse 18 (10A)
- 4x4 LOW indicator
- 4x4 LOW LED
- Mode select switch (MSS)
- Transfer case
- Transfer case shift motor
- 4X4 control module
- ABS module
- Circuit CCF03 (GY/BN)
- CAN

PINPOINT TEST Q: THE VEHICLE DOES NOT SHIFT BETWEEN 4x4 AUTO AND 4x4 LOW CORRECTLY

Q1 CHECK FOR DTCs

- Key in ON position.
- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs retrieved?**

YES : If C1729, go to Q27 . If C1970, go to Q15 . If C1971, go to Q16 . If P1812, go to Q9 . If P1815, go to Q12 . If P1849, P1853, P1857 or P1861, go to Q26 . If P1867 or P1891, Go to Q24 .

NO : Go to Q2.

Q2 MONITOR THE 4x4 LOW LED SWITCH

- Select 4x4 LOW:
 - press the brake pedal.
 - vehicle at rest.

- transmission in N (neutral).
- Monitor the 4x4 LOW LED.
- **Does the 4x4 LOW LED blink then stay illuminated?**
YES : Go to Q3.
NO : Go to Q4.

Q3 VERIFY THE 4x4 LOW LED STATE

- Monitor the 4x4 LOW LED.
- **Does the 4x4 LOW LED continue blinking?**
YES : Go to Q4.
NO : Go to Q8.

Q4 VERIFY THE 4x4 LOW LED STATE

- Monitor the 4x4 LOW LED.
- **Does the 4x4 LOW LED illuminate constantly?**
YES : Go to Q5.
NO : Go to Q17.

Q5 MONITOR THE 4x4 LOW INDICATOR (CLUSTER)

- Monitor the 4x4 LOW instrument cluster (IC) indicator.
- **Is the 4x4 LOW IC indicator illuminated?**
YES : Go to Q6.
NO : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

Q6 CHECK FOR WIND-UP IN TURNS ON THROTTLE

- Drive the vehicle on a dry, hard surface, executing turns while applying the throttle.
- **Is wind-up present?**
YES : Go to Q7.
NO : Go to Q18.

Q7 CHECK FOR GEAR REDUCTION

- While driving the vehicle, monitor the engine rpm and vehicle speed.
- **Does the engine rpm and vehicle speed indicate that the vehicle is in 4x4 LOW (high rpm at low vehicle speed)?**
YES : The system is functioning correctly.
NO : Go to Q22.

Q8 CHECK THE IGNITION STATUS PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Key in ON position.
- Monitor the ignition status PID.
- **Does the ignition switch position correspond with the ignition status PID?**
YES : Go to Q9.
NO : CHECK the ignition switch circuit(s) and CAN communication network. REFER to **MODULE COMMUNICATIONS NETWORK** .

Q9 CHECK THE MSS

- Key in OFF position.

- Disconnect: MSS C284

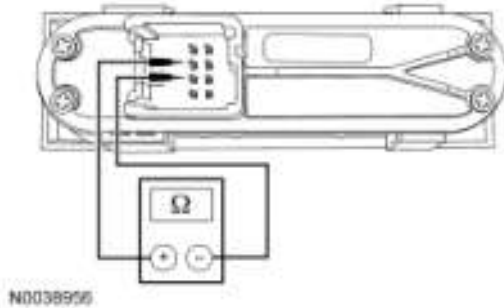


Fig. 44: Measuring Resistance Between MSS C284-2, Component Side & C284-3
Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2, component side and C284-3, component side. Refer to the following chart:

MSS Position	Resistance (± 1 percent)
4x4 AUTO	39 ohms
4x4 HIGH	237 ohms
4x4 LOW	536 ohms

- Are the resistances within the specified values?

YES : Go to Q10.

NO : INSTALL a new MSS. REFER to **Mode Select Switch (MSS)**.

Q10 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR AN OPEN

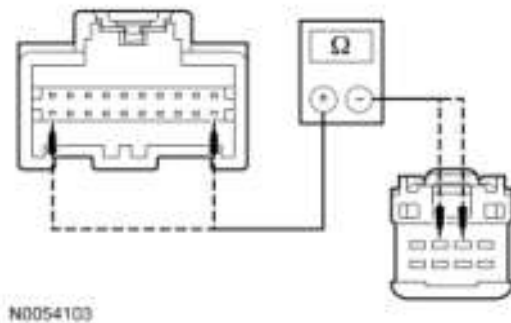


Fig. 45: Measuring Resistance Between MSS C284-2 & C284-3, C281A-20 & C281A-11, RCF13 (WH/BN) & CCF13 (BU/BK)
Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2 harness side and 4X4 control module C281a-20 harness side, circuit RCF13 (WH/BN); measure the resistance between MSS C284-3 harness side and 4X4 control module C281a-11 harness side, circuit CCF13 (BU/BK).

- Are the resistances less than 5 ohms?

YES : Go to Q11.

NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

Q11 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO VOLTAGE

- Key in ON position.

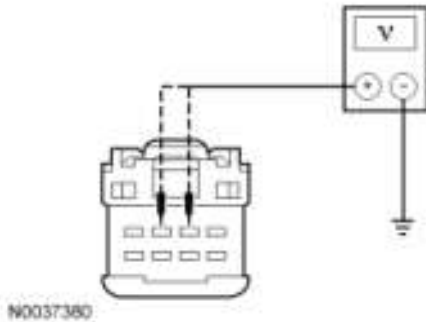


Fig. 46: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Short To Voltage
 Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-2, circuit RCF13 (WH/BN) and ground; measure the voltage between MSS C284-3, circuit CCF13 (WH/BU) and ground.
- **Is voltage present?**
 YES : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.
 NO : Go to Q12.

Q12 CHECK MSS CIRCUITS RCF13 (WH/BN) AND CCF13 (WH/BU) FOR A SHORT TO GROUND

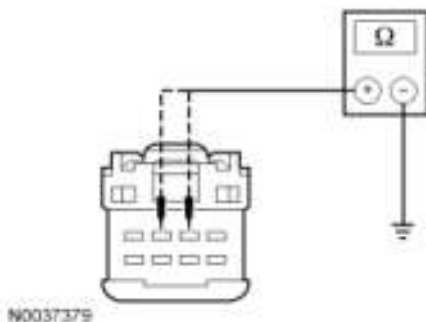


Fig. 47: Checking MSS Circuits RCF13 (WH/BN) And CCF13 (WH/BU) For Short To Ground
 Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-2, circuit RCF13 (WH/BN) and ground; measure the resistance between MSS C284-3, circuit CCF13 (WH/BU) and ground.
- **Are the resistances greater than 10,000 ohms?**
 YES : Go to Q13.
 NO : REPAIR the circuit(s). CLEAR the DTCs. REPEAT the self-test.

Q13 CHECK MSS LED CIRCUIT A_CB P18 (GY/OG) FOR VOLTAGE

- Key in ON position.

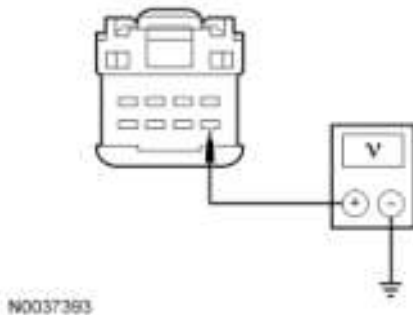


Fig. 48: Checking MSS LED Circuit A_CB P18 (GY/OG) For Voltage
Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-5, circuit A_CB P18 (GY/OG) and ground.
- **Is the voltage greater than 8 volts?**
YES : Go to Q14.
NO : REPAIR the circuit. TEST the system for normal operation.

Q14 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR AN OPEN

- Key in OFF position.

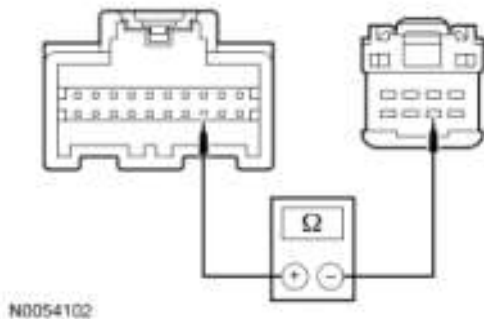


Fig. 49: Measuring Resistance Between MSS C284-6 & 4X4 Control Module C281A-18, Circuit CCF06 (BU/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-6 and 4X4 control module C281a-18, circuit CCF06 (BU/GN).
- **Is the resistance less than 5 ohms?**
YES : Go to Q15.
NO : REPAIR the circuit. TEST the system for normal operation.

Q15 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR A SHORT TO VOLTAGE

- Key in ON position.

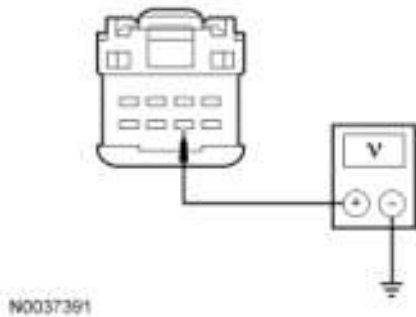


Fig. 50: Checking MSS LED Circuit CCF06 (BU/GN) For Short To Voltage
 Courtesy of FORD MOTOR CO.

- Measure the voltage between MSS C284-6, circuit CCF06 (BU/GN) and ground.
- **Is voltage present?**
YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
NO : Go to Q16.

Q16 CHECK MSS LED CIRCUIT CCF06 (BU/GN) FOR A SHORT TO GROUND

- Key in ON position.

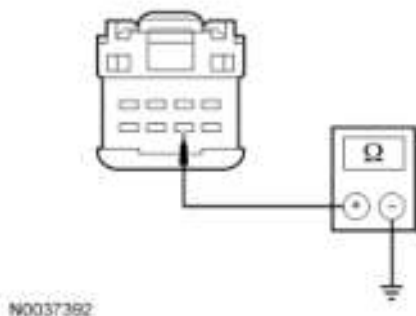


Fig. 51: Checking MSS Led Circuit CCF06 (BU/GN) For Short To Ground
 Courtesy of FORD MOTOR CO.

- Measure the resistance between MSS C284-6, circuit CCF06 (BU/GN) and ground.
- **Is the resistance greater than 10,000 ohms?**
YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
NO : INSTALL a new MSS. REFER to **Mode Select Switch (MSS)**. CLEAR the DTCs. REPEAT the self test.

Q17 CHECK THE TRANSMISSION RANGE (TR), BRAKE ON/OFF (BOO) AND SHAFT SPEED PIDs DURING 4x4 LOW SHIFT

- Connect the diagnostic tool.
- Key in ON position.
- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- A. Monitor the 4X4 control module transmission range (TR) sensor status PID while shifting the transmission through gear ranges.
- B. Monitor the 4X4 control module brake ON/OFF (BOO) switch PID while pressing and releasing the brake pedal.
- C. Monitor the 4X4 control module shaft speed PIDs.

- **A.** Does the 4X4 control module transmission range (TR) sensor 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 shaft speed PIDs indicate 0 km/h (0 mph)?

YES : If all 3 PIDs are accurate, go to Q24 .

NO : **A.** REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 5R55S** or **AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60** for further diagnosis of the TR sensor and the CAN communication network.

B. REFER to **VEHICLE DYNAMIC SYSTEMS** for further diagnosis of the BOO switch and the CAN communication network.

C. REFER to **VEHICLE DYNAMIC SYSTEMS** for further diagnosis of the ABS system and the CAN communication network.

Q18 CHECK THE TRANSFER CASE CLUTCH DUTY CYCLE PID

- Key in ON position.
- 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 wide open throttle (WOT), with the transfer case in 4x4 LOW, engine off, key on.
- **Does the clutch duty cycle PID indicate 98 percent clutch application at WOT?**

YES : Go to Q19.

NO : Go to Q21.

Q19 CHECK FOR VOLTAGE ON CLUTCH POWER CIRCUIT CCF03 (GY/BN)

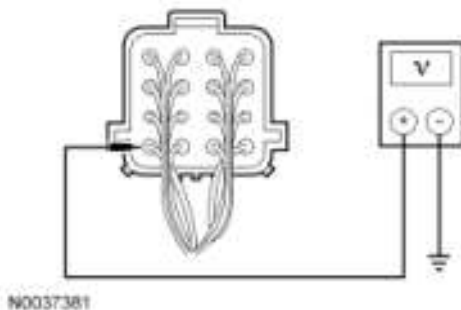


Fig. 52: Checking Voltage On Clutch Power Circuit CCF03 (GY/BN) During Active Command
 Courtesy of FORD MOTOR CO.

- Carefully back-probe the transfer case connector C350-16, circuit CCF03 (GY/BN).
- Measure the voltage on circuit CCF03 (GY/BN) using a digital multimeter.
- Use the scan tool active commands to cycle the transfer case clutch to 98 percent.
- **Is the voltage greater than 9 volts?**

YES : End the active command. CHECK the transfer case. REFER to **TRANSFER CASE** .

NO : End the active command. Go to Q20 .

Q20 CHECK CIRCUIT CCF03 (GY/BN) FOR AN OPEN

- Disconnect: Transfer Case C350
- Disconnect: 4X4 Control Module C281b

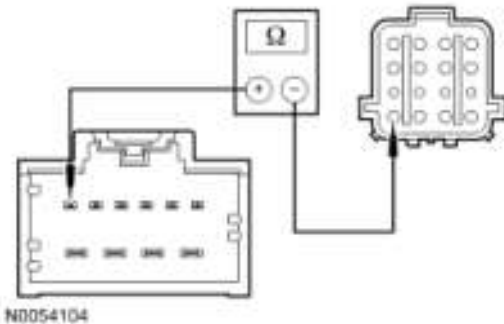


Fig. 53: Measuring Resistance Between Transfer Case C350-16, 4X4 Control Module C281B-1 & CCF03 (GY/BN)

Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-16 harness side, and 4X4 control module C281b-1 harness side, circuit CCF03 (GY/BN).

• Is the resistance less than 5 ohms?

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

NO : REPAIR the circuit. CHECK the system for normal operation.

Q21 CHECK THE 4X4 CONTROL MODULE THROTTLE POSITION OUTPUT PID

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Monitor the 4X4 control module throttle position output PID.
- Slowly move throttle from closed throttle to WOT and observe the throttle position sensor PID.
- **Does the value vary between 0 percent at closed throttle and 100 percent at WOT?**

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

NO : CHECK the CAN communication network. REFER to the **Introduction - Gasoline Engines** .

Q22 CHECK THE CONTACT PLATE ENCODER PIDs IN 4x4 LOW

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- With the MSS in 4x4 LOW, monitor the contact plate position PIDs. Refer to the following chart:

Contact Plate Position PID	MSS PID 4WD AUTO/4H	MSS PID 4L
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- Do the contact plate position PIDs indicate that the transfer case shift motor is in 4x4 LOW?

YES : Go to Q23.

NO : Go to Q24.

Q23 CHECK THE TRANSFER CASE SHIFT MOTOR

- Remove the transfer case shift motor from the transfer case.
- Rotate the shift cam through all positions.
- Does the transfer case shift cam rotate with difficulty (is the force required to rotate the cam greater than 45 N.m [33 lb-ft])?

YES : REPAIR the transfer case. REFER to TRANSFER CASE . CLEAR the DTCs. REPEAT the self-test.

NO : INSTALL a new transfer case shift motor. REFER to Transfer Case Shift Motor. CLEAR the DTCs. REPEAT the self-test.

Q24 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR AN OPEN

- Key in OFF position.
- Disconnect: Transfer Case C350
- Disconnect: 4X4 Control Module C281a

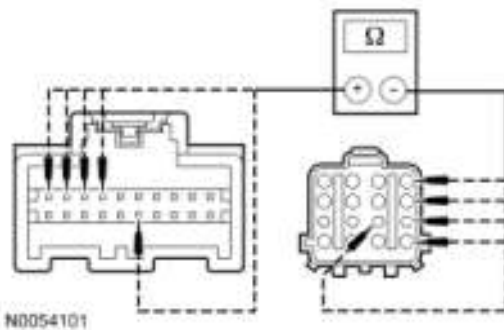


Fig. 54: Measuring Resistance Of Circuits Between 4X4 Control Module C281A & Transfer Case C350

Courtesy of FORD MOTOR CO.

- Measure the resistance of the following circuits between 4X4 control module C281a, harness side and transfer case C350, harness side:

Circuit	C281a	C350
RCF09 (BN/WH)	16	10
CCF17 (WH/OG)	4	13
CCF16 (VT/GN)	3	9
CCF15 (BN/YE)	2	1
CCF14 (GN/OG)	1	5

- Are the resistances less than 5 ohms?

YES : Go to Q25.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Q25 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR A SHORT TO VOLTAGE

- Key in ON position.

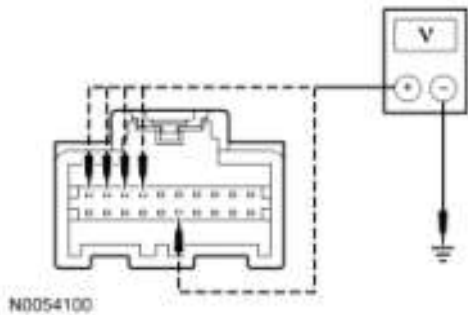


Fig. 55: Measuring Voltage Of Circuits Between 4X4 Control Module C281A & Ground
Courtesy of FORD MOTOR CO.

- Measure the voltage between the following circuits at the 4X4 control module C281a, harness side and ground:

Circuit	C281a
RCF09 (BN/WH)	16
CCF17 (WH/OG)	4
CCF16 (VT/GN)	3
CCF15 (BN/YE)	2
CCF14 (GN/OG)	1

- Is voltage present?

YES : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

NO : Go to Q26.

Q26 CHECK CIRCUITS RCF09 (BN/WH), CCF17 (WH/OG), CCF16 (VT/GN), CCF15 (BN/YE) AND CCF14 (GN/OG) FOR A SHORT TO GROUND

- Key in OFF position.

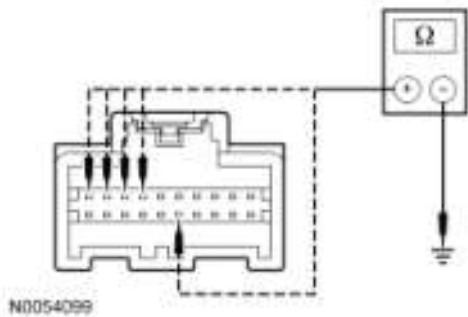


Fig. 56: Measuring Resistance Between Circuits At 4X4 Control Module C281A, Harness Side & Ground
 Courtesy of FORD MOTOR CO.

- Measure the resistance between the following circuits at 4X4 control module C281a, harness side and ground:

Circuit	C281a
RCF09 (BN/WH)	16
CCF17 (WH/OG)	4
CCF16 (VT/GN)	3
CCF15 (BN/YE)	2
CCF14 (GN/OG)	1

- Are the resistances greater than 10,000 ohms?

YES : Go to Q27.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

Q27 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR POWER DURING ACTIVE COMMANDS

- Connect: 4X4 Control Module C281a
- Enter the following diagnostic mode on the diagnostic tool: Access Active Commands

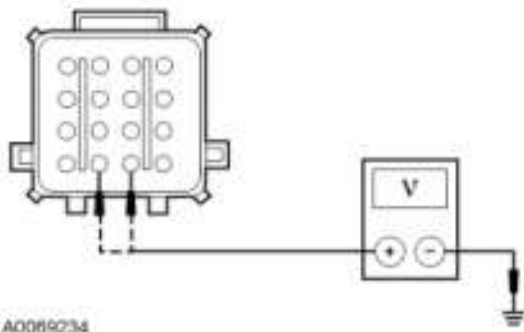


Fig. 57: Measuring Voltage Between Transfer Case C350-15 & C350-14, Circuit CCF07 (GN/RD) & CCF08 (GY/OG)

Courtesy of FORD MOTOR CO.

- Enter the clockwise (CW) transfer case shift motor active command ON and OFF and measure the voltage between transfer case C350-15, circuit CCF07 (GN/RD) harness side and ground. Enter the counterclockwise (CCW) transfer case shift motor active command ON and OFF and measure the voltage between transfer case C350-14, circuit CCF08 (GY/OG) harness side and ground.
- **Are the voltages 10 volts or greater while the corresponding active commands are on?**
YES : INSTALL a new transfer case shift motor. CLEAR the DTCs. REPEAT the self-test.
NO : Go to Q28.

Q28 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR AN OPEN

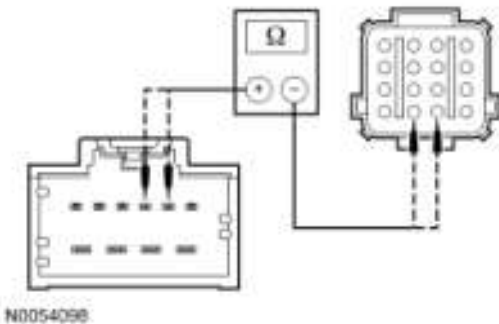


Fig. 58: Measuring Resistance Between Transfer Case C350-14 & C350-15, C281b-4 & C281b-5, CCF08 (GY/OG) & CCF07 (BN/GN)
Courtesy of FORD MOTOR CO.

- Measure the resistance between transfer case C350-14, circuit and 4X4 control module C281b-4, harness side, circuit CCF08 (GY/OG).
- Measure the resistance between transfer case C350-15, circuit and 4X4 control module C281b-5, harness side, circuit CCF07 (BN/GN).
- **Are the resistances less than 5 ohms?**
YES : Go to Q29.
NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. Go to **Pinpoint Test V.**

Q29 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR A SHORT TO VOLTAGE

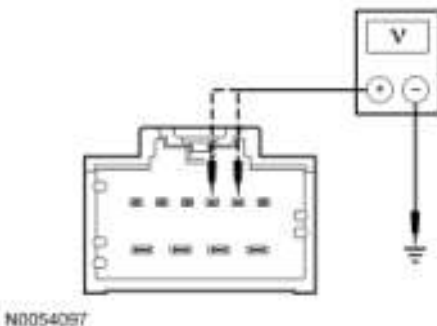


Fig. 59: Measuring Voltage Between 4X4 Control Module C281B-4 & C281B-5, CCF08 (GY/OG) & CCF07 (BN/GN)
Courtesy of FORD MOTOR CO.

- Measure the voltage between 4X4 control module C281b-4, circuit CCF08 (GY/OG), harness side and ground.
- Measure the voltage between 4X4 control module C281b-5, circuit CCF07 (BN/GN), harness side and ground.
- **Is voltage present?**
YES : Go to Q30.

NO : REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test. Go to **Pinpoint Test V**.

Q30 CHECK CIRCUITS CCF08 (GY/OG) AND CCF07 (BN/GN) FOR A SHORT TO GROUND

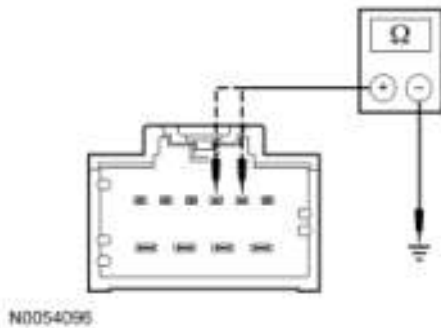


Fig. 60: Measuring Resistance Between 4X4 Control Module C281B-5, Circuit CCF07 (BN/GN)

Courtesy of FORD MOTOR CO.

- Measure the resistance between 4X4 control module C281b-5, circuit CCF07 (BN/GN) harness side and ground.
- **Are the resistances greater than 10,000 ohms?**
YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. Go to **Pinpoint Test V**.
- NO : REPAIR the circuit. CLEAR the DTC(s). REPEAT the self-test. Go to **Pinpoint Test V**.

Pinpoint Test R: The 4x4 Indicators Do Not Operate Correctly/Do Not Operate

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

The 4x4 HIGH indicator status is transmitted to the instrument cluster (IC) from the 4X4 control module through the controller area network (CAN). A steady indicator displays whether the vehicle is in 4x4 LOW or 4x4 HIGH, according to the driver selection. A 4WD system fault will cause the powertrain malfunction indicator to illuminate when a 4WD system fault condition has been detected. This light also indicates other general powertrain failures.

Possible Causes

- Instrument cluster (IC)
- 4WD system fault
- CAN circuits

- 4X4 control module

PINPOINT TEST R: THE 4x4 INDICATORS DO NOT OPERATE CORRECTLY/DO NOT OPERATE

R1 CHECK THE 4x4 INDICATOR PROVE-OUT

- Key in ON position.
- Observe the 4x4 LOW and 4x4 indicators in the instrument cluster (IC).
- **Do the 4x4 LOW and 4x4 indicators prove out correctly?**
YES : Go to R2.
NO : CHECK the IC. REFER to **INSTRUMENT CLUSTER** .

R2 CHECK FOR DTCs

- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs present?**
YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.
NO : Go to R3.

R3 CHECK FOR INCORRECT 4x4 INDICATOR ILLUMINATION

- Select 4x4 AUTO with transmission in NEUTRAL, vehicle at rest, brake pressed and engine running.
- Observe the IC.
- **Do any 4x4 IC indicators illuminate?**
YES : Go to R4.
NO : Go to R6.

R4 CHECK THE CONTACT PLATE ENCODER PIDs

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Monitor the contact plate position PIDs. Refer to the following chart:

Contact Plate Position PID	MSS PID 4WD AUTO/4H	MSS PID 4L
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- **Does the contact plate position PID indicate that the transfer case shift motor is in 4WD AUTO?**
YES : Go to R5.
NO : Go to **Pinpoint Test Q**.

R5 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 clutch duty cycle PID read 2 percent at closed throttle?

YES : CHECK the IC. REFER to INSTRUMENT CLUSTER .

NO : Go to Pinpoint Test P.

R6 CHECK THE 4x4 INDICATOR

- Select 4x4 HIGH.
- Observe the IC.
- Does the 4x4 indicator illuminate?

YES : Go to R7.

NO : Go to Pinpoint Test P.

R7 CHECK THE 4x4 INDICATORS

- Observe the IC.
- Are other 4x4 indicators illuminated?

YES : CHECK the IC. REFER INSTRUMENT CLUSTER .

NO : Go to R8.

R8 CHECK THE 4x4 LOW INDICATOR

- Select 4x4 LOW:
 - vehicle stationary.
 - press the brake.
 - shift the transmission to NEUTRAL.
 - select 4x4 LOW.
 - wait for the 4x4 LOW indicator to illuminate in the IC indicating that the shift is complete.
- Does the 4x4 LOW indicator illuminate?

YES : Go to R10.

NO : Go to R9.

R9 CHECK THE 4x4 INDICATORS

- Observe the IC.
- Are other 4x4 indicators illuminated?

YES : CHECK the IC. REFER to INSTRUMENT CLUSTER .

NO : The indicators are working correctly. Go to Pinpoint Test V.

R10 CHECK THE CONTACT PLATE ENCODER AND TRANSFER CASE CLUTCH DUTY CYCLE PIDs

- 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.
- Monitor the contact plate encoder PIDs. Refer to the following chart:

Contact Plate PID	MSS PID 4WD AUTO/4H	MSS PID 4L
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN

PLATE_D | CLOSED | CLOSED

- **Does the clutch duty cycle PID read 10 percent with closed throttle and the contact plate position PID indicate that the transfer case shift motor is in 4x4 LOW?**

YES : CHECK the IC. REFER to INSTRUMENT CLUSTER .

NO : CHECK the 4WD system. Go to Pinpoint Test Q.

Pinpoint Test S: Straight Line Driveline Wind-up

Normal Operation

In order for the four wheel drive (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

PINPOINT TEST S: STRAIGHT LINE DRIVELINE WIND-UP

NOTE: **4x4 HIGH/4x4 LOW is not intended for driving on hard/dry surfaces.**

S1 VERIFY THE CONCERN

- Drive the vehicle and shift from 4x4 AUTO to 4x4 HIGH. There should be minimal wind-up in 4x4 HIGH 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 S2.

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

S2 CHECK FOR MATCHING WHEEL AND TIRE SIZES

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

YES : Go to S3.

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

S3 CHECK TIRE WEAR

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

YES : Go to S4.

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

S4 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 S5.

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

S5 CHECK THE FRONT AND REAR AXLE RATIOS

- Check that front and rear axle ratios match. Refer to **DRIVELINE SYSTEM - GENERAL INFORMATION** .

- **Do the front and rear axle ratios match?**

YES : RETURN the vehicle to the customer and ADVISE about correct 4WD usage and normal vehicle behavior.

NO : CHECK the vehicle identification label. INSTALL the correct axle(s). REFER to **REAR DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR** and **FRONT DRIVE AXLE/DIFFERENTIAL - DANA 30** .

Pinpoint Test T: The Vehicle Binds in Turns/Resists Turning/Pulsates/Shudders in a Straight Line

Normal Operation

When the vehicle is operating in 4x4 AUTO, all 4 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

PINPOINT TEST T: THE VEHICLE BINDS IN TURNS/RESISTS TURNING/PULSATES/SHUDDERS IN A STRAIGHT LINE

NOTE: **4x4 HIGH/4x4 LOW is not intended for driving on hard/dry surfaces.**

T1 VERIFY THE CONCERN

- Test drive the vehicle on a straight stretch of road in 4x4 AUTO mode.
- Drive the vehicle through turns and parking lot maneuvers.
- **Does the vehicle bind, pulsate or shudder?**

YES : If the problem occurs in 4x4 AUTO mode, go to T2 ; in 4x4 HIGH mode or 4x4 LOW mode, binding is a normal condition.

NO : Go to **Pinpoint Test V**.

T2 CHECK THE INDICATORS

- Review the test drive notes.

- **Did any of the instrument cluster (IC) 4x4 indicators or the powertrain malfunction indicator illuminate?**

YES : If the 4x4 or 4x4 LOW indicators stayed illuminated, go to T3 . If the powertrain malfunction indicator stayed illuminated, go to T4 .

NO : Go to T5.

T3 VERIFY THE FAULT

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

YES : The system is functioning correctly.

NO : The fault may have been caused by an intermittent, un-commanded or auto lock shift.

TEST the system for normal operation. Go to **Pinpoint Test V.**

T4 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to T5.

T5 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 **REAR DRIVE AXLE/DIFFERENTIAL - FORD 8.8-INCH RING GEAR .**

Vehicles without limited slip rear differential: INSPECT the driveline components for damage or wear. REFER to Inspection and Verification.

NO : Go to T6.

T6 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 percent?**

YES : Go to T7.

NO : CHECK the transfer case. REFER to **TRANSFER CASE .**

T7 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 T8.

NO : VERIFY that the 4 road wheels are the same size and have similar tread depth. CHECK the ABS system for faults. REFER to **VEHICLE DYNAMIC SYSTEMS** .

T8 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 percent at closed throttle and 100 percent at WOT?**

YES : Go to T9.

NO : CHECK the throttle position sensor and/or PCM for faults. REFER to the **Introduction - Gasoline Engines** .

T9 CHECK THE TRANSFER CASE FRONT DRIVESHAFT OUTPUT

- Raise the vehicle on a hoist. Refer to **JACKING AND LIFTING** .
- Rotate the front driveshaft by hand.
- **Does the front driveshaft rotate freely (does it require less than 45 N.m (33 lb-ft) to rotate)?**

YES : INSTALL a new 4X4 control module. REFER to **4X4 Control Module**. TEST the system for normal operation.

NO : CHECK the transfer case. REFER to **TRANSFER CASE** . TEST the system for normal operation.

Pinpoint Test U: Neutral Tow Functional Test

Normal Operation

Neutral tow is a dealer-installed option that allows the vehicle to be towed with the 4 road wheels without damaging the transmission. Neutral tow operates by disengaging the transmission from the rear differential.

Possible Causes

- Neutral tow indicator
- CAN circuits
- Vehicle security module (VSM)
- **4.0L** Digital transmission range (TR) sensor
- **4.6L** Neutral shifter position sensor
- Brake ON/OFF (BOO) switch
- Door ajar switch
- Ignition switch/circuitry

PINPOINT TEST U: NEUTRAL TOW FUNCTIONAL TEST

U1 CHECK NEUTRAL TOW INDICATOR PROVE-OUT

- Key in ON position.
- Key in OFF position.
- **Does the neutral tow indicator prove out?**

YES : Go to U2.

NO : Go to U7.

U2 CHECK NEUTRAL TOW ACTIVATION

- Activate neutral tow:
 - press and hold the brake pedal.
 - transmission in NEUTRAL.
 - key in OFF position.
 - press the 4x4 AUTO and hold it for 5 seconds.
- **Does neutral tow activate?**

YES : Go to U3.

NO : Go to U9.

U3 CHECK FOR NEUTRAL TOW INDICATOR TIME-OUT

- Close the driver door.
- Monitor the neutral tow indicator.
- **Does the indicator turn off after 20 seconds?**

YES : Go to U4.

NO : CHECK the module configuration. REFER to **MODULE CONFIGURATION** .

U4 CHECK NEUTRAL TOW INDICATION

- Open the driver's door.
- Monitor the neutral tow indicator.
- **Does the neutral tow indicator illuminate?**

YES : Go to U5.

NO : CHECK the module configuration. REFER to **MODULE CONFIGURATION** .

U5 CHECK NEUTRAL TOW DEACTIVATION BY IGNITION SWITCH

- Key in ON position.
- **Does neutral tow deactivate?**

YES : Go to U6.

NO : Go to U9.

U6 CHECK NEUTRAL TOW REACTIVATION

- Reactivate neutral tow:
 - press and hold the brake pedal.
 - transmission in NEUTRAL.
 - key in OFF position.
 - press the 4x4 AUTO and hold it for 5 seconds.
- Deactivate neutral tow by shifting the transmission out of NEUTRAL.
- **Does neutral tow reactivate then deactivate?**

YES : The neutral tow system is operating correctly.

NO : Go to U10.

U7 CHECK NEUTRAL TOW SYSTEM INSTALLATION

- Verify that the neutral tow system components are installed correctly.

- **Are the neutral tow system components installed correctly?**

YES : Go to U8.

NO : INSTALL the neutral tow system components as necessary, then REPEAT the Neutral Tow Functional Test.

U8 CHECK THE NEUTRAL TOW INDICATOR OPERATION

- Connect the diagnostic tool.
- Follow the scan tool directions to activate neutral tow system.
- Monitor the neutral tow indicator.
- Key ON, then key OFF.
- **Does the neutral tow indicator prove out correctly?**

YES : Go to U2.

NO : CHECK and REPAIR neutral tow system wiring as necessary, then REPEAT the Neutral Tow Functional Test.

U9 CHECK THE TRANSFER CASE SHIFT MOTOR OPERATION BY ACTIVATING 4x4 LOW

- Key in ON position.
- Select 4x4 LOW:
 - vehicle stationary.
 - press the brake.
 - shift the transmission to NEUTRAL.
 - select 4x4 LOW.
 - wait for the 4x4 LOW indicator to illuminate in the instrument cluster (IC) indicating that the shift is complete.
- **Does the 4x4 LOW indicator illuminate?**

YES : Go to U10.

NO : Go to **Pinpoint Test Q**.

U10 CHECK THE NEUTRAL SAFETY SWITCH, BRAKE ON/OFF (BOO) AND IGNITION STATE PIDs

- Connect the scan tool.
- Key in OFF position.
- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- A. Monitor the transmission neutral safety switch status 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 ignition state PID.
- **A. Does the 4X4 control module transmission neutral safety switch position PID indicate NEUTRAL when the transmission is shifted to NEUTRAL?**
- **B. Does the BOO switch PID agree with the actual brake pedal positions?**
- **C. Does the ignition state PID indicate OFF?**

YES : If all 3 PIDs are accurate, INSTALL a new 4X4 control module, then REPEAT the

Neutral Tow Functional Test.

NO : A. REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION - 5R55S** or **AUTOMATIC TRANSAXLE/TRANSMISSION - 6R60** for further diagnosis of the neutral safety switch.

B. REFER to **VEHICLE DYNAMIC SYSTEMS** for further diagnosis of the BOO switch.

C. REFER to **INSTRUMENT CLUSTER** for further diagnosis of the ignition switch.

Pinpoint Test V: Four Wheel Drive (4WD) System Functional Test

Refer to **SYSTEM WIRING DIAGRAMS** , Four-Wheel Drive (4WD) System for schematic and connector information.

Normal Operation

When the vehicle is operating in 4x4 HIGH or 4x4 LOW, (4H/4L), all 4 wheels 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 operate correctly, each wheel/tire assembly must have matching sizes and the front and rear axle ratios must match.

Possible Causes

- 4x4 indicators
- 4X4 control module
- Transfer case and related components
- Wheel/tire assemblies

PINPOINT TEST V: 4WD SYSTEM FUNCTIONAL TEST

NOTE: **4x4 HIGH/4x4 LOW** are not intended for driving on hard/dry surfaces.

V1 CHECK 4x4 INDICATOR PROVE-OUT

- Key in ON position.
- **Do the 4x4 indicators illuminate at prove out?**

YES : Go to V2.

NO : CHECK the instrument cluster (IC). REFER to **INSTRUMENT CLUSTER** .

V2 CHECK 4x4 AUTO OPERATION

- If in 4x4 LOW, switch the MSS to 4x4 AUTO.
- **Are the 4x4 indicators off?**

YES : Go to V5.

NO : Go to V3.

V3 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to V4.

V4 CHECK FOR WIND-UP IN 4x4 AUTO

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

YES : Go to **Pinpoint Test P.**

NO : Go to **Pinpoint Test Q.**

V5 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 2 to 4 percent clutch application at closed throttle?**

YES : Go to V7.

NO : Go to V6.

V6 CHECK THE CONTACT PLATE ENCODER PIDs

- Enter the following diagnostic mode on the diagnostic tool: PID/DATA Monitor and Record
- Monitor the contact plate position PIDs. Refer to the following chart:

Contact Plate Position PID	MSS PID 4WD AUTO/4H	MSS PID 4L
PLATE_A	CLOSED	OPEN
PLATE_B	OPEN	CLOSED
PLATE_C	CLOSED	OPEN
PLATE_D	CLOSED	CLOSED

- **Does the contact plate position PID indicate that the transfer case shift motor is in 4WD AUTO?**

YES : Go to **Pinpoint Test P.**

NO : Go to **Pinpoint Test Q.**

V7 CHECK THE 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 the rear wheel speed.
- **Do the front shaft speed and rear shaft speed values match within 1.5 km/h (1 mph)?**

YES : Go to V8.

NO : CHECK the ABS system. REFER to **VEHICLE DYNAMIC SYSTEMS** and VERIFY that the 4 road tire sizes match.

V8 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 control module.
- Key ON, engine OFF.

- Slowly move throttle from closed throttle to WOT and observe the 4X4 control module throttle sensor PID.
- **Does the PID value vary between 0 percent at closed throttle and 100 percent at WOT?**
YES : Go to V9.
NO : CHECK the throttle position sensor and/or PCM. REFER to the **Introduction - Gasoline Engines** .

V9 CHECK FOR WIND-UP IN TURNS ON THROTTLE

- Drive the vehicle on a dry, hard surface, executing turns while applying the throttle.
- **Is wind-up present?**
YES : CHECK the transfer case. REFER to **TRANSFER CASE** .
NO : Go to V10.

V10 CHECK 4x4 HIGH OPERATION

- Select 4x4 HIGH.
- **Does the 4x4 HIGH indicator illuminate correctly?**
YES : Go to V11.
NO : Go to V12.

V11 CHECK FOR 4x4 HIGH WIND-UP

- Drive the vehicle on a dry, hard surface in turns.
- **Is wind-up present in turns?**
YES : Go to V14.
NO : Go to **Pinpoint Test P**.

V12 CHECK FOR DTCs

- Connect the diagnostic tool.
- Carry out the on-demand self test.
- **Are DTCs present?**
YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.
NO : Go to V13.

V13 CHECK FOR WIND-UP IN 4x4 HIGH ON THROTTLE

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.
- **Is wind-up present in turns?**
YES : Go to **Pinpoint Test Q**.
NO : Go to **Pinpoint Test P**.

V14 CHECK THE 4x4 LOW OPERATION

- Select 4x4 LOW:
 - vehicle stationary.
 - press the brake.
 - shift the transmission to N (NEUTRAL).
 - select 4x4 LOW.
 - wait for the 4x4 LOW indicator to illuminate in the instrument cluster (IC) indicating that the shift is complete.
- **Does the 4x4 LOW indicator illuminate?**

YES : Go to V15.

NO : Go to V16.

V15 CHECK FOR WIND-UP IN 4x4 LOW

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.

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

YES : Go to V19.

NO : Go to V17.

V16 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to V18.

V17 CHECK FOR DTCs

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

YES : REFER to the 4X4 Control Module DTC Chart for diagnosis.

NO : Go to **Pinpoint Test P.**

V18 CHECK FOR WIND-UP IN 4x4 LOW

- Drive the vehicle on a dry, hard surface in turns while applying the throttle.

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

YES : Go to **Pinpoint Test P.**

NO : Go to **Pinpoint Test P.**

V19 CHECK 4x4 AUTO OPERATION

- Switch the MSS to 4x4 AUTO.
- **Do the 4x4 indicators turn off?**

YES : The 4WD system is operating correctly.

NO : Go to V20.

V20 CHECK FOR DTCs

- Carry out the on-demand self test.
- **Are DTCs retrieved?**

YES : REFER the 4X4 Control Module DTC Chart.

NO : Go to V21.

V21 CHECK FOR WIND-UP IN 4x4 AUTO

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

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

YES : Go to **Pinpoint Test Q.**

NO : Go to **Pinpoint Test P.**

REMOVAL AND INSTALLATION

4X4 CONTROL MODULE

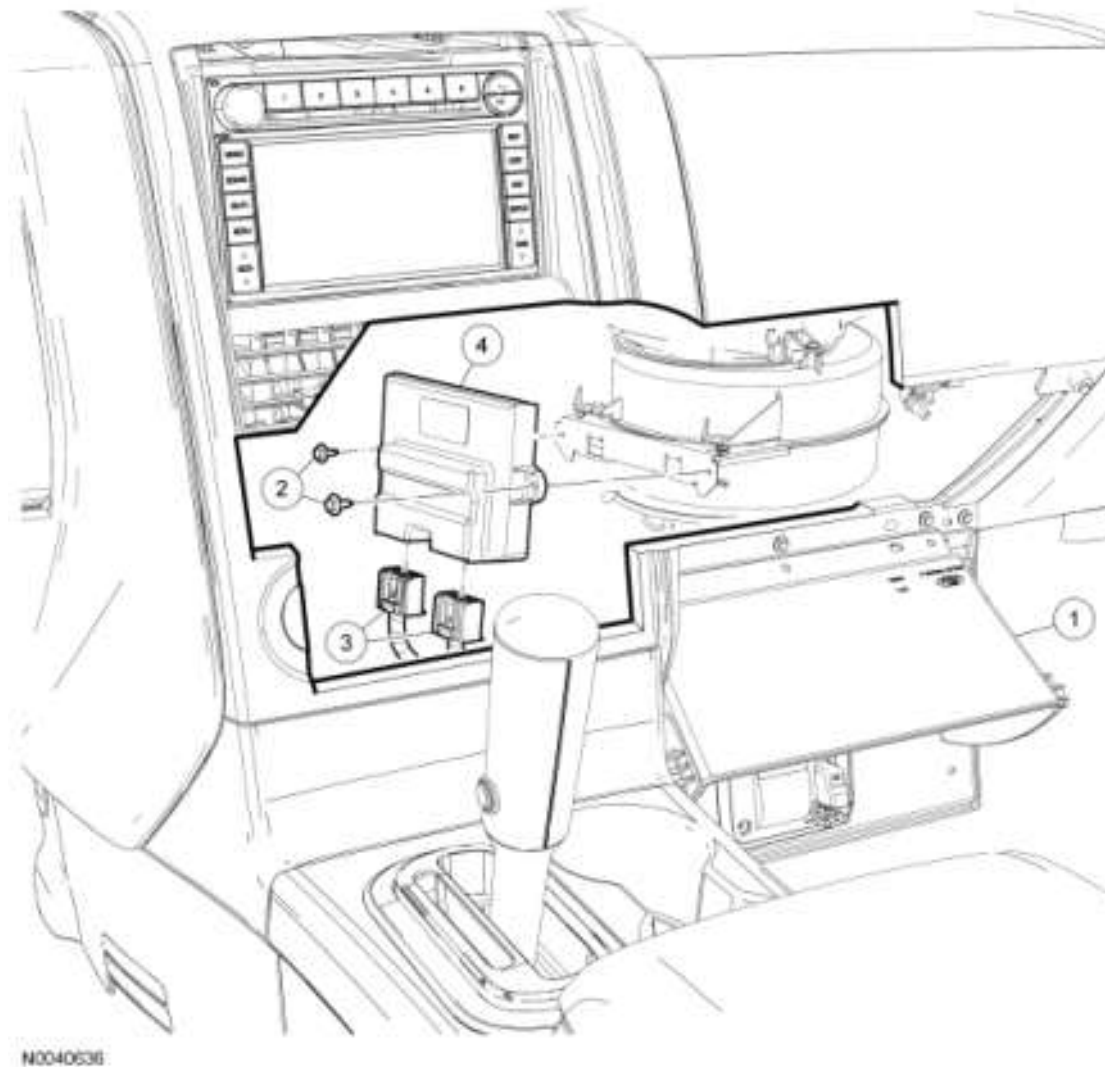


Fig. 61: Exploded View Of 4X4 Control Module
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Glove compartment
2	W705314	Screws
3	-	Connectors
4	7E453	4X4 control module

1. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** .
2. Open the glove compartment, press in on sides and lower it to gain access.
3. Remove the 2 screws.
4. Disconnect the electrical connectors.
5. Remove the 4X4 control module.

6. To install, reverse the removal procedure.

TRANSFER CASE SHIFT MOTOR

Material

Item	Specification
Multi-Purpose Grease XG-4 and/or XL-5	ESB-M1C93-B
Silicone Gasket and Sealant TA-30	WSE-M4G323-A4

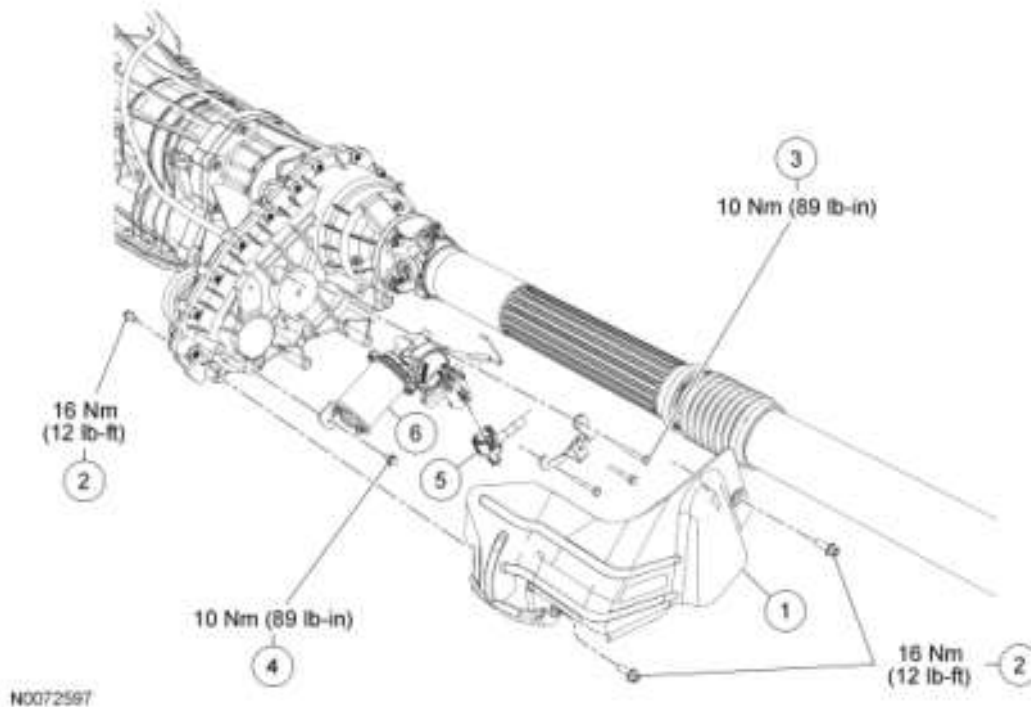


Fig. 62: Exploded View Of Transfer Case Shift Motor With Torque Specifications
Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	7C277	Heat shield
2	7A443	Heat shield bolts (3 required)
3	N800670-S	Transfer case shift motor bolt (3 required)
4	N802503-S	Transfer case shift motor bolt
5	-	Transfer case shift motor electrical connector
6	7G360	Transfer case shift motor

REMOVAL AND INSTALLATION

1. With the ignition ON, press the 4X4 HIGH button on the mode select switch (MSS).
2. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to **JACKING**

AND LIFTING .

3. Remove the 3 heat shield bolts and the heat shield.
 - To install, tighten to 16 Nm (12 lb-ft).
4. Disconnect the transfer case shift motor electrical connector.

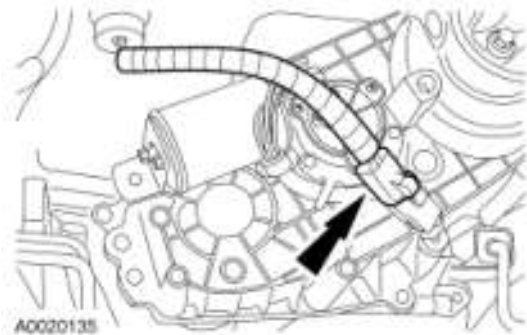
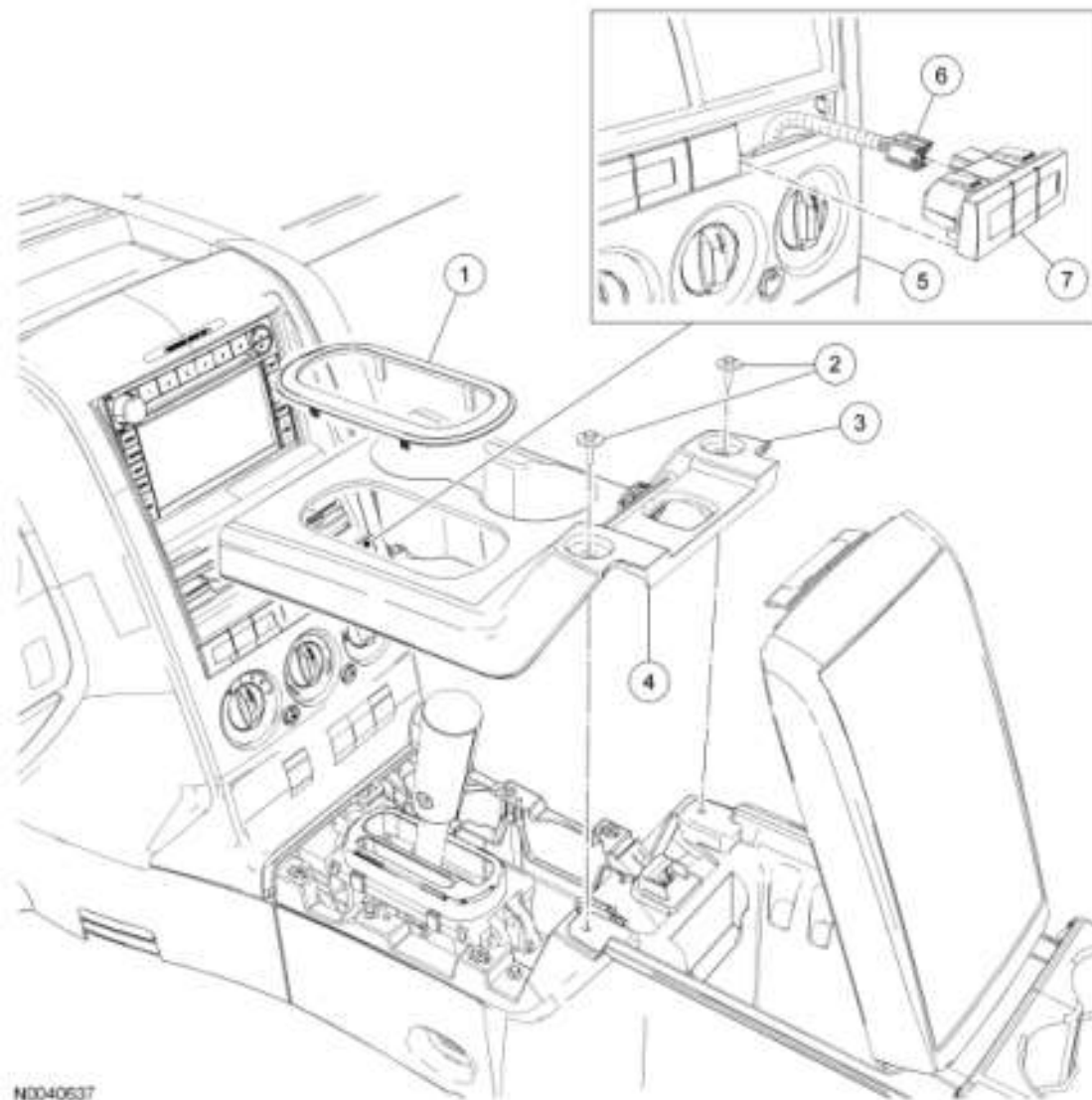


Fig. 63: Locating Transfer Case Shift Motor Connector
Courtesy of FORD MOTOR CO.

5. Using an electrical connector pin extractor tool, remove the coil wire pin from the electrical connector.
6. Remove the 4 transfer case shift motor mounting bolts and the transfer case shift motor.
 - To install, tighten to 10 Nm (89 lb-in).
7. To install, reverse the removal procedure.
 - Apply a coat of multi-purpose grease to the transfer case shift motor bolts.
 - Apply a thin coat of silicone sealant to the shift motor sealing surface.

MODE SELECT SWITCH (MSS)



N0040537

Fig. 64: Exploded View Of Mode Select Switch (MSS)
 Courtesy of FORD MOTOR CO.

Item	Part Number	Description
1	-	Bezel
2	W705314	Screws
3	-	Floor console center finish panel
4	14401	Auxiliary power point electrical connector
5	980327	Instrument panel center finish panel
6	14401	Mode select switch (MSS) electrical connector
7	7Z155	MSS

REMOVAL AND INSTALLATION

1. Disconnect the battery ground cable. For additional information, refer to **BATTERY, MOUNTING AND CABLES** .

2. Remove the bezel.
3. With the center console cover open, remove the floor console center finish panel screws.
4. Raise the floor console center finish panel and disconnect the auxiliary power point electrical connector.
5. Remove the floor console center finish panel.
6. Disconnect the electrical connector(s).
7. Disengage the locking tangs and remove the mode select switch (MSS) from the instrument panel center finish panel.

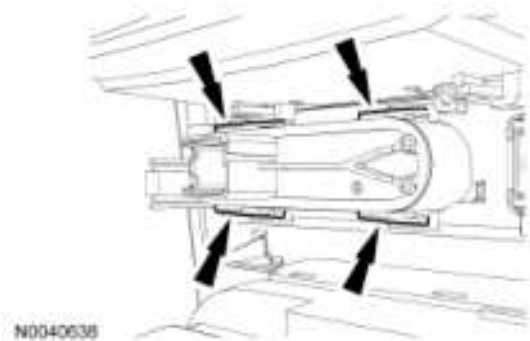


Fig. 65: Locating MSS From Instrument Panel Center Finish Panel
Courtesy of FORD MOTOR CO.

8. To install, reverse the removal procedure.