





Anti-Lock Control

Refer to Wiring Diagrams Cell 42 for schematic and connector information.

Special Tool(s)

 ST2332-A	Worldwide Diagnostic System (WDS), Vehicle Communication Module (VCM) with appropriate adapters, or equivalent diagnostic tool
 ST1137-A	73III Digital Multimeter 105-R0057 or equivalent
 ST1138-A	Flex Probe Kit 418-F090 (105-R025B) or equivalent
 ST3030-A	Rotunda Active Wheel Speed Sensor Tester 105-R0110

Principles of Operation

The anti-lock brake system (ABS) module receives wheel speed readings from each wheel speed sensor and processes this information to determine if an ABS event is necessary. The wheel speed sensor electrically senses each tooth of the wheel speed sensor indicators as it passes through the wheel speed sensor's magnetic field.

The ABS module continuously monitors and compares the rotational speed of each wheel, and when it detects an impending wheel lock, modulates hydraulic brake pressure to the appropriate brake caliper. This is accomplished by the ABS module triggering the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel returns to normal speed, the ABS module returns the solenoid valves to their normal position, and normal (base) braking resumes.

The ABS module is self-monitoring. When the ignition switch is turned to the RUN position, the ABS module does a preliminary electrical check, and at approximately 12 km/h (8 mph) the pump motor is turned on for approximately one half-second. Any malfunction of the ABS causes the ABS to shut off and the yellow ABS warning indicator to illuminate, however, normal power assisted braking remains.

The traction control system controls wheelspin by modulating engine torque and applying, then releasing the appropriate rear brake to restore traction when driving on slippery or loose surfaces.

On high-traction surfaces, a controlled amount of rear wheel spin will be allowed in the interest of quick acceleration. In order to avoid unnecessary traction control activation, the traction control strategy uses several inputs to determine when traction control activation is beneficial to the driver. The PCM relays throttle position information to the ABS

module over the High Speed Controller Area Network (HS-CAN) bus. The throttle position is utilized to determine if the driver intends to accelerate quickly. If this is the case, traction control will allow a controlled amount of rear wheel spin. If rear wheel spin is permitted, input from the front wheel speed sensors will be used to calculate vehicle acceleration. If the vehicle is accelerating while wheel spin is occurring, the ABS module will check for a difference between the left front and right front wheel speeds to determine if the vehicle is accelerating in a straight line. If the vehicle is not accelerating (rear wheels spinning on a slippery surface) or if the vehicle is turning, traction control will activate to help make better use of the available traction.

The traction control system can be disabled by pressing the traction control switch and is indicated by an indicator lamp in the traction control switch. The traction control will reset and return to normal traction assist when the ignition switch is cycled or when the traction control switch is pressed and released a second time.

Inspection and Verification

1. Verify the customer concern.
2. Verify the stoplamps operate correctly by applying and releasing the brake pedal with the ignition switch in the OFF position. If the stoplamps do not operate correctly, refer to [Section 417-01](#). If the stoplamps operate correctly, proceed to the next step.
3. Visually inspect for obvious signs of mechanical or electrical damage:

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> • Brake fluid level • Tire inflation • Wheel and tire sizes • Steering components and suspension components • Base brake system • Wheel speed sensor ring • HCU 	<ul style="list-style-type: none"> • Bussed electrical center (BEC) fuse(s): <ul style="list-style-type: none"> ▪ 7 (40A) ▪ 65 (30A) • Smart junction box (SJB) fuse 18 (10A) • Circuitry • Brake fluid level switch • Stoplamp switch • Wheel speed sensor • Anti-lock brake system (ABS) module • Traction control switch

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step. If the cause is not visually evident, connect the diagnostic tool to the data link connector (DLC) and select the vehicle to be tested from the diagnostic tool menu. If the diagnostic tool does not communicate with the vehicle:
 - check that the program card is correctly installed.
 - check the connections to the vehicle.
 - check the ignition switch position.
5. If the diagnostic tool still does not communicate with the vehicle, refer to the diagnostic tool operating manual.
6. Carry out the diagnostic tool data link test. If the diagnostic tool responds with:
 - CAN or ISO circuit fault; all electronic control units no response/not equipped, refer to [Section 418-00](#).
 - No response/not equipped for the ABS module, [GO to Pinpoint Test A](#).
 - No response/not equipped for the SJB, [Section 419-10](#).

- System passed, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the ABS module.

7. If the DTCs retrieved are related to the concern, go to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Index.

8. If no DTCs related to the concern are retrieved, GO to [Symptom Chart](#).

Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1317	Battery Voltage High	ABS Module	GO to Pinpoint Test B.
B1318	Battery Voltage Low	ABS Module	GO to Pinpoint Test B.
B1342	ECU Is Defective	ABS Module	NOTE: <i>If other DTCs are present, REPAIR them before installing a new module.</i> CLEAR the DTCs. RETRIEVE the DTCs. If DTC B1342 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test.
B2477	Module Configuration Failure	ABS Module	CONFIGURE the ABS module. REFER to Section 418-01 . CLEAR the DTCs. REPEAT the self-test. If DTC B2477 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. REPEAT the self-test.
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS Module	GO to Pinpoint Test C.
C1096	ABS Hydraulic Pump Motor Circuit Open	ABS Module	GO to Pinpoint Test C.
C1115	ABS Power Relay Output Short Circuit To Battery	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1115 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1145	Wheel Speed Sensor RF Input Circuit Failure	ABS Module	GO to Pinpoint Test D.
C1155	Wheel Speed Sensor LF Input Circuit Failure	ABS Module	GO to Pinpoint Test D.
C1165	Wheel Speed Sensor RR Input Circuit Failure	ABS Module	GO to Pinpoint Test D.
C1175	Wheel Speed Sensor LR Input Circuit Failure	ABS Module	GO to Pinpoint Test D.
C1185	ABS Power Relay Output Circuit Failure	ABS Module	CLEAR all DTCs. If DTC C1185 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1194	ABS Outlet Valve Coil LF Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1194 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.

DTC	Description	Source	Action
C1198	ABS Inlet Valve Coil LF Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1198 is retrieved again, INSTALL a new ABS module. INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1210	ABS Outlet Valve Coil RF Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1210 is retrieved again, INSTALL a new ABS module. INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1214	ABS Inlet Valve Coil RF Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1214 is retrieved again, INSTALL a new ABS module. INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1222	Wheel Speed Mismatch	ABS Module	GO to Pinpoint Test E.
C1233	Wheel Speed LF Input Signal Missing	ABS Module	GO to Pinpoint Test E.
C1234	Wheel Speed RF Input Signal Missing	ABS Module	GO to Pinpoint Test E.
C1235	Wheel Speed RR Input Signal Missing	ABS Module	GO to Pinpoint Test E.
C1236	Wheel Speed LR Input Signal Missing	ABS Module	GO to Pinpoint Test E.
C1242	ABS Outlet Valve Coil LR Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1242 is retrieved again, INSTALL a new ABS module. INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1246	ABS Outlet Valve Coil RR Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1246 is retrieved again, INSTALL a new ABS module. INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1250	ABS Inlet Valve Coil LR Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1250 is retrieved again, INSTALL a new ABS module. INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1254	ABS Inlet Valve Coil RR Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1254 is retrieved again, INSTALL a new ABS module. INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1329	ABS Valve Outlet Coil Over RF Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1329 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1330	ABS Valve Outlet Coil Over LR Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1330 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1331	ABS Valve Outlet Coil Over RR Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1331 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1332	ABS Valve Outlet Coil Over LF Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1332 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1333	ABS Valve Inlet Coil Over RF Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1333 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.

DTC	Description	Source	Action
C1334	ABS Valve Inlet Coil Over LR Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1334 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1335	ABS Valve Inlet Coil Over RR Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1335 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1336	ABS Valve Inlet Coil Over LF Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1336 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1404	Traction Control Valve Rear Circuit Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1404 is retrieved again, INSTALL a new ABS module. INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1446	Brake Switch Circuit Failure	ABS Module	GO to Pinpoint Test F.
C1527	ABS TC Valve Inlet Coil Over Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1527 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1531	ABS TC Valve Outlet Coil Over Temperature	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1531 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1730	Reference Voltage Out of Range (+5 V)	ABS Module	If any other DTC(s) are present, diagnose those DTC(s) first. CLEAR all DTCs. DRIVE the vehicle. If the DTC is still present, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
C1958	ABS TC Valve Outlet Coil Failure	ABS Module	CLEAR all DTCs. DRIVE the vehicle. If DTC C1958 is retrieved again, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CARRY OUT the self-test with the brake pedal not applied.
U0073	CAN Bus off - Transmit Error	ABS Module	REFER to Section 418-00.
U1900	CAN Communication Bus Fault - Receive Error	ABS Module	REFER to Section 418-00.

Symptom Chart

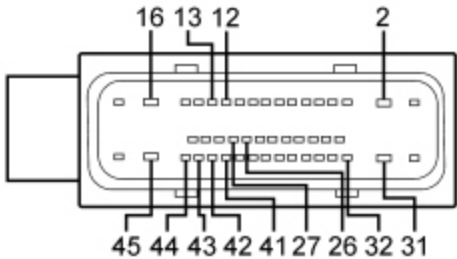
Symptom Chart

Condition	Possible Causes	Action
<ul style="list-style-type: none"> No communication with the anti-lock brake system (ABS) module 	<ul style="list-style-type: none"> Circuitry ABS module 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
<ul style="list-style-type: none"> No communication with the instrument cluster 	<ul style="list-style-type: none"> Circuitry Instrument cluster 	<ul style="list-style-type: none"> REFER to Section 413-01 to continue diagnosis of the communication network.
<ul style="list-style-type: none"> The red brake warning indicator does not self-check 	<ul style="list-style-type: none"> Circuitry Instrument cluster 	<ul style="list-style-type: none"> REFER to Section 413-01 to continue diagnosis of the red brake warning indicator.
<ul style="list-style-type: none"> The red brake warning indicator stays on when the ignition is in RUN 	<ul style="list-style-type: none"> Base brake system Circuitry Low brake fluid warning switch 	<ul style="list-style-type: none"> REFER to Section 413-01 to continue diagnosis of the red brake warning indicator.

	<ul style="list-style-type: none"> • Parking brake switch • Anti-lock brake system (ABS) module • Instrument cluster 	
<ul style="list-style-type: none"> • The yellow anti-lock brake system (ABS) warning indicator does not self-check 	<ul style="list-style-type: none"> • Circuitry • Instrument cluster 	<ul style="list-style-type: none"> • REFER to Section 413-01 to continue diagnosis of the yellow brake warning indicator.
<ul style="list-style-type: none"> • Spongy/soft/low brake pedal with no warning indicator 	<ul style="list-style-type: none"> • Air in brake hydraulic system • Base brake system • Hydraulic control unit (HCU) 	<ul style="list-style-type: none"> • GO to Pinpoint Test G.
<ul style="list-style-type: none"> • Poor vehicle tracking during anti-lock function 	<ul style="list-style-type: none"> • Tire pressure • Air in the brake system • Base brake system • Hydraulic control unit (HCU). 	<ul style="list-style-type: none"> • REFER to Section 206-00 to continue diagnosis of the brake system. • GO to Pinpoint Test H.
<ul style="list-style-type: none"> • The traction control is inoperative 	<ul style="list-style-type: none"> • Circuitry • Traction control switch • Anti-lock brake system (ABS) module 	<ul style="list-style-type: none"> • INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section.
<ul style="list-style-type: none"> • The traction control system cannot be disabled 	<ul style="list-style-type: none"> • Circuitry • Traction control switch • Instrument cluster • Anti-lock brake system (ABS) module 	<ul style="list-style-type: none"> • GO to Pinpoint Test I.
<ul style="list-style-type: none"> • The traction control switch indicator is never/always on 	<ul style="list-style-type: none"> • Circuitry • Traction control switch • Anti-lock brake system (ABS) module • Instrument cluster 	<ul style="list-style-type: none"> • GO to Pinpoint Test J.

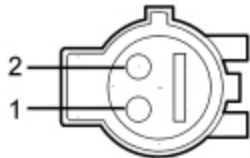
Connector Circuit Reference

Anti-Lock Brake System (ABS) C135



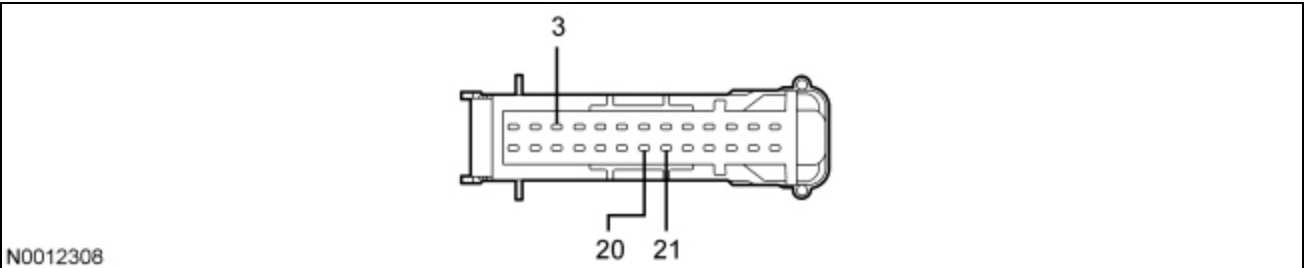
Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
2	601 (LB/PK) coil voltage	Voltage at all times. Less than 5 ohms between the ABS module and the bussed fused electrical center (BEC). Greater than 10,000 ohms between the ABS module and ground.
12	521 (TN/OG) LF wheel speed sensor voltage	0 volts, less than 5 ohms between the LF wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground.
13	522 (TN/BK) LF wheel speed sensor signal	0 volts, less than 5 ohms between the LF wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground.
16	1205 (BK) ground	0 volts, less than 5 ohms between the ABS module and ground. Greater than 10,000 ohms between the ABS module and ground.
26	514 (YE/RD) RF wheel speed sensor voltage	0 volts, less than 5 ohms between the RF wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground.
27	516 (YE/BK) RF wheel speed sensor signal	0 volts, less than 5 ohms between the RF wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground.
31	534 (YE/LG) pump motor voltage	Hot at all times.
32	1844 (LG/RD) ABS module voltage	Hot in RUN/START.
41	519 (LG/BK) LR wheel speed sensor signal	0 volts, less than 5 ohms between the LR wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground.
42	518 (LG/RD) LR wheel speed sensor voltage	0 volts, less than 5 ohms between the LR wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground.
43	523 (RD/PK) RR wheel speed sensor voltage	0 volts, less than 5 ohms between the RR wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground.
44	524 (PK/BK) RR wheel speed sensor signal	0 volts, less than 5 ohms between the RR wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground.
45	1205 (BK) pump motor ground	0 volts, less than 5 ohms between the ABS module and ground. Greater than 10,000 ohms between the ABS module and ground.

LH Front Wheel Speed Sensor C150, RH Front Wheel Speed Sensor C160, LH Rear Wheel Speed Sensor C3116, RH Rear Wheel Speed Sensor C3117



Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
1 (C150)	521 (TN/OG) LH front wheel speed voltage	0 volts, less than 5 ohms between the wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground with the ABS module disconnected.
1 (C160)	514 (YE/RD) RH front wheel speed voltage	0 volts, less than 5 ohms between the wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground with the ABS module disconnected.
1 (C3116)	518 (LG/RD) LH rear wheel speed voltage	0 volts, less than 5 ohms between the wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground with the ABS module disconnected.
1 (C3117)	523 (RD/PK) RH rear wheel speed voltage	0 volts, less than 5 ohms between the wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground with the ABS module disconnected.
2 (C150)	522 (TN/BK) LH front wheel speed signal	0 volts, less than 5 ohms between the wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground with the ABS module disconnected.
2 (C160)	516 (YE/BK) RH front wheel speed signal	0 volts, less than 5 ohms between the wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground with the ABS module disconnected.
2 (C3116)	519 (LG/BK) LH rear wheel speed signal	0 volts, less than 5 ohms between the wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground with the ABS module disconnected.
2 (C3117)	524 (PK/BK) RH rear wheel speed signal	0 volts, less than 5 ohms between the wheel speed sensor and the ABS module. Greater than 10,000 ohms between the ABS module and ground with the ABS module disconnected.

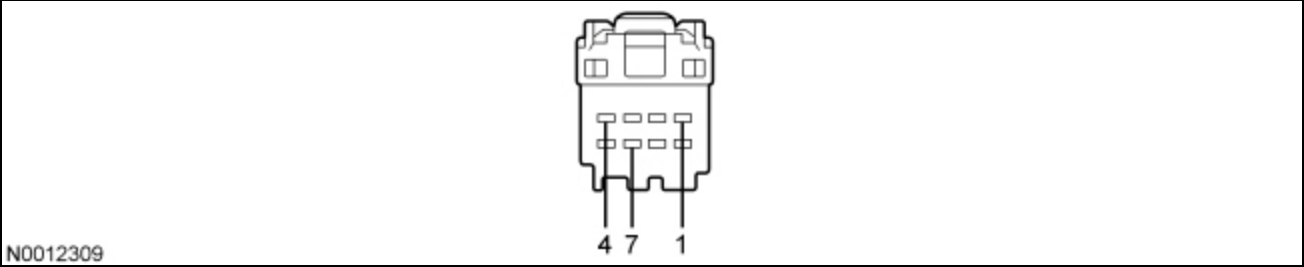
Instrument Cluster C220



N0012308

Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
3	1001 (WH/YE) instrument cluster voltage	Voltage at all times. Less than 5 ohms between the instrument cluster and the smart junction box (SJB). Greater than 10,000 ohms between the ABS module and ground.
20	1412 (WH/PK) traction control override input	Less than 5 ohms between the instrument cluster and the traction control switch.
21	939 (VT) traction control switch indicator output	Less than 5 ohms between the instrument cluster and the traction control switch.

Traction Control Switch C2039



Pin Number(s)	Circuit Designation/Description	Normal Condition/Measurement
1	1205 (BK) traction control switch ground	Less than 5 ohms between the traction control switch and ground.
4	939 (VT) traction control switch indicator input	Less than 5 ohms between the traction control switch and the instrument cluster.
7	1412 (WH/PK) traction control switch cancel	Less than 5 ohms between the traction control switch and the instrument cluster.

Pinpoint Test A: No Communication With the Anti-lock Brake System (ABS) Module

Normal Operation

The operating voltage required to supply the ABS module, hydraulic pump, and isolation valves is in a range between 10 and 16 volts.

Voltage is supplied by the smart junction box (SJB) through circuit 1844 (LG/RD) (ignition feed) and the bussed electrical center (BEC) through circuit 601 (LB/PK) (voltage at all times). Ground is provided through circuit 1205 (BK).

Possible Causes

- circuit 601 (LB/PK) open
- circuit 1205 (BK) open
- circuit 1844 (LG/RD) open
- ABS module

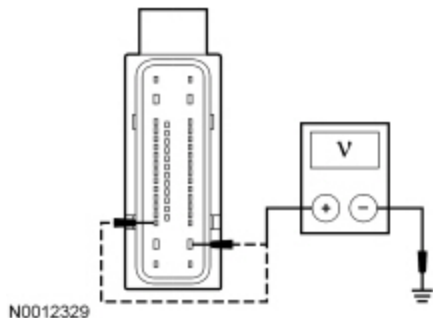
PINPOINT TEST A : NO COMMUNICATION WITH THE ANTI-LOCK BRAKE SYSTEM (ABS) MODULE

NOTICE: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

A1 CHECK CIRCUIT 601 (LB/PK) FOR AN OPEN

- Ignition OFF.
- Disconnect: ABS Module C135.
- Ignition ON.

- Measure the voltage between the ABS module C135 Pin 2, circuit 601 (LB/PK), harness side and ground; and between the ABS module C135 Pin 32, circuit 1844 (LG/RD), harness side and ground.

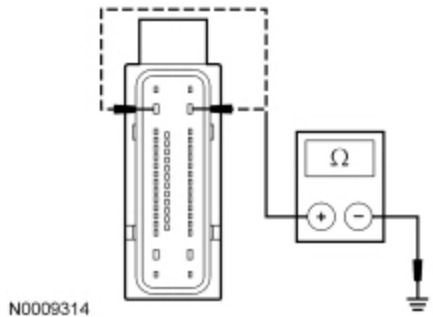


Are the voltages greater than 10 volts?

Yes	GO to A2 .
No	REPAIR the circuit in question. REPEAT the self-test.

A2 CHECK CIRCUIT 1205 (BK) FOR AN OPEN

- Ignition OFF.
- Measure the resistance between the ABS module C135 Pin 16, circuit 1205 (BK), harness side and ground; and between the ABS module C135 Pin 45, circuit 1205 (BK), harness side and ground.



Are the resistances less than 5 ohms?

Yes	CHECK the module communications network. REFER to Section 418-00 .
No	REPAIR the circuit in question. REPEAT the self-test.

Pinpoint Test B: DTCs B1317 AND B1318 — Battery Voltage High/Low

Normal Operation

The vehicle electrical system voltage supplied is within the range of 10-16 volts. Above or below that voltage range, the DTC B1317 (Battery Voltage High) or the DTC B1318 (Battery Voltage Low) will be set. The voltage is supplied by the bussed electrical center (BEC) through circuit 601 (LB/PK) (voltage at all times) and the smart junction box (SJB) through circuit 1844 (LG/RD) (ignition feed). Ground is provided through circuit 1205 (BK).

Possible Causes

- circuit 601 (LB/PK) open
- circuit 1205 (BK) open
- circuit 1844 (LG/RD) open
- charging system
- anti-lock brake system (ABS) module

PINPOINT TEST B : DTCS B1317 AND B1318 — BATTERY VOLTAGE HIGH/LOW

NOTICE: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

B1 CHECK THE BATTERY VOLTAGE

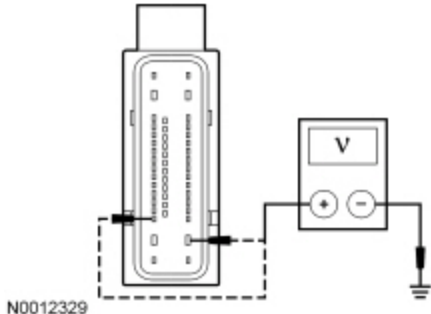
- Measure the battery voltage between the positive and negative battery terminals with the key ON and the engine OFF (KOEO), and with the engine running.

Is the battery voltage between 10 and 13 volts with KOEO, and between 13 and 17 volts with the engine running?

Yes	GO to B2 .
No	REFER to Section 414-00 to continue diagnosis of the charging system.

B2 CHECK CIRCUIT 601 (LB/PK) AND CIRCUIT 1844 (LG/RD) FOR VOLTAGE

- Ignition OFF.
- Disconnect: Anti-Lock Brake Module C135.
- Ignition ON.
- Measure the voltage between the ABS module C135 Pin 2, circuit 601 (LB/PK), harness side and ground; and between the ABS module C135 Pin 32, circuit 1844 (LG/RD), harness side and ground.

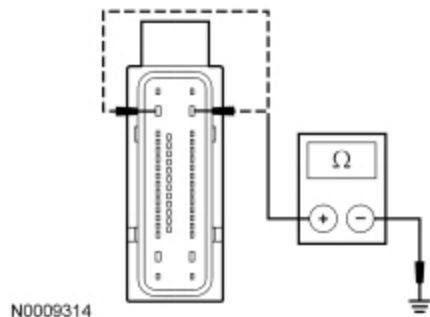


Are the voltages greater than 10 volts?

Yes	GO to B3 .
No	REPAIR the circuit in question. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

B3 CHECK CIRCUIT 1205 (BK) FOR AN OPEN

- Ignition OFF.
- Measure the resistance between the ABS module C135 Pin 16, circuit 1205 (BK), harness side and ground; and between the ABS module C135 Pin 45, circuit 1205 (BK), harness side and ground.



Are the resistances less than 5 ohms?

Yes	GO to B4 .
No	REPAIR the circuit in question. REPEAT the self-test.

B4 CHECK FOR CORRECT ABS MODULE OPERATION

- Disconnect the ABS connector.
- Check for:
 - corrosion
 - spread or bent pins
 - pushed-out pins
- Connect the ABS connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. CARRY OUT the self-test with the brake pedal not applied.

Pinpoint Test C: DTCs C1095 and C1096 — ABS Hydraulic Pump Motor Circuit Failure/Open

Normal Operation

Anti-lock brake system (ABS) diagnostic trouble code (DTC) C1095 sets only when the motor is initially commanded on for 100 ms (+/-6 ms), and the ABS hydraulic pump motor is then commanded off and the voltage back is read after 6 ms. If the voltage indicates the motor is spinning at less than 500 rpm there may be a locked motor. If this condition is detected 4 times then a locked motor DTC C1095 is set. The pump motor is checked for an open circuit 2 seconds after the most recent successful pump motor off command. If the pump motor feedback remains greater than 0.75 volt for more than 50 ms (+/-6 ms) after these conditions have been met, then DTC C1096 is set.

Voltage is supplied from the bussed electrical center (BEC) through circuit 534 (YE/LG) (voltage at all times). Ground is provided through circuit 1205 (BK).

Possible Causes

- circuit 534 (YE/LG) open
- circuit 1205 (BK) open
- hydraulic pump motor
- ABS module

PINPOINT TEST C : DTCS C1095 AND C1096 — ABS HYDRAULIC PUMP MOTOR CIRCUIT FAILURE/OPEN

NOTICE: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

C1 CHECK THE ANTI-LOCK BRAKE SYSTEM (ABS) PUMP MOTOR

- Ignition ON.

Is the ABS pump motor running all the time?

Yes	INSTALL a new ABS module and hydraulic control unit (HCU) as necessary. REFER to Anti-Lock Brake System (ABS) Module and Hydraulic Control Unit (HCU) in this section. CLEAR the DTCs. REPEAT the ABS self-test.
No	GO to C2 .

C2 CHECK THE PUMP MOTOR OPERATION

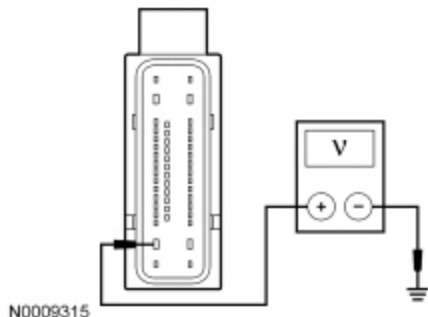
- Enter the following diagnostic mode on the scan tool: ABS Module Active Command.
- Trigger the ABS module pump motor ON active command.

Does the ABS pump motor run for approximately 2 seconds?

Yes	CLEAR the DTCs. CHECK the yellow ABS warning indicator while driving the vehicle (brakes must not be applied) above 32 km/h (20 mph). If the yellow ABS warning indicator illuminates, RETRIEVE the DTCs. If DTC C1096 is retrieved, GO to C5 . If DTC C1095 is retrieved, INSTALL a new HCU. REFER to Hydraulic Control Unit (HCU) in this section. CLEAR the DTCs. REPEAT the self-test.
No	TRIGGER the ABS module pump motor OFF active command. GO to C3 .

C3 CHECK CIRCUIT 534 (YE/LG) FOR AN OPEN

- Disconnect: ABS Module C135.
- Measure the voltage between the ABS module C135 Pin 31, circuit 534 (YE/LG), harness side and ground.

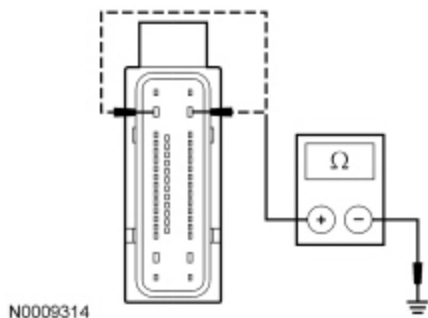


Is the voltage greater than 10 volts?

Yes	GO to C4 .
No	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

C4 CHECK CIRCUIT 1205 (BK) FOR AN OPEN

- Ignition OFF.
- Measure the resistance between the ABS module C135 Pin 45, circuit 1205 (BK), harness side and ground; and between the ABS module C135 Pin 16, circuit 1205 (BK), harness side and ground.



Are the resistances less than 5 ohms?

Yes	INSTALL a new HCU. REFER to Hydraulic Control Unit (HCU) in this section. CLEAR the DTCs. REPEAT the self-test.
No	REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

C5 CHECK FOR CORRECT ABS MODULE OPERATION

- Disconnect the ABS connector.
- Check for:
 - corrosion.
 - spread or bent pins.
 - pushed-out pins.

- Connect the ABS connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test D: DTCs C1145, C1155, C1165, and C1175 — Wheel Speed Sensor Input Circuit Failure

Normal Operation

The active wheel speed sensors generate a square wave signal that is sent to the anti-lock brake system (ABS) module. The wheel speed sensor circuitry connects to the ABS module through 2 wires and a connector at each wheel speed sensor. When the ignition is turned to the RUN position, the ABS module carries out a self-test by sending a reference voltage to all of the wheel speed sensors and their circuitry to determine if they are functional.

Voltage and ground signals are supplied to the wheel speed sensors from the ABS module.

Possible Causes

- circuit 514 (YE/RD) open, short to voltage, or short to ground
- circuit 516 (YE/BK) open, short to voltage, or short to ground
- circuit 518 (LG/RD) open, short to voltage, or short to ground
- circuit 519 (LG/BK) open, short to voltage, or short to ground
- circuit 521 (TN/OG) open, short to voltage, or short to ground
- circuit 522 (TN/BK) open, short to voltage, or short to ground
- circuit 523 (RD/PK) open, short to voltage, or short to ground
- circuit 524 (PK/BK) open, short to voltage, or short to ground
- wheel speed sensor
- ABS module

PINPOINT TEST D : DTCS C1145, C1155, C1165, AND C1175 — WHEEL SPEED SENSOR INPUT CIRCUIT FAILURE

NOTICE: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

D1 CHECK FOR FAULT REPEATABILITY

- Connect the scan tool.
- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Clear the Continuous DTCs.
- Drive the vehicle at least 16 km/h (10 mph).
- Retrieve and document continuous DTCs.

Is DTC C1145, C1155, C1165 or C1175 retrieved?

Yes	If the active wheel speed sensor tool is available, GO to D2 . If the active wheel speed sensor tool is not available, GO to D4 .
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No	INSPECT the wheel speed sensors, wheel speed sensor wiring and wheel speed sensor tone rings. REPAIR or INSTALL new as necessary. If any other DTCs are retrieved, GO to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Index.
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D2 CHECK THE ABS MODULE OUTPUT USING THE SPECIAL TOOL

- Ignition OFF.
- Disconnect: Suspect Wheel Speed Sensor.
- Connect the special tool to the wheel speed sensor connectors.
- Ignition ON.
- Select the correct system polarity on the special tool and turn the special tool power switch to the ON position.

Is the module output LED illuminated?

Yes	GO to D3 .
No	GO to D6 .

D3 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE SPECIAL TOOL

- Raise the suspect wheel until it can spin freely. Refer to [Section 100-02](#).
- While monitoring the special tool, slowly spin the suspect wheel.

Do the sensor output LEDs illuminate and flash and is the current overload LED not illuminated?

Yes	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
No	If the current level LED is not illuminated and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test. If the current level LED is not illuminated and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. If the tone ring is OK, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. For the rear wheel speed sensor, REFER to Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test.

D4 CHECK THE WHEEL SPEED CIRCUITS FOR A SHORT TO VOLTAGE

NOTE: Both circuits must be checked for each DTC.

- Ignition OFF.
- Disconnect: Anti-lock Brake System (ABS) Module C135.
- Disconnect: Suspect Wheel Speed Sensor.
- Ignition ON.
- Measure the voltage between the ABS module C135, harness side and ground as follows:

DTC	ABS Module Connector-Pin	Circuit
C1145	C135 Pin 26	514 (YE/RD)
C1145	C135 Pin 27	516 (YE/BK)
C1155	C135 Pin 13	522 (TN/BK)
C1155	C135 Pin 12	521 (TN/OG)
C1165	C135 Pin 44	524 (PK/BK)
C1165	C135 Pin 43	523 (RD/PK)
C1175	C135 Pin 42	518 (LG/RD)
C1175	C135 Pin 41	519 (LG/BK)

Is any voltage present?

Yes	REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.
No	GO to D5 .

D5 CHECK THE WHEEL SPEED CIRCUITS FOR A SHORT TO GROUND

NOTE: Both circuits must be checked for each DTC.

- Ignition OFF.
- Measure the resistance between the ABS module C135, harness side and ground as follows:

DTC	ABS Module Connector-Pin	Circuit
C1145	C135 Pin 26	514 (YE/RD)
C1145	C135 Pin 27	516 (YE/BK)
C1155	C135 Pin 13	522 (TN/BK)
C1155	C135 Pin 12	521 (TN/OG)
C1165	C135 Pin 44	524 (PK/BK)
C1165	C135 Pin 43	523 (RD/PK)
C1175	C135 Pin 42	518 (LG/RD)
C1175	C135 Pin 41	519 (LG/BK)

Are the resistances greater than 10,000 ohms?

Yes	GO to D6 .
No	REPAIR the circuit(s) in question. CLEAR the DTCs. REPEAT the self-test.

D6 CHECK THE WHEEL SPEED CIRCUITS FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

- Ignition OFF.
- Disconnect: ABS Module C135.
- Disconnect: Suspect Wheel Speed Sensor.
- Measure the resistance between the ABS module C135, harness side and the suspect wheel speed sensor connector, harness side as follows:

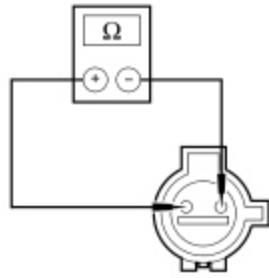
DTC	Circuit	ABS Module Connector-Pin	Wheel Speed Sensor Connector-Pin
C1145	514 (YE/RD)	C135 Pin 26	RH front wheel speed sensor C160 Pin 1
C1145	516 (YE/BK)	C135 Pin 27	RH front wheel speed sensor C160 Pin 2
C1155	521 (TN/OG)	C135 Pin 12	LH front wheel speed sensor C150 Pin 1
C1155	522 (TN/BK)	C135 Pin 13	LH front wheel speed sensor C150 Pin 2
C1165	523 (RD/PK)	C135 Pin 43	RH rear wheel speed sensor C3117 Pin 1
C1165	524 (PK/BK)	C135 Pin 44	RH rear wheel speed sensor C3117 Pin 2
C1175	519 (LG/BK)	C135 Pin 41	LH rear wheel speed sensor C3116 Pin 2
C1175	518 (LG/RD)	C135 Pin 42	LH rear wheel speed sensor C3116 Pin 1

Are the resistances less than 5 ohms?

Yes	GO to D7 .
No	REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

D7 CHECK FOR SHORTED WHEEL SPEED SENSOR CIRCUITS

- Measure the resistance between the suspect wheel speed sensor pins, harness side with the meter in the 10 mega ohm range.



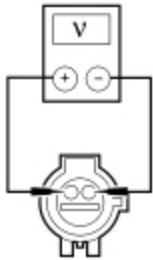
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Is there any continuity?

Yes	REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.
No	GO to D8 .

D8 CHECK THE ABS MODULE OUTPUT

- Connect: ABS Module C135.
- Ignition ON.
- Measure the voltage between the suspect wheel speed sensor pins, harness side.



A0057374

Is the voltage greater than 10 volts?

Yes	INSTALL a new wheel speed sensor. REFER to Wheel Speed Sensor — Front or Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test.
No	GO to D9 .

D9 CHECK FOR CORRECT ABS MODULE OPERATION

- Disconnect the ABS connector.
- Check for:
 - corrosion.
 - spread or bent pins.

- pushed-out pins.
- Connect the ABS connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test E: DTCs C1222, C1233, C1234, C1235, and C1236 — Wheel Speed Sensor Input Signal Missing/Mismatch

Normal Operation

The wheel speed sensor and sensor ring generate a square wave signal to the anti-lock brake system (ABS) module that is proportional to wheel speed. The ABS module compares wheel speed inputs from all wheel speed sensors to determine an impending wheel lockup. Incorrect tire size can set these DTCs as well.

Possible Causes

- wheel speed sensor
- ABS module

PINPOINT TEST E : DTCS C1222, C1233, C1234, C1235, AND C1236 — WHEEL SPEED SENSOR INPUT SIGNAL MISSING/MISMATCH

NOTICE: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

E1 CHECK THE DTCS FROM THE SELF-TEST

- Retrieve the recorded results from the anti-lock brake system (ABS) module continuous and on-demand self-tests.

Are DTCs C1145, C1155, C1165, or C1175 present?

Yes	GO to Pinpoint Test D.
No	For DTC C1222, GO to E6. For DTCs C1233, C1234, C1235 and C1236, if the active wheel speed sensor tool is available, GO to E2. If the active wheel speed sensor tool is not available, GO to E5. For all other DTCs, GO to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Index.

E2 CHECK THE ABS MODULE OUTPUT USING THE SPECIAL TOOL

- Ignition OFF.
- Disconnect: Suspect Wheel Speed Sensor.
- Connect the special tool to the wheel speed sensor connectors.
- Ignition ON.
- Select the correct system polarity on the special tool and turn the special tool power switch to the ON position.

Is the module output LED illuminated?

Yes	GO to E4 .
No	GO to E3 .

E3 CHECK THE WHEEL SPEED SENSOR CIRCUITS FOR AN OPEN

NOTE: Both circuits must be checked for each DTC.

- Ignition OFF.
- Disconnect: ABS Module C155 .
- Measure the resistance between ABS module C155, harness side and the suspected wheel speed sensor connector, harness side, as follows:

DTC	Circuit	ABS Module Connector-Pin	Wheel Speed Sensor Connector-Pin
C1233	522 (TN/BK)	C135 Pin 13	LH front wheel speed sensor C150 Pin 2
C1233	521 (TN/OG)	C135 Pin 12	LH front wheel speed sensor C150 Pin 1
C1234	516 (YE/BK)	C135 Pin 27	RH front wheel speed sensor C160 Pin 2
C1234	514 (YE/RD)	C135 Pin 26	RH front wheel speed sensor C160 Pin 1
C1235	523 (RD/PK)	C135 Pin 43	RH rear wheel speed sensor C3117 Pin 1
C1235	524 (PK/BK)	C135 Pin 44	RH rear wheel speed sensor C3117 Pin 2
C1236	518 (LG/RD)	C135 Pin 42	LH rear wheel speed sensor C3116 Pin 1
C1236	519 (LG/BK)	C135 Pin 41	LH rear wheel speed sensor C3116 Pin 2

Are the resistances less than 5 ohms?

Yes	GO to E7 .
No	REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

E4 CHECK THE WHEEL SPEED SENSOR OUTPUT WITH THE SPECIAL TOOL

- Raise the suspect wheel until it can spin freely. Refer to [Section 100-02](#).
- While monitoring the special tool, slowly spin the suspect wheel.

Do the sensor output LEDs illuminate and flash and is the current overload LED not illuminated?

Yes	INSPECT the wheel speed sensor tone ring for damage and looseness. INSTALL new components as necessary. If the tone ring is OK, the concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.
No	If the current level LED is not illuminated and the sensor output LEDs do not illuminate or if the current level LED is illuminated red, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to Wheel Speed Sensor — Front in this section. For the rear wheel

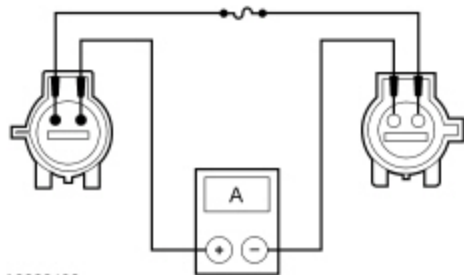
speed sensor, REFER to [Wheel Speed Sensor — Rear](#) in this section. CLEAR the DTCs. REPEAT the self-test.
 If the current level LED is not illuminated and the sensor output LEDs illuminate green but do not flash, INSPECT the wheel speed sensor tone ring and INSTALL new if necessary. If the tone ring is OK, INSTALL a new wheel speed sensor. For the front wheel speed sensor, REFER to [Wheel Speed Sensor — Front](#) in this section. For the rear wheel speed sensor, REFER to [Wheel Speed Sensor — Rear](#) in this section. CLEAR the DTCs. REPEAT the self-test.

E5 CHECK THE WHEEL SPEED SENSOR OUTPUT

NOTE: The ignition must be in the OFF position until the connections are made or a DTC sets and the ABS light illuminates, cutting voltage to the wheel speed sensors. If this happens, turn the key to the OFF position, and make sure that no jumper connections are shorted to ground or shorted together. Turn the key ON and wait for the ABS light to prove out.

- Disconnect: Suspect Wheel Speed Sensor.
- Connect a fused (5A) jumper wire between the wheel speed sensor, component side, and the wheel speed sensor, harness side as follows:

DTC	Suspect Wheel Speed Sensor (Component Side)	Suspect Wheel Speed Sensor Connector-Pin	Circuit
C1233	LH front wheel speed sensor pin 1	C150 Pin 1	521 (TN/OG)
C1234	RH front wheel speed sensor pin 1	C160 Pin 1	514 (YE/RD)
C1235	RH rear wheel speed sensor pin 1	C3117 Pin 1	523 (RD/PK)
C1236	LH rear wheel speed sensor pin 1	C3116 Pin 1	518 (LG/RD)



- Connect the automotive meter between the wheel speed sensor, component side and the wheel speed sensor, harness side as follows:

DTC	Suspect Wheel Speed Sensor (Component Side)	Suspect Wheel Speed Sensor Connector-Pin	Circuit
C1233	LH front wheel speed sensor pin 2	C150 Pin 2	522 (TN/BK)
C1234	RH front wheel speed sensor pin 2	C160 Pin 2	516 (YE/BK)
C1235	RH rear wheel speed sensor pin 2	C3117 Pin 2	524 (PK/BK)
C1236	LH rear wheel speed sensor pin 2	C3116 Pin 2	519 (LG/BK)

- Ignition ON.
- **NOTE:** *The wheel must be moved very slowly to allow the meter to read the high and low current as the sensor passes the sensor tone ring openings.*
Measure the current while slowly moving the wheel.

Does the automotive meter switch between 6.3 mA and 15.4 mA?

Yes	GO to E7 .
No	INSTALL a new wheel speed sensor. REFER to Wheel Speed Sensor — Front or Wheel Speed Sensor — Rear in this section. CLEAR the DTCs. REPEAT the self-test.

E6 CHECK FOR CORRECT ABS MODULE CONFIGURATION OPERATION

NOTE: *DTC C1222 indicates there is a problem with the configuration in the ABS module.*

- Carry out the ABS module configuration. Verify the vehicle data matches the vehicle options. Refer to [Section 418-01](#).
- Clear the DTCs and carry out the self-test.

Is DTC C1222 still present?

Yes	GO to E7 .
No	The system is operating correctly at this time. CLEAR the DTCs. REPEAT the self-test.

E7 CHECK FOR CORRECT ABS MODULE OPERATION

- Disconnect the ABS connector.
- Check for:
 - corrosion.
 - spread or bent pins.
 - pushed-out pins.
- Connect the ABS connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSPECT the wheel speed sensor tone ring for damage and looseness. INSTALL new components as necessary. If the tone ring is OK, INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Tests

Pinpoint Test F: DTC C1446 — Brake Switch Circuit Failure

Normal Operation

The normally-closed brake pedal position (BPP) switch (also known as the speed control deactivation switch) receives fused battery voltage from smart junction box (SJB) fuse 18 (10A) along circuit 1890 (RD) when the ignition key is turned to the RUN position. This voltage is sent through the BPP switch to the anti-lock brake system (ABS) module and the bussed electrical center (BEC) along circuit 535 (LB/RD). The voltage passes through the BEC and continues to the PCM along circuit 535 (LB/RD). When the brake pedal is applied, the BPP opens and the voltage signal is no longer referenced by the ABS module and PCM.

When the fluid level in the brake master cylinder reservoir reaches a predetermined level, the brake fluid level switch closes and voltage is sent to the smart junction box (SJB). The SJB then sends a message to the ABS module along the high-speed controller area network (HS-CAN) bus network.

If the BPP input to the ABS module is missing or does not agree with other sensor input (pressure transducer and wheel speed sensors) or if the ABS module receives the low fluid message from the SJB, DTC C1446 will be set.

Possible Causes

- Circuit open
- Circuit shorted
- Brake pedal switch
- Brake fluid level sensor (master cylinder)
- ABS module

PINPOINT TEST F : DTC C1446 — BRAKE SWITCH CIRCUIT FAILURE

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

F1 MONITOR THE RED BRAKE WARNING INDICATOR

- Ignition ON.
- Observe the red brake warning indicator while turning the ignition switch from OFF to RUN.

Does the indicator illuminate for a brief period and then extinguish?

Yes	GO to F2 .
No	REFER to Section 413-01 to diagnose the red brake warning indicator.

F2 CHECK THE ABS MODULE AND THE SJB FOR COMMUNICATION DTCS

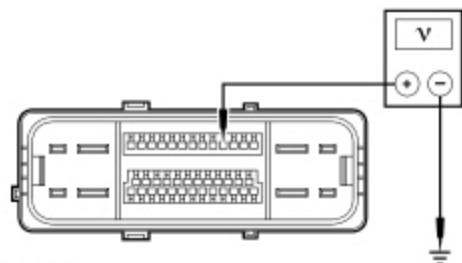
- Connect the scan tool.
- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Self Test ABS Module.
- Retrieve and record any ABS module communication DTCs.
- Enter the following diagnostic mode on the scan tool: Self Test SJB.
- Retrieve and record any SJB communication DTCs.

Are any communication DTCs present in the ABS module and/or the SJB?

Yes	For ABS module communication DTCs, REFER to the Anti-Lock Brake System (ABS) Module Diagnostic Trouble Code (DTC) Chart. For SJB communication DTCs, REFER to the Master DTC Chart in Section 419-10 .
No	GO to F3 .

F3 CHECK FOR BPP SWITCH VOLTAGE TO THE ABS MODULE

- Ignition OFF.
- Disconnect: ABS Module C135 .
- Ignition ON.
- While pressing and releasing the brake pedal, measure the voltage between ABS module C135 Pin 6, circuit 535 (LB/RD), harness side and ground.



N0077321

Is the voltage greater than 10 volts with the pedal released and 0 volts with the pedal pressed?

Yes	GO to F12 .
No	GO to F4 .

F4 ISOLATE THE BPP SWITCH

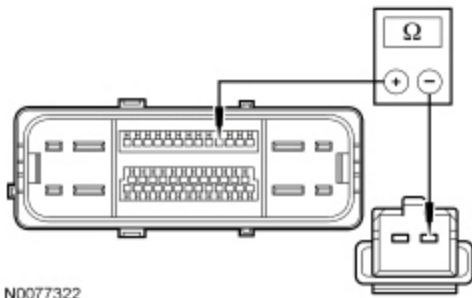
- Ignition OFF.
- Disconnect: BPP Switch C278 (also known as the speed control deactivator switch).
- While pressing and releasing the brake pedal, measure the resistance between BPP switch C278 pin-1, component side, and BPP switch C278 pin-2, component side.

Is the resistance greater than 10,000 ohms with the pedal pressed and less than 5 ohms with the brake pedal released?

Yes	GO to F5 .
No	INSPECT BEC C1035A for corrosion, spread terminals and pushed-out pins. REPAIR as necessary. CLEAR the DTC. REPEAT the self-test. If the connector is OK, INSTALL a new BPP switch. REFER to Speed Control Deactivator Switch Removal and Installation in Section 310-03 . CLEAR the DTC. REPEAT the self-test.

F5 CHECK CIRCUIT 535 (LB/RD) FOR AN OPEN

- Ignition OFF.
- Disconnect: BEC C1035A .
- Measure the resistance between ABS module C135 Pin 6, circuit 535 (LB/RD), harness side and BPP switch C278 Pin 1, circuit 535 (LB/RD), harness side.



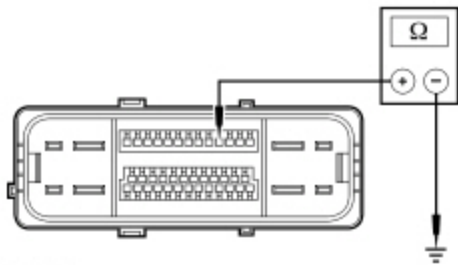
N0077322

Is the resistance less than 5 ohms?

Yes	GO to F6 .
No	INSPECT BEC C1035A for corrosion, spread terminals and pushed-out pins. REPAIR as necessary. If the connector is OK, REPAIR circuit 535 (LB/RD). CLEAR the DTC. REPEAT the self-test.

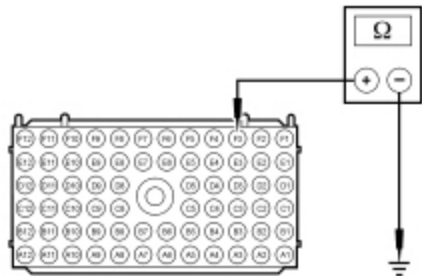
F6 CHECK CIRCUIT 535 (LB/RD) FOR A SHORT TO GROUND

- Disconnect: BEC C1035B .
- Disconnect: PCM C175B .
- Measure the resistance between ABS module C135 Pin 6, circuit 535 (LB/RD), harness side and ground.



N0077323

- Measure the resistance between BEC C1035B Pin F3, circuit 535 (LB/RD), harness side and ground.



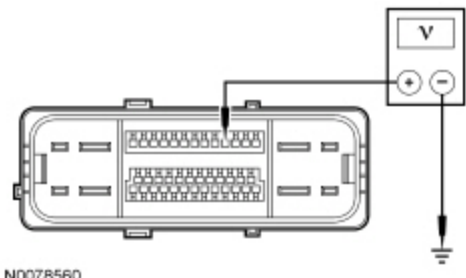
N0077334

Are the resistances greater than 10,000 ohms?

Yes	GO to F7 .
No	REPAIR circuit 535 (LB/RD). CLEAR the DTC. REPEAT the self-test.

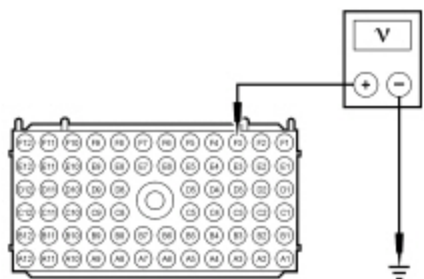
F7 CHECK CIRCUIT 535 (LB/RD) FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure the voltage between ABS module C135 Pin 6, circuit 535 (LB/RD), harness side and ground.



N0078560

- Measure the voltage between BEC C1035B Pin F3, circuit 535 (LB/RD), harness side and ground.



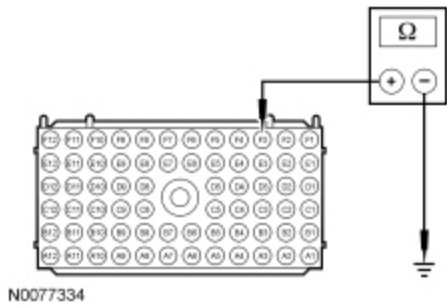
N0078561

Is any voltage present?

Yes	REPAIR circuit 535 (LB/RD). CLEAR the DTC. REPEAT the self-test.
No	GO to F8 .

F8 CHECK THE PCM FOR A SHORT TO GROUND

- Ignition OFF.
- Connect: PCM C175B .
- Measure the resistance between BEC C1035B Pin F3, circuit 535 (LB/RD), harness side and ground.

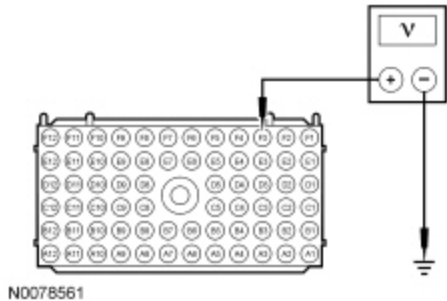


Is the resistance greater than 10,000 ohms?

Yes	GO to F9 .
No	INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTC. REPEAT the self-test.

F9 CHECK THE PCM FOR A SHORT TO VOLTAGE

- Ignition ON.
- Measure the voltage between BEC C1035B Pin F3, circuit 535 (LB/RD), harness side and ground.

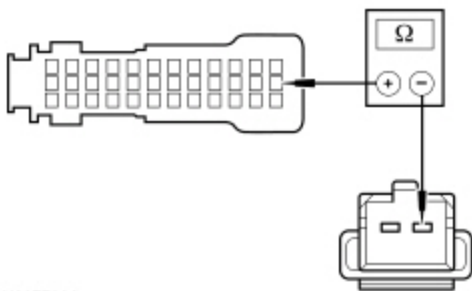


Is any voltage present?

Yes	INSTALL a new PCM. REFER to Section 303-14 . CLEAR the DTC. REPEAT the self-test.
No	GO to F10 .

F10 CHECK CIRCUIT 1890 (RD) FOR AN OPEN

- Ignition OFF.
- Disconnect: SJB C2280H .
- Measure the resistance between BPP switch C278 Pin 2, circuit 1890 (RD), harness side and SJB C2280H Pin 24, circuit 1890 (RD), harness side.



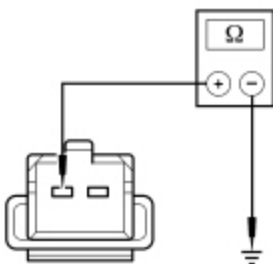
N0077336

Is the resistance less than 5 ohms?

Yes	GO to F11 .
No	VERIFY SJB fuse 18 (10A) is OK. If OK, REPAIR circuit 1890 (RD). CLEAR the DTC. REPEAT the self-test.

F11 CHECK CIRCUIT 1890 (RD) FOR A SHORT TO GROUND

- Measure the resistance between BPP switch C278 Pin 2, circuit 1890 (RD), harness side and ground.



N0077325

Is the resistance greater than 10,000 ohms?

Yes	INSTALL a new BPP switch. REFER to speed control deactivator switch in Section 310-03 . CLEAR the DTCs. REPEAT the self-test.
No	REPAIR circuit 1890 (RD). CLEAR the DTC. REPEAT the self-test.

F12 CHECK FOR CORRECT ABS MODULE OPERATION

- Ignition OFF.
- Disconnect: ABS Module C135 .
- Check the ABS module connector for:
 - corrosion.
 - pushed-out pins.
 - spread terminals.
- Connect: ABS Module C135 .

- Make sure the ABS module connector seats correctly, then operate the system and verify if the concern is still present.

Is the concern still present?

Yes	INSTALL a new ABS module. REFER to Anti-Lock Brake System (ABS) Module in this section. CLEAR the DTCs. REPEAT the self-test.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test with the brake pedal not applied.

Pinpoint Test G: Spongy/Soft/Low Brake Pedal with No Warning Indicator

Normal Operation

The brake pedal should be firm when applied.

Possible Causes

- base brake system
- hydraulic control unit (HCU)

PINPOINT TEST G : SPONGY/SOFT/LOW BRAKE PEDAL WITH NO WARNING INDICATOR

G1 CHECK THE BASE BRAKE COMPONENTS

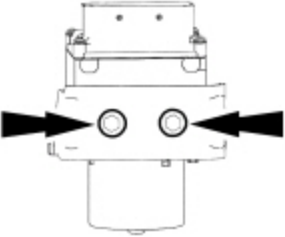
- Visually inspect the brake lines from the hydraulic control unit (HCU) to the brake calipers.
- Visually inspect the calipers and brake components.

Are any of these components damaged?

Yes	REPAIR or INSTALL new components as necessary. TEST the system for normal operation.
No	GO to G2 .

G2 CHECK FOR A LEAKING DUMP VALVE

- Ignition OFF.
- Remove the rubber boots from the 2 HCU low pressure accumulators (LPA) and insert a clean steel implement (e.g. paper clip or a small screwdriver) into each LPA.



- Ignition ON.
- **NOTE:** A leaking dump valve is similar to the master cylinder bypass condition. It is important that the pedal be quickly and forcefully applied to rule out master cylinder bypass as a condition.

Have an assistant press hard on the brake pedal while observing the steel implements.

Do either of the implements move out 6.35 mm (0.25 in) or more?

Yes	INSTALL a new HCU. REFER to Hydraulic Control Unit (HCU) in this section.
No	REMOVE the steel implements. INSTALL the rubber boots on each LPA. REFER to Section 206-00 to continue diagnosis of the base brake system.

Pinpoint Test H: Poor Vehicle Tracking During Anti-lock Function

Normal Operation

The operating voltage required to supply the anti-lock brake system (ABS) module, hydraulic pump, and isolation valves is in a range between 10 and 16 volts.

Voltage is supplied by the smart junction box (SJB) through circuit 1844 (LG/RD) (ignition feed) and from the bussed electrical center (BEC) through circuit 534 (YE/LG), and circuit 601 (LB/PK) (voltage at all times). Ground is provided through circuit 1205 (BK).

Possible Causes

- base brake system
- hydraulic control unit (HCU)

PINPOINT TEST H : POOR VEHICLE TRACKING DURING ANTI-LOCK FUNCTION

H1 BLEED THE BRAKE SYSTEM

- Bleed the brake system using the diagnostic tool. Refer to [Section 206-00](#).
- Test drive the vehicle.

Does the vehicle track correctly?

Yes	The brake system is operating correctly. The concern may have been caused by air in the hydraulic system or a sticky valve.
No	GO to H2 .

H2 CHECK THE ABS INLET VALVE (CLOSED POSITION)

- Ignition ON.
- Enter the following diagnostic mode on the scan tool: ABS Module Active Command.
- With the vehicle in NEUTRAL, position it on a hoist. Refer to [Section 100-02](#).
- Rotate all the wheels to make sure they rotate freely (the transmission must be in NEUTRAL).
- Trigger the ABS module LF INLET ON active command.
- Apply moderate brake pedal effort.

- Have an assistant attempt to rotate the LF wheel.

Does the LF wheel rotate?

Yes	TRIGGER the LF INLET OFF active command. GO to H3 .
No	INSTALL a new HCU. REFER to Hydraulic Control Unit (HCU) in this section. TEST the system for normal operation.

H3 CHECK THE ABS INLET VALVE (OPEN POSITION)

- Apply moderate brake pedal effort.
- Have an assistant attempt to rotate the LF wheel.

Does the LF wheel rotate?

Yes	INSTALL a new HCU. REFER to Hydraulic Control Unit (HCU) in this section. TEST the system for normal operation.
No	GO to H4 .

H4 CHECK THE ABS OUTPUT VALVE (OPEN POSITION)

- Apply moderate brake pedal effort.
- Trigger ABS module LF INLET ON active command.
- Trigger ABS module ABS POWER ON active command (turns on the pump motor) for 6 seconds. (The trigger must be pressed 3 times. Each press runs the pump for 2 seconds.)
- Trigger the ABS module LF OUTLET ON active command, then trigger the ABS module LF OUTLET OFF active command. Repeat 3 times.
- Have an assistant attempt to rotate the LF wheel.

Does the LF wheel rotate?

Yes	TRIGGER all active commands OFF. GO to H5 .
No	INSTALL a new HCU. REFER to Hydraulic Control Unit (HCU) in this section. TEST the system for normal operation.

H5 CHECK THE ABS INLET AND OUTLET VALVES (CLOSED POSITION)

- Apply moderate brake pedal effort.
- Have an assistant attempt to rotate the LF wheel.

Does the LF wheel rotate?

Yes	INSTALL a new HCU. REFER to Hydraulic Control Unit (HCU) in this section. TEST the system for normal operation.
No	REPEAT this procedure (beginning with Step H2) for the RF, LR and RR wheels using the appropriate active commands. If no failure occurs, the system is operating normally.

Pinpoint Test I: The Traction Control System Cannot Be Disabled

Normal Operation

Engine torque modulation is achieved by regulating fuel and spark to the cylinders. The traction control system operates using the anti-lock brake system (ABS) module to interact with the powertrain control module (PCM) to reduce engine torque and apply the brakes if the wheels lose traction and begin to spin during acceleration.

The instrument cluster circuit 1412 (WH/PK) monitors for a ground (change of state). When the traction control switch is pressed momentary ground occurs through circuit 1205 (BK). The instrument cluster then sends a voltage to the traction control switch through circuit 939 (VT) illuminating the traction control switch and disabling the system.

Possible Causes

- circuit 1205 (BK) open
- circuit 1412 (WH/PK) open or short to ground
- traction control switch
- ABS module
- instrument cluster

PINPOINT TEST I : THE TRACTION CONTROL SYSTEM CANNOT BE DISABLED

NOTICE: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

I1 MONITOR THE INSTRUMENT CLUSTER PID

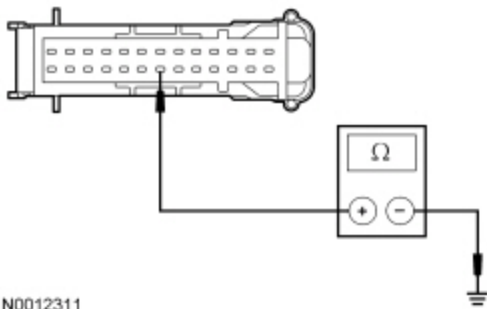
- Ignition ON.
- Enter the following diagnostic mode on the scan tool: Instrument Cluster PID.
- Monitor the instrument cluster traction control switch status PID while pressing the traction control disable switch repeatedly.

Does the PID agree with the switch position?

Yes	GO to I6 .
No	GO to I2 .

I2 CHECK THE TRACTION CONTROL SWITCH INPUT

- Ignition OFF.
- Disconnect: Instrument Cluster C220.
- Measure the resistance between the instrument cluster C220 Pin 20, circuit 1412 (WH/PK), harness side and ground while pressing and releasing the traction control switch.



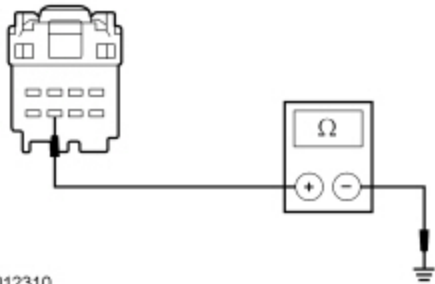
N0012311

Is the resistance less than 5 ohms with the switch pressed and greater than 10,000 ohms with the switch released?

Yes	GO to I3 .
No	INSTALL a new traction control switch. REFER to Traction Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.

I3 CHECK CIRCUIT 1412 (WH/PK) FOR A SHORT TO GROUND

- Ignition OFF.
- Disconnect: Traction Control Switch C2039.
- Measure the resistance between the traction control switch C2039 Pin 7, circuit 1412 (WH/PK), harness side and ground.



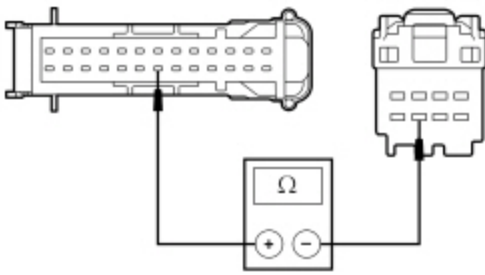
N0012310

Is the resistance greater than 10,000 ohms?

Yes	GO to I4 .
No	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

I4 CHECK CIRCUIT 1412 (WH/PK) FOR AN OPEN

- Disconnect: Traction Control Switch C2039.
- Measure the resistance between the instrument cluster C220 Pin 20, circuit 1412 (WH/PK), harness side and the traction control switch C2039 Pin 7, circuit 1412 (WH/PK), harness side.



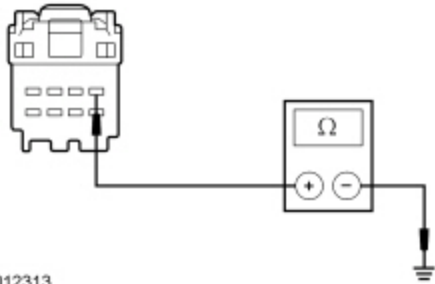
N0012312

Is the resistance less than 5 ohms?

Yes	GO to 15 .
No	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

15 CHECK CIRCUIT 1205 (BK) FOR AN OPEN

- Measure the resistance between the traction control switch C2039 Pin 1, circuit 1205 (BK), harness side and ground.



N0012313

Is the resistance less than 5 ohms?

Yes	INSTALL a new traction control switch. REFER to Traction Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.
No	REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

16 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION

- Disconnect the instrument cluster connector.
- Check for:
 - corrosion
 - spread or bent pins
 - pushed-out pins
- Connect the instrument cluster connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.

Pinpoint Test J: The Traction Control Switch Indicator is Never/Always On

Normal Operation

The instrument cluster circuit 1412 (WH/PK) monitors for a ground (change of state). When the traction control switch is pressed momentary ground occurs through circuit 1205 (BK). The instrument cluster then sends a voltage to the traction control switch through circuit 939 (VT) illuminating the traction control switch and disabling the system.

Possible Causes

- circuit 939 (VT) open or short to ground
- circuit 1412 (WH/PK) open or short to ground
- traction control switch
- instrument cluster

PINPOINT TEST J : THE TRACTION CONTROL SWITCH INDICATOR IS NEVER/ALWAYS ON

NOTICE: Use the flex probe kit for all test connections to prevent damage to the wiring terminals. Do not use standard multimeter probes.

J1 VERIFY THE TRACTION CONTROL SYSTEM OPERATION

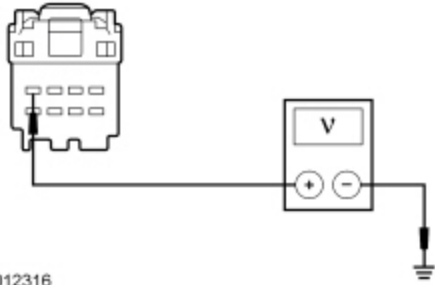
- Operate the system and verify the traction control system can be enabled and disabled.

Does the traction control system operate correctly?

Yes	GO to J2 .
No	REFER to symptom chart to continue diagnosis.

J2 CHECK CIRCUIT 939 (VT) FOR VOLTAGE

- Ignition OFF.
- Disconnect: Traction Control Switch C2039.
- Ignition ON.
- Measure the voltage between the traction control switch C2039 Pin 4, circuit 939 (VT), harness side and ground.



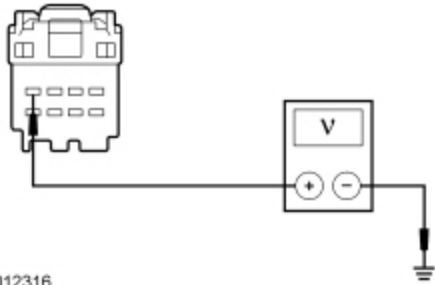
N0012316

Is any voltage present?

Yes	GO to J3 .
No	GO to J4 .

J3 CHECK CIRCUIT 939 (VT) FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Disconnect: Instrument Cluster C220.
- Ignition ON.
- Measure the voltage between the traction control switch C2039 Pin 4, circuit 939 (VT), harness side and ground.



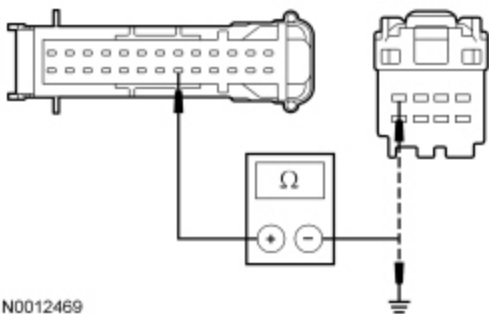
N0012316

Is any voltage present?

Yes	REPAIR the circuit. TEST the system for normal operation.
No	GO to J6 .

J4 CHECK CIRCUIT 939 (VT) FOR AN OPEN OR SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between the instrument cluster C220 Pin 21, circuit 939 (VT), harness side and the traction control switch C2039 Pin 4, circuit 939 (VT), harness side; and between the instrument cluster C220 Pin 21, circuit 939 (VT), harness side and ground.



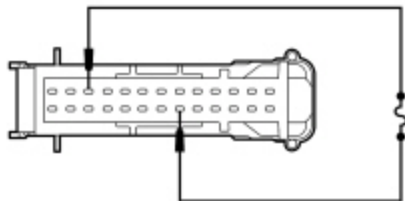
N0012469

Is the resistance less than 5 ohms between the instrument cluster and the traction control switch, and greater than 10,000 ohms between the instrument cluster and ground?

Yes	GO to J5 .
No	REPAIR the circuit. TEST the system for normal operation.

J5 CHECK THE INSTRUMENT CLUSTER OPERATION

- Connect: Traction Control Switch C2039.
- Connect a fused (10A) jumper wire between the instrument cluster C220 Pin 21, circuit 939 (VT), harness side and the instrument cluster C220 Pin 3, circuit 1001 (WH/YE), harness side.



N0012470

Does the traction control switch indicator illuminate?

Yes	Remove the jumper wire. GO to J6 .
No	INSTALL a new traction control switch. REFER to Traction Control Switch in this section. CLEAR the DTCs. REPEAT the self-test.

J6 CHECK FOR CORRECT INSTRUMENT CLUSTER OPERATION

- Disconnect the instrument cluster connector.
- Check for:
 - corrosion
 - spread or bent pins

- pushed-out pins
- Connect the instrument cluster connector and make sure it seats correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new instrument cluster. REFER to Section 413-01 . CLEAR the DTCs. REPEAT the self-test.
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. CLEAR the DTCs. REPEAT the self-test.