CIRCUIT OPERATION

Petrol Engine

For vehicles equipped with a manual transmission, cruise control can only be activated when the Cruise Control Switch (X115) is depressed, the transfer gear box is in Hi range, and the clutch pedal is not depressed. Also, the BeCM (Z238) will deactivate cruise control if the engine rpm rises above 5000 ± 10%, due to the possibility of selecting gears manually without the use of the clutch.

For vehicles equipped with an automatic transmission, cruise control can only be activated when the Cruise Control Switch (X115) is depressed, the transfer gear box is in Hi range, and the transmission is in one of the forward gears.

With the Cruise Control Switch (X115) on, a ground signal is applied to C1279/Pin 14 of the BeCM (Z238).The BeCM (Z238) then suplies signal voltage via its Pin 18 to the Converter/Inverter (Z249), to Pin 8 of the Cruise Control ECU (Z121) and to the "Operation" bulb of the Cruise Control Switch (X115). The transfer gearbox Hi range status from the Transfer Gear Box ECU (Z256) is applied to C1287/Pin 3 of the BeCM (Z238). The X, Y, and Z switch status (PRND321 position information) from the gearbox position switch is applied to C1287/Pins 8, 9, and 18 of the BeCM (Z238). The clutch pedal position input is applied to C1279/Pin 4 and the engine speed input C1288/Pin 9 of the BeCM (Z238). When the transfer gearbox is in Hi range, a forward gear is selected and the Cruise Control Switch (X115) is on, theBeCM (Z238) suplies voltage via C1276/Pin 1 and the Brake Switch Vent Valve (X112) to the Cruise Control ECU (Z121) Pin 1, which then "knows" that cruise control can be operated.

When cruise control is activated and a cruise speed is set, the Cruise Control ECU (Z121) applies voltage through the OU wire and ground through the OR wire to operate the Cruise Control Vacuum Pump (M103) motor. The Cruise Control ECU (Z121) applies ground through the OK wire to close the normally open solenoid valve in the pump. The pump applies vacuum to the actuator.

SET/ACCEL

To set a cruise speed, the Cruise Control Switch (X115) must be on and vehicle speed must exceed 28 mph (45 km/h). When the SET/ACCEL Switch is depressed under these conditions, the Converter/Inverter (Z249) is supplied with a ground signal. This signal is "converted" to a voltage signal and is transmitted via the SY wire to the Cruise Control ECU (Z121) terminal 4, causing the vacuum pump to operate. When the SET/ACCEL Switch is released, the signal is removed from terminal 4, signalling the ECU to set the speed.

RES/DECEL

When the RES/DECEL Switch is depressed, a signal is applied via the RY wire to terminal 2 of the Cruise Control ECU (Z121). This tells the ECU (Z121) to disengage the system and the vehicle slows down. When the switch is depressed a second time, the signal is again applied to the ECU (Z121) and the vehicle returns to the previously set speed.

Speed Input

Terminal 15 of the Cruise Control ECU (Z121) receives the Vehicle Speed output signal from the BeCM (Z238) through the Y or YR wire. The BeCM (Z238) receives the vehicle speed signal from the Anti–lock Brake System ECU (Z108). The signal is a pulsing voltage and its frequency changes with vehicle speed.

System Disable

The cruise control system can be disabled in one of four ways:

1. The Cruise Control Switch (X115) is put in the 0 position, removing the BeCM (Z238) power from the Cruise Control ECU (Z121) and vacuum pump, and erasing the set speed memory.
2. The RES/DECEL Switch is depressed, signalling the Cruise Control ECU (Z121) via the Inverter/ Converter (Z249) to disengage the system.
3. The brake pedal is depressed and a vacuum valve in the Switch Vent Valve opens (X112). This vents vacuum to the actuator valve and releases the throttle.
4. The Voltage applied to the Cruise Control ECU (Z121) terminal 1 is interrupted, causing the Cruise Control ECU (Z121) to turn off the vacuum pump and de–energize the vacuum solenoid valve. This voltage path is interrupted when:

- The brake pedal is depressed. With the brake pedal depressed, the Brake Switch Vent Valve (X112) moves to position 1 and the circuit is interrupted.
- The transfer gear box is not in Hi range.
- The vehicle speed does not exceed 28 mph (45 km/h).
- The vehicle is not in a forward gear (P, R, or N) (Automatic Transmission).
- The clutch pedal is depressed (Manual Transmission).
- The engine rpm rises above 5000 ± 10% (Manual Transmission).

The BeCM (Z238), which monitors these signals, will then remove power from C1279/Pin 18.

Diesel Engine

For vehicles equipped with a manual transmission, cruise control can only be activated when the Cruise Control Switch (X115) is depressed and the clutch pedal is not depressed. The Diesel Engine Control Module (Z132) will not allow the engine to overspeed if a cruise control speed is requested that is beyond the capability of the engines speed range.

For vehicles equipped with an automatic transmission, cruise control can only be activated when the Cruise Control Switch (X115) is depressed, the transfer gear box is in Hi range, and the transmission is in one of the forward gears.

With the Cruise Control Switch (X115) on, a ground signal is applied to C1279/Pin 14 of the BeCM (Z238). The X, Y, and Z switch status (PRND321 position information) from the gearbox position switch is applied to C1287/Pins 8, 9, and 18 of the BeCM (Z238). The clutch pedal position input is applied to C1279/Pin 4 and the engine speed input is applied to C1288/Pin 9 of the BeCM (Z238). The BeCM (Z238) then supplies voltage, via its Pin 18 to the Inverter/Converter (Z249) and to the “Operation” bulb of the Cruise Control Switch (X115).

The Cruise Control Converter/Inverter Module (Z249) supplies the Engine Control Module (Z132) via its pin 4 with a voltage signal to “switch on” the cruise circuit. For the Diesel Engine, the Engine Control Module (Z132) controls the cruise circuit as the Cruise Control ECU (Z121) does for the Petrol Engine. The Engine Control Module (Z132) is also responsible for the acceleration/deceleration of the vehicle.

SET/ACCEL

To set a cruise speed, the Cruise Control Switch (X115) must be on and vehicle speed must exceed 28 mph (45 km/h). When the SET/ACCEL Switch is depressed under these conditions, the Inverter/Converter (Z249) is suppplied with a ground signal. This signal is transmitted via the OY wire to the Engine Control Module (ECM) (Z132) causing the vehicle to accelerate. When the SET/ACCEL Switch is released, the signal is removed signalling the Engine Control Module (ECM) (Z132) to set the speed.

RES

When the RES Switch is depressed, a signal is applied to the ECM (Z132) and the vehicle will return to the previously set speed.

Speed Input

The BeCM (Z238) receives the vehicle speed signal from the Anti–lock Brake System ECU (Z108). The BeCM (Z238) then provides the vehicle speed signal to the Engine Control Module (ECM) (Z132). This signal is a pulsing voltage and its frequency changes with the vehicle speed.

System Disable

The cruise control system can be disabled in two ways:

1. The Cruise Control Switch (X115) is put in the 0 position, causing the BeCM (Z238) to remove power from the Engine Control Module (ECM) (Z132) and erasing the set speed memory.
2. The Voltage applied via the Inverter/Converter (Z249) to the Engine Control Module (ECM) (Z132) terminal 20 is interrupted, causing the Engine Control Module (ECM) (Z132) to disengage the system. This voltage path is interrupted when :

- The brake pedal is depressed. The Engine Control Module (ECM) (Z132) has two Stop Lamp Switch (X168) inputs, each of opposite polarity. The ECM (Z132) compares the polarity states to determine when the brake pedal has been depressed.
- The vehicle speed does not exceed 28mph (45 km/h).
- The vehicle is not in a forward gear (P, R, or N) (Automatic Transmission).
- The clutch pedal is depressed (Manual Transmission).

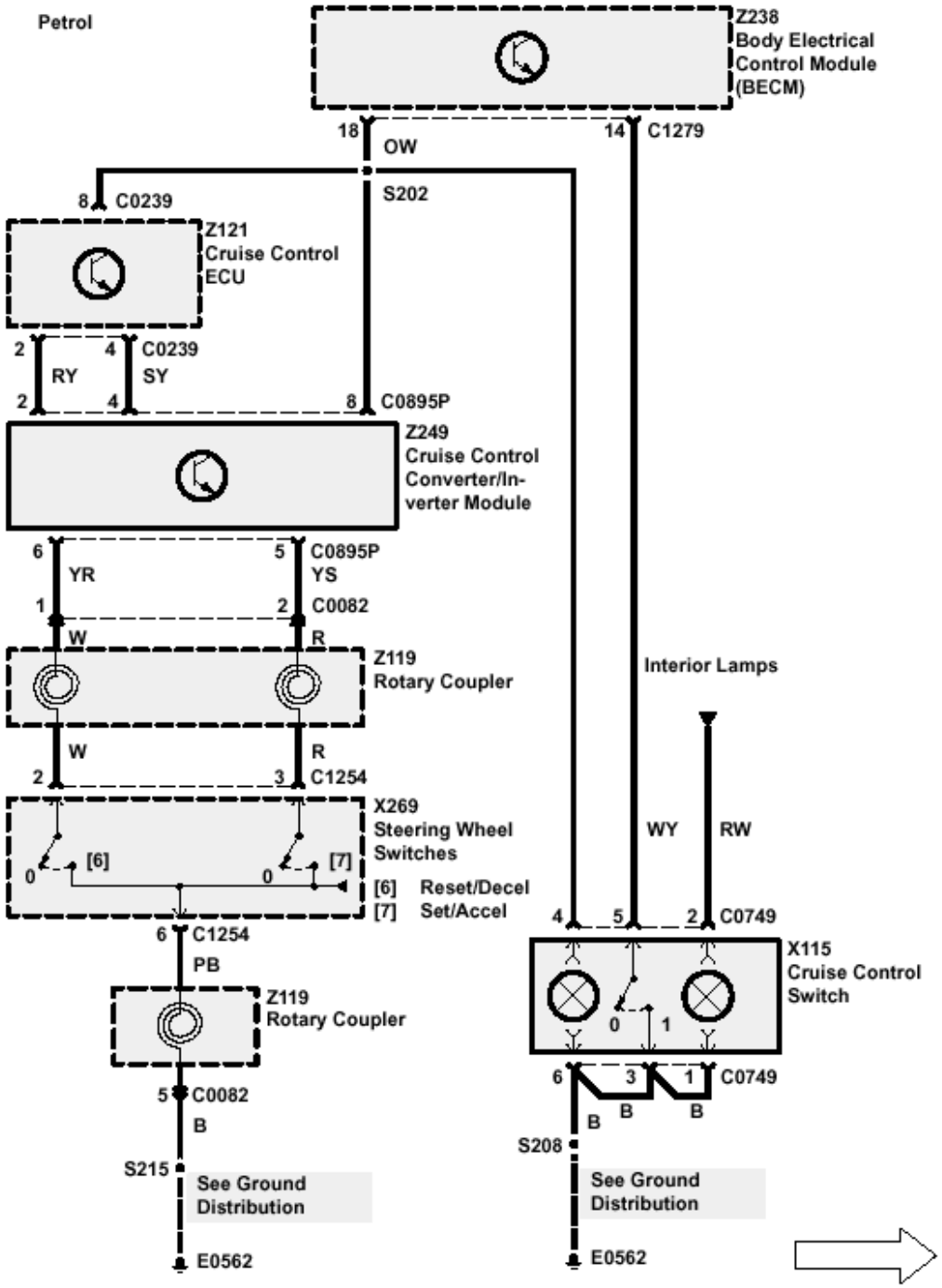
The BeCM (Z238), which monitors these signals, will then remove power from C1279/Pin 18.

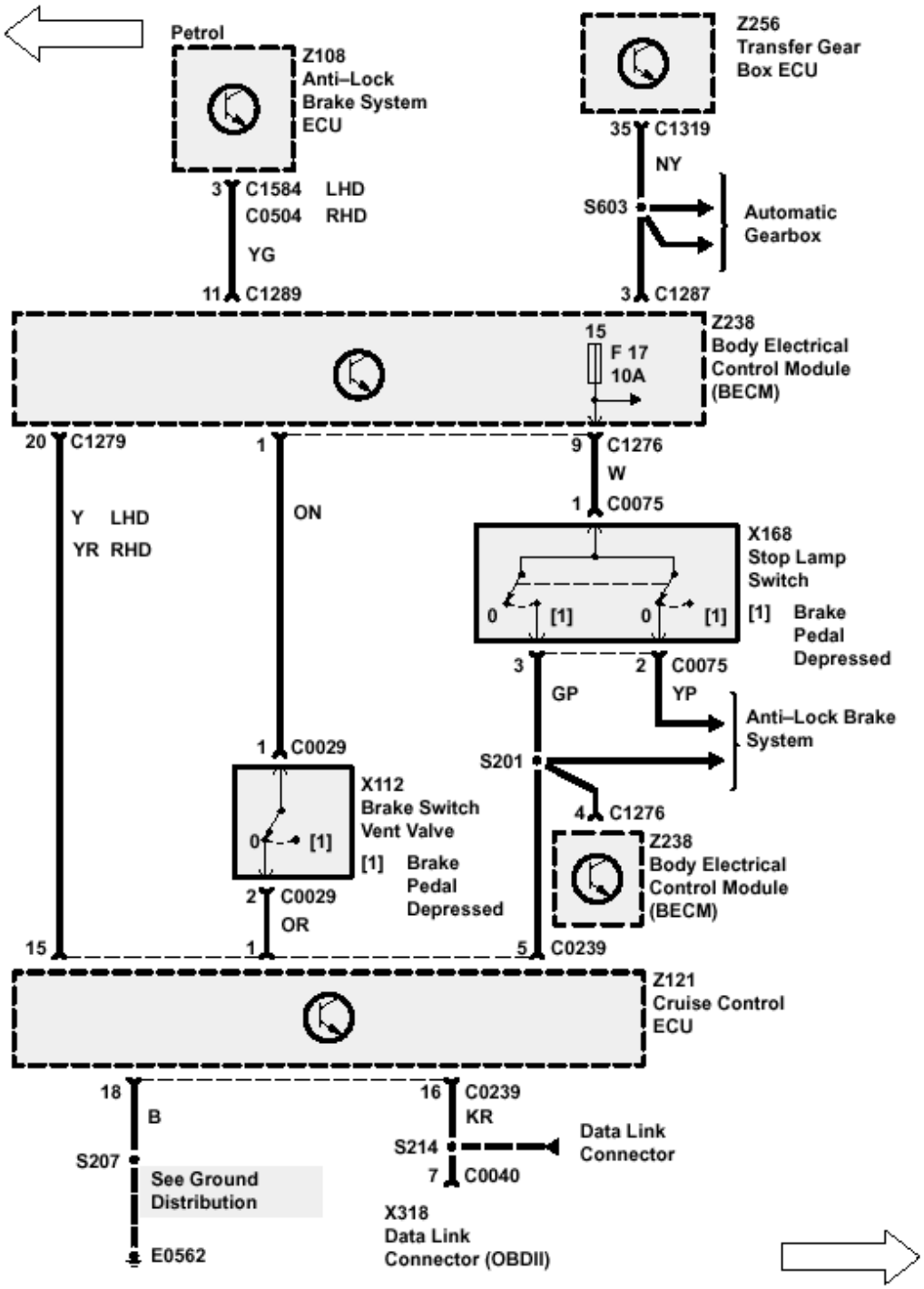
Road Test

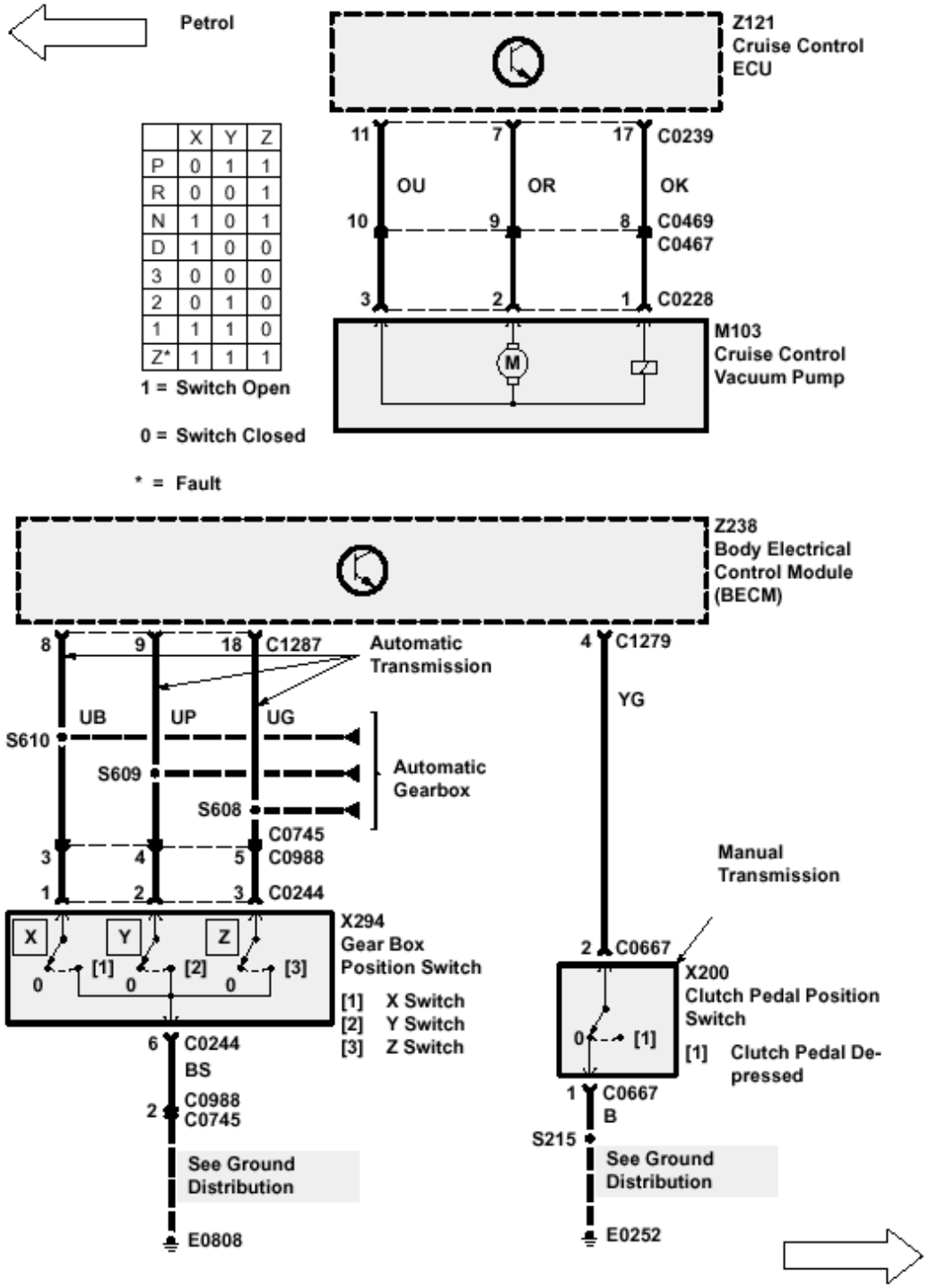
CAUTION: DO NOT ENGAGE CRUISE CONTROL WHEN VEHICLE IS BEING USED IN LOW TRANSFER GEARS.

WARNING: The use of cruise control is not recommended on winding, snow covered or slippery roads, or in heavy traffic conditions where constant speed cannot be maintained.

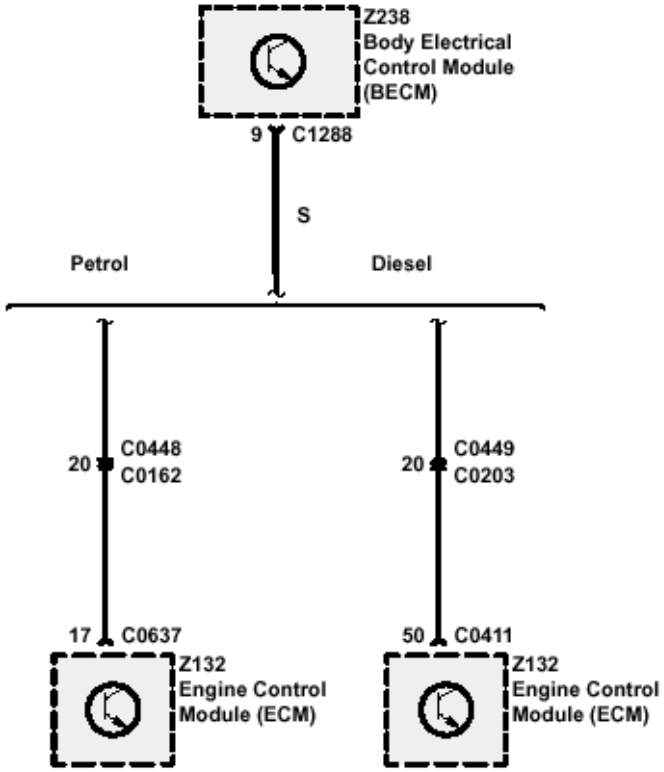
1. Start the engine and depress the Cruise Control Switch (X115) to activate the cruise control system. Accelerate to approximately 30 mph (50 km/h) and press the SET/ACCEL Switch. Immediately release the switch and remove foot from the accelerator pedal. The vehicle should maintain the speed at which the SET/ACCEL Switch was pressed.
2. Press the SET/ACCEL Switch and hold at that position. The vehicle should accelerate smoothly until the switch is released. The vehicle should now maintain the new speed at which the SET/ACCEL Switch was released.
3. Press the RES/DECEL Switch while the vehicle is in the cruise control mode. The cruise control should disengage. Slow to approximately 35 mph (55km/h) and press the RES/DECEL Switch. Immediately release the switch and remove foot from the accelerator. The vehicle should smoothly accelerate to the previously set speed. Increase speed using the accelerator pedal. Releasing the pedal should return the vehicle to the previously set speed.
4. Depressing the brake pedal should immediately disengage the cruise control system and return the vehicle to driver's control at accelerator pedal. Press the RES/DECEL Switch and the vehicle should accelerate to the previously set speed without operation of the accelerator pedal.
5. Press the RES/DECEL Switch and allow the vehicle to decelerate to below 26 mph (42 km/h). Press the RES/DECEL Switch and remove foot from the accelerator pedal. The vehicle should smoothly adjust to the previously memorized speed.
6. Press the SET/ACCEL Switch below 28 mph (45km/h) and the cruise control system should remain disengaged. Accelerate the vehicle above 28 mph (45 km/h), press the RES/DECEL Switch and remove foot from the accelerator pedal. The vehicle should smoothly adjust to the previously memorized speed.
7. Pressing the Cruise Control Switch (X115) should immediately disengage the cruise control system and erase the previously set speed from Cruise Control ECU (Z121)/Engine Control Module (ECM) (Z132) memory.

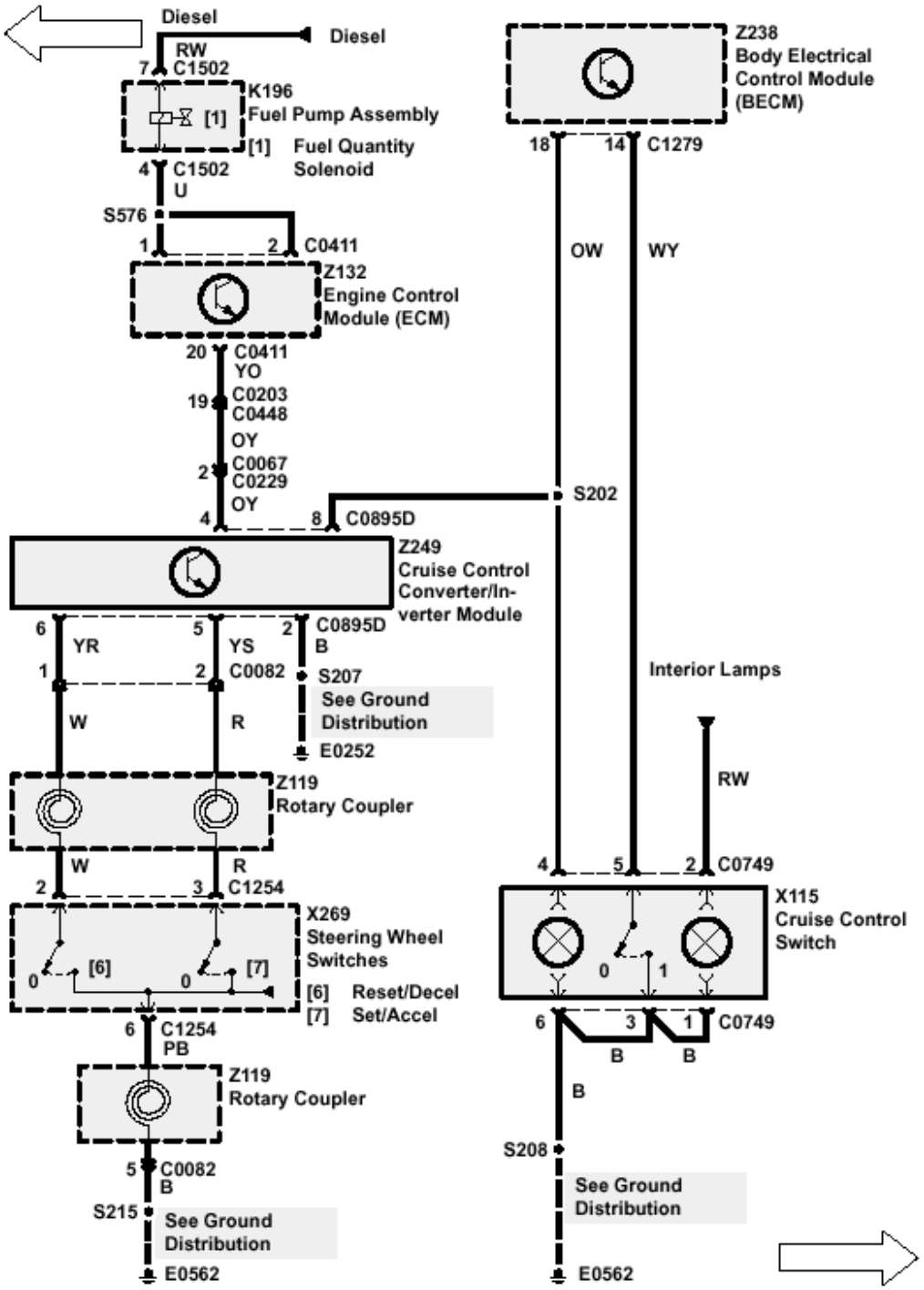

Petrol
Z238
Body Electrical
Control Module
(BECM)
18
OW
14
C1279
8
C0239
S202
Z121
Cruise Control
ECU
2
4
C0239
RY
SY
2
4
8
C0895P
Z249
Cruise Control
Converter/In-
verter Module
6
YR
5
C0895P
YS
1
2
C0082
W
R
Z119
Rotary Coupler
Interior Lamps
W
R
2
3
C1254
X269
Steering Wheel
Switches
0
[6]
0
[7]
[6] Reset/Decel
[7] Set/Accel
WY
RW
4
5
2
C0749
6
C1254
PB
Z119
Rotary Coupler
X115
Cruise Control
Switch
0
1
5
C0082
B
6
3
1
C0749
B
B
B
S215
See Ground
Distribution
S208
See Ground
Distribution
E0562
E0562

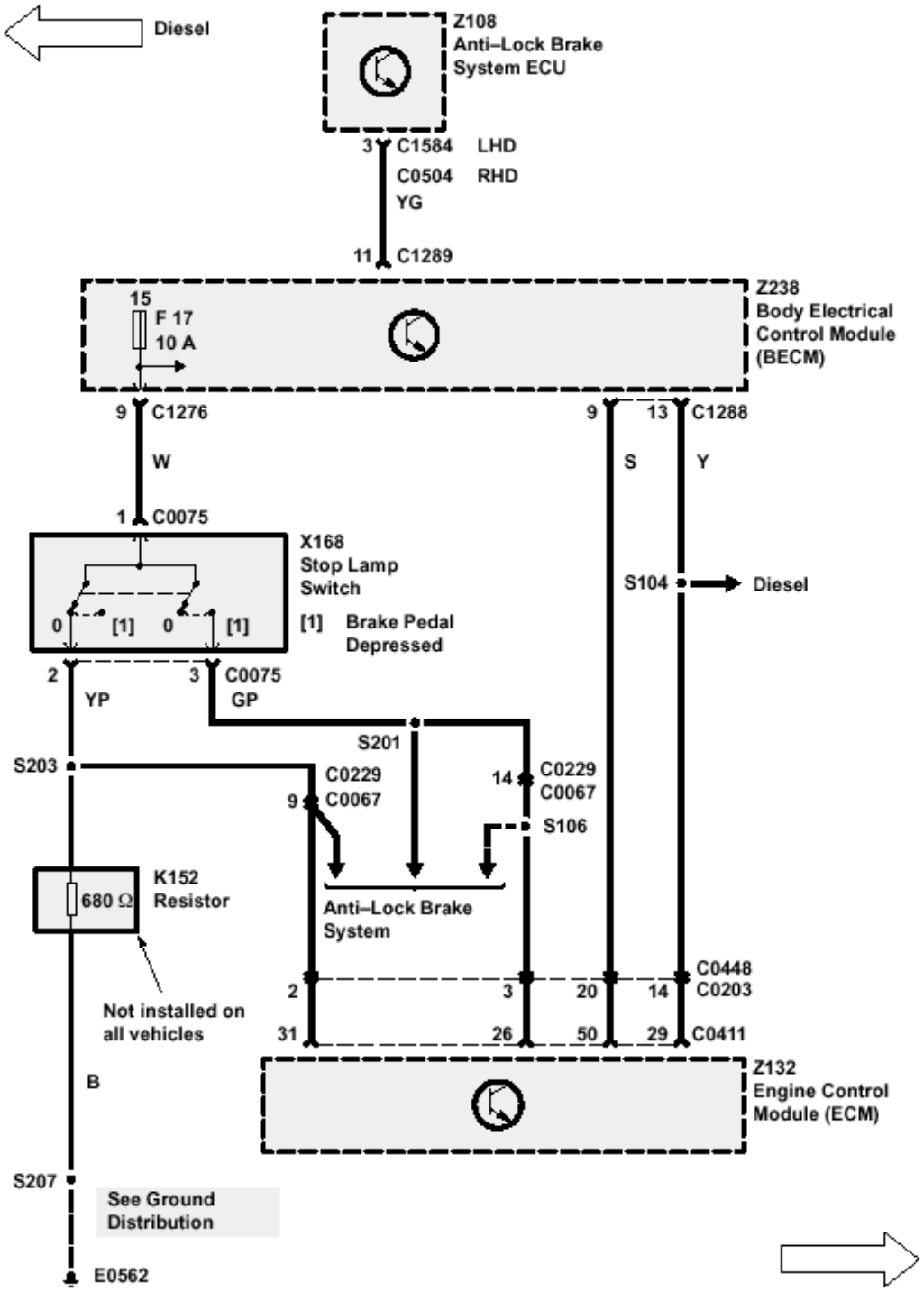

Petrol
Z108
Anti–Lock
Brake System
ECU
3 C1584 LHD
C0504 RHD
YG
11 C1289
Z256
Transfer Gear
Box ECU
35 C1319
NY
S603
Automatic
Gearbox
3 C1287
Z238
Body Electrical
Control Module
(BECM)
15
F 17
10A
20 C1279
Y LHD
YR RHD
1
ON
9 C1276
W
1 C0075
X168
Stop Lamp
Switch
0 [1] 0 [1]
[1] Brake
Pedal
Depressed
3
GP
2 C0075
YP
Anti–Lock Brake
System
S201
1 C0029
X112
Brake Switch
Vent Valve
0 [1]
[1] Brake
Pedal
Depressed
2 C0029
OR
4 C1276
Z238
Body Electrical
Control Module
(BECM)
15
1
5 C0239
Z121
Cruise Control
ECU
18
B
S207
See Ground
Distribution
E0562
16 C0239
KR
S214
Data Link
Connector
7 C0040
X318
Data Link
Connector (OBDII)

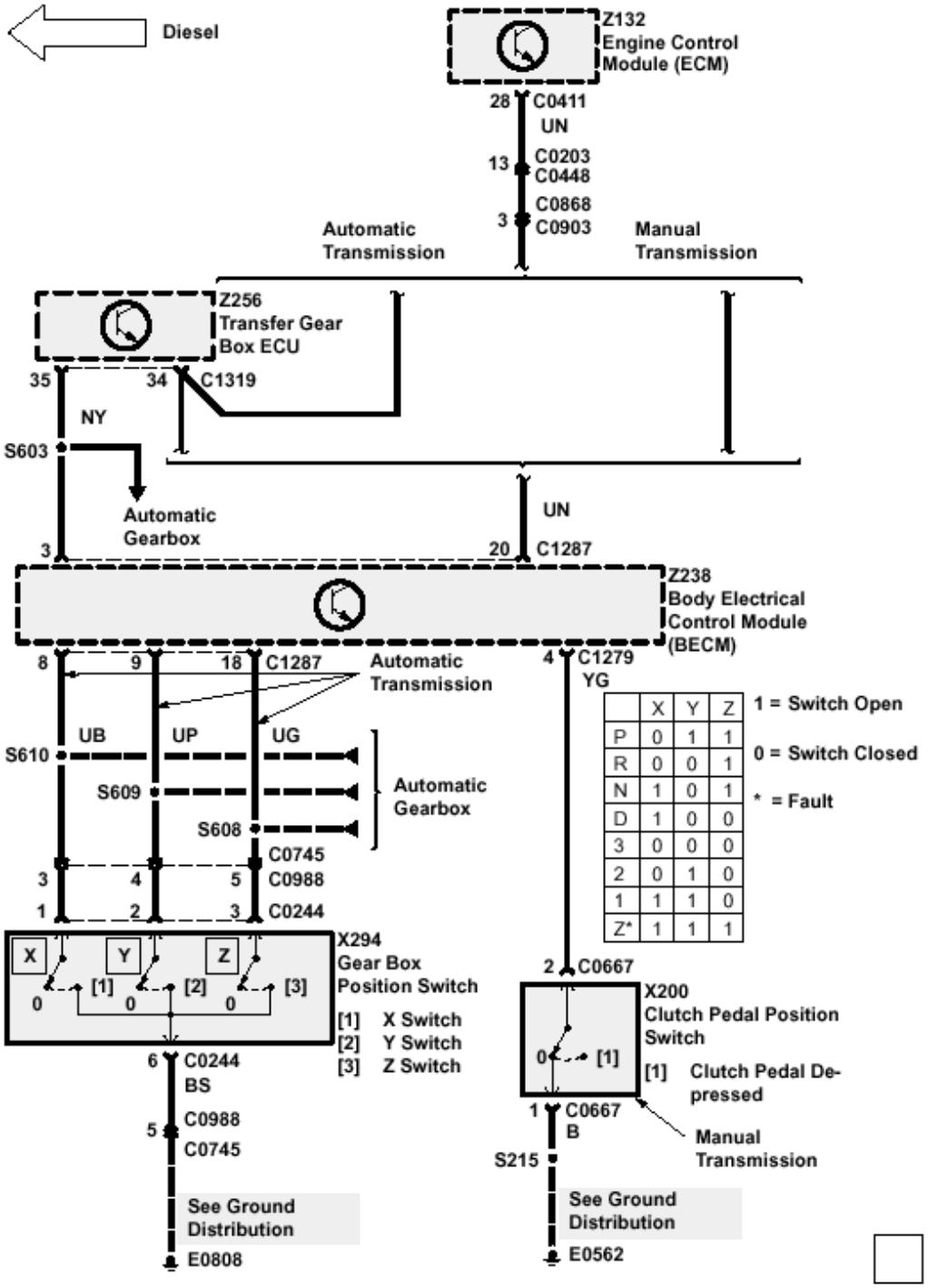


	X	Y	Z
P	0	1	1
R	0	0	1
N	1	0	1
D	1	0	0
3	0	0	0
2	0	1	0
1	1	1	0
Z*	1	1	1


Z238
Body Electrical
Control Module
(BECM)
9
C1288
S
Petrol
Diesel
20
C0448
C0162
20
C0449
C0203
17
C0637
50
C0411
Z132
Engine Control
Module (ECM)
Z132
Engine Control
Module (ECM)


Diesel
Diesel
RW
7 C1502
K196
Fuel Pump Assembly
[1]
[1] Fuel Quantity Solenoid
4 C1502
U
S576
1
2 C0411
Z132
Engine Control Module (ECM)
20 C0411
YO
19 C0203
C0448
OY
2 C0067
C0229
OY
4
8 C0895D
Z249
Cruise Control Converter/Inverter Module
6 YR
5 YS
2 C0895D
B
1
2 C0082
S207
See Ground Distribution
E0252
W
R
Z119
Rotary Coupler
W
R
2
3 C1254
X269
Steering Wheel Switches
0 [6] 0 [7]
[6] Reset/Decel
[7] Set/Accel
6 C1254
PB
Z119
Rotary Coupler
5 C0082
B
S215
See Ground Distribution
E0562
Z238
Body Electrical Control Module (BECM)
18 14 C1279
OW
WY
S202
Interior Lamps
RW
4 5 2 C0749
X115
Cruise Control Switch
0 1
6 3 1 C0749
B B
B
S208
See Ground Distribution
E0562


Diesel
Z108
Anti–Lock Brake
System ECU
3
C1584 LHD
C0504 RHD
YG
11
C1289
Z238
Body Electrical
Control Module
(BECM)
15
F 17
10 A
9
C1276
W
1
C0075
9
13
C1288
S
Y
X168
Stop Lamp
Switch
0 [1] 0 [1]
[1] Brake Pedal
Depressed
S104
Diesel
2
YP
3
C0075
GP
S201
S203
C0229
C0067
9
14
C0229
C0067
S106
K152
Resistor
680 Ω
Anti–Lock Brake
System
Not installed on
all vehicles
2
3
20
14
C0448
C0203
31
26
50
29
C0411
B
Z132
Engine Control
Module (ECM)
S207
See Ground
Distribution
E0562



	X	Y	Z
P	0	1	1
R	0	0	1
N	1	0	1
D	1	0	0
3	0	0	0
2	0	1	0
1	1	1	0
Z*	1	1	1

TROUBLESHOOTING HINTS

5. If the interior lights operate but the cruise control switch light does not illuminate, check the bulb, B wire and RW wire. If the cruise control system operates but the cruise control switch light does not illuminate, check bulb and OW wire.
6. Inspect vacuum hoses for kinks and restrictions.
7. Inspect actuator linkage for restrictions and adjustment.
8. Check the following two input signals to the BeCM (Z238): Signal from Clutch Pedal Position Switch (X200) for vehicles equipped with a manual transmission, or the X, Y, and Z switch signals from the Gearbox Position Switch (X294) for vehicles equipped with an automatic transmission.
9. For vehicles equipped with a Petrol Engine, check the following input signal to the BeCM (Z238): Transfer box in Hi range signal from Transfer Gear Box ECU (Z256).
10. For vehicles equipped with a Diesel engine, check the Stop Lamp Switch (X168) inputs to the Engine Control Module (ECM) (Z132).
11. Note: For vehicles equipped with a manual transmission, cruise control can only be activated when the Cruise Control Switch (X115) is depressed, the transfer gear box is in Hi range (Petrol only), and the clutch pedal is not depressed. Also, the BeCM (Z238) will deactivate cruise control if the engine rpm rises above 5000 +/– 10 percent, due to the possibility of selecting manual without the use of the clutch (Petrol only). For vehicles equipped with an automatic transmission, cruise control can only be activated when the Cruise Control Switch (X115) is depressed, the transfer gear box is in Hi range (Petrol only), and the transmission is in one of the forward gears. The Transfer Gear Box ECU (Z256) provides the BeCM (Z238) with transfer gear box Hi range status. The Transfer Gear Box Position Switch (X294) provides the BeCM (Z238) with X, Y, Z switch status (PRND321 position information).

SYSTEM DIAGNOSIS

1. If the cruise control system does not operate correctly and the vehicle is equipped with a Petrol Engine, do Test A.
2. If the cruise control system does not operate correctly and the vehicle is equipped with a Diesel Engine, do Test E.

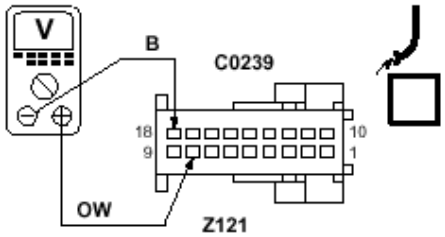
For petrol engine cars start here at Test “A”, for Diesel engine cars start at test “E”

Test A

1A

CONDITIONS
- **Ignition Switch**
  Position: II
- **Cruise Control Switch**
  On

RESULTS
Within 1.5V of battery voltage



OK

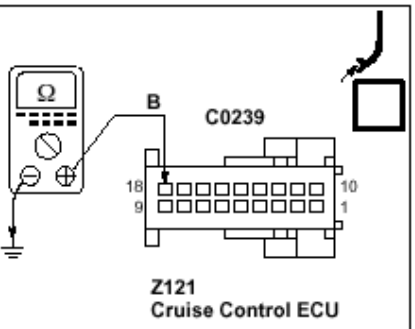
OK GO TO TEST B

2A

2A

CONDITIONS
- **Ignition Switch**
  Position: 0

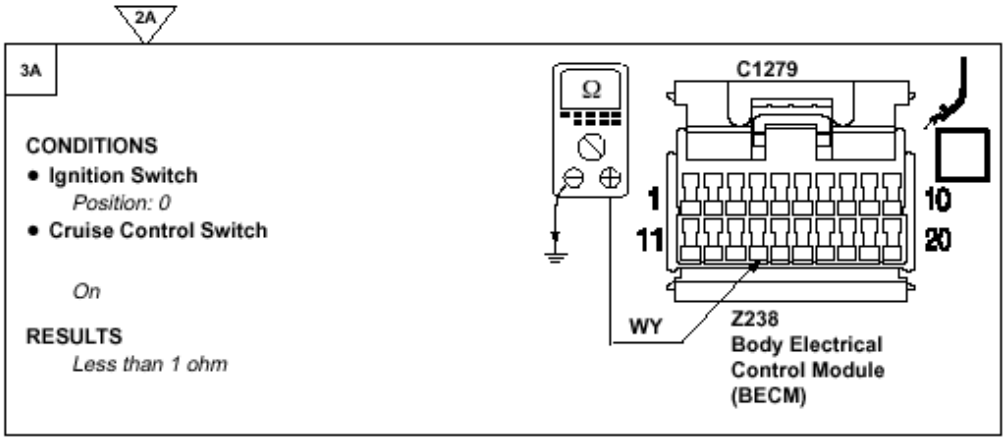
RESULTS
Less than 1 ohm



OK PROBLEM CAUSE
- B Wire

OK

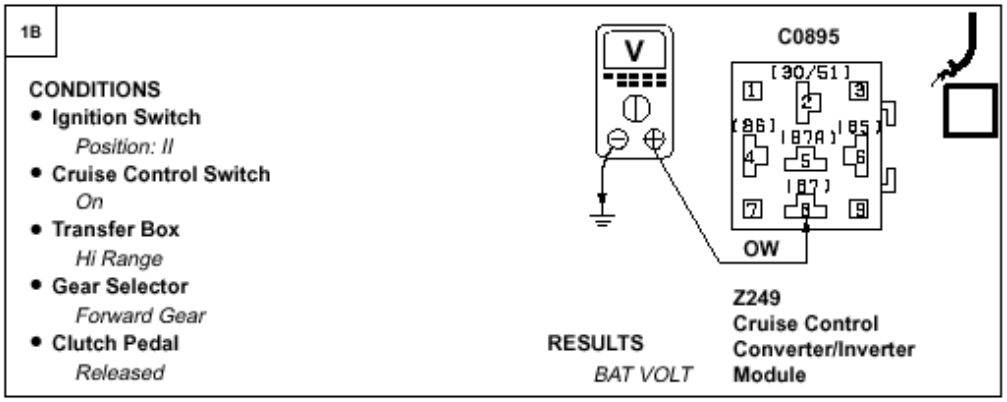
3A



OK **PROBLEM CAUSE**
- WY Wire
- B Wire
- Cruise Control Switch

OK **PROBLEM CAUSE**
- OW Wire
- Body Electrical Control Module (BECM)

Test B



OK **PROBLEM CAUSE**
- OW Wire

OK

2B

1B

2B

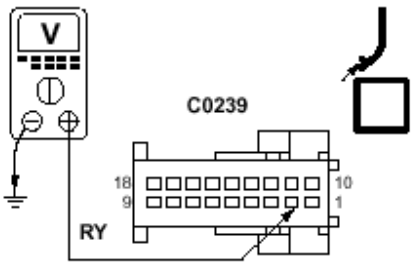
CONDITIONS

- **Ignition Switch**
  Position: II
- **Cruise Control Switch**
  On

RESULTS

- **Steering Wheel Switches**
  RES/DECEL Switch

On	=	*BAT VOLT*
Off	=	*0V*



Z121
Cruise Control ECU

OK

OK **GO TO TEST C**

3B

3B

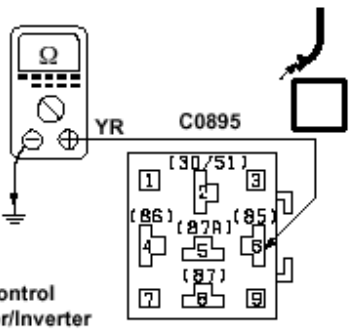
CONDITIONS

- **Ignition Switch**
  Position: 0

RESULTS

- **Steering Wheel Switches**
  RES/DECEL Switch

On	=	*Less than 1 ohm*
Off	=	*More than 10K ohms*



Z249
Cruise Control Converter/Inverter Module

OK **PROBLEM CAUSE**
- **YR, W Wire**
- **B, PB Wire**
- **Steering Wheel Switches**
- **Rotary Coupler**

OK **PROBLEM CAUSE**
- **Cruise Control Converter/ Inverter Module**

Test C

1C

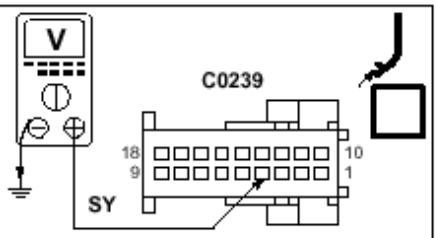
CONDITIONS

- **Ignition Switch**
  Position: II
- **Cruise Control Switch**
  On

RESULTS

- **Steering Wheel Switches**
  SET/ACCEL Switch

On	=	*BAT VOLT*
Off	=	*0 V*



Z121
Cruise Control ECU

OK

2C

OK **GO TO TEST D**

2C

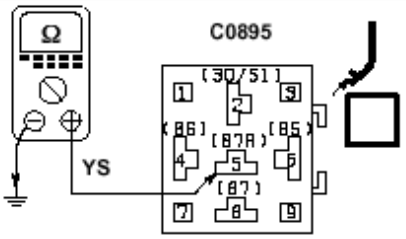
CONDITIONS

- **Ignition Switch**
  Position: 0

RESULTS

- **Steering Wheel Switches**
  SET/ACCEL Switch

On	=	*Less than 1 ohm*
Off	=	*More than 10K ohms*



Z249
Cruise Control Converter/Inverter Module

OK **PROBLEM CAUSE**
- **YS,R Wire**
- **Rotary Coupler**
- **Steering Wheel Switches**

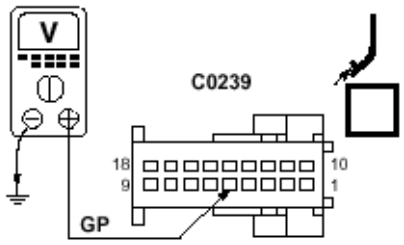
OK **PROBLEM CAUSE**
- **Cruise Control Converter/ Inverter Module**

Test D

1D

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
- **Brake Pedal**
  Depressed = *BAT VOLT*
  Released = *0 V*



OK

PROBLEM CAUSE
- **GP Wire**
- **W Wire**
- **Stop Lamp Switch**

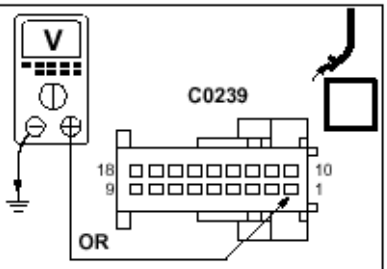
OK

2D

2D

CONDITIONS
- **Ignition Switch**
  Position: II
- **Cruise Control Switch**
  On
- **Transfer Box**
  Hi Range
- **Gear Selector**
  Forward Gear

RESULTS
- **Brake Pedal**
  Depressed = *0 V*
  Released = *BAT VOLT*



OK

PROBLEM CAUSE
- **OR, ON Wire**
- **Brake Switch Vent Valve**
- **Body Electrical Control Module (BECM)**

OK

3D

2D

3D

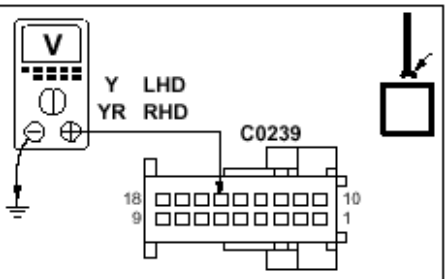
CONDITIONS

- **Ignition Switch**
  Position: II
- **Turn a drive wheel by hand**

RESULTS

= *5V with ignition position II*

= *2.5V approx. with wheels turning*



OK **PROBLEM CAUSE**
- **Y, YR Wire**
- **Body Electrical Control Module (BECM)**

OK → 4D

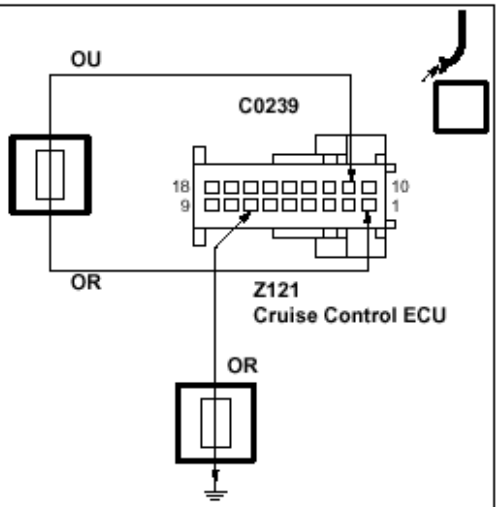
4D

CONDITIONS

- **Ignition Switch**
  Position: II
- **Cruise Control Switch**
  On
- **Transfer Gearbox**
  Hi Range
- **Gear Selector**
  Forward Gear
- **Brake Pedal**
  Released

RESULTS

- **Cruise Control Vacuum Pump**
  Operates



OK **PROBLEM CAUSE**
- **OU, OR Wire**
- **Cruise Control Vacuum Pump**

OK → 5D

4D

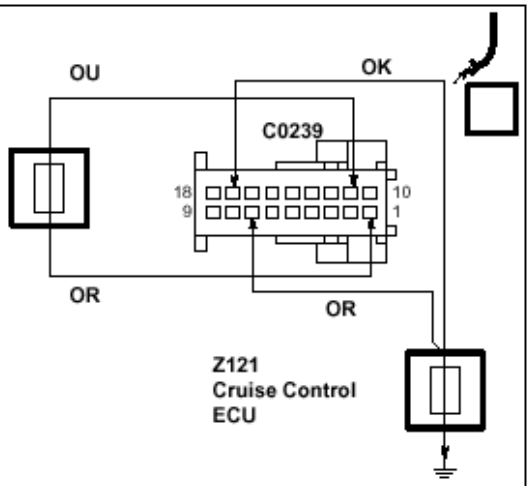
5D

CONDITIONS

- **Ignition Switch**
  Position: II
- **Cruise Control Switch**
  On
- **Transfer Gearbox**
  Hi Range
- **Gear Selector**
  Forward Gear
- **Brake Pedal**
  Released

RESULTS

- **Cruise Control Vacuum Pump**
  Operates
  Valve Closes
  Throttle Opens Wide



OK **PROBLEM CAUSE**
- OK Wire
- Cruise Control Vacuum Pump

OK **PROBLEM CAUSE**
- Cruise Control ECU

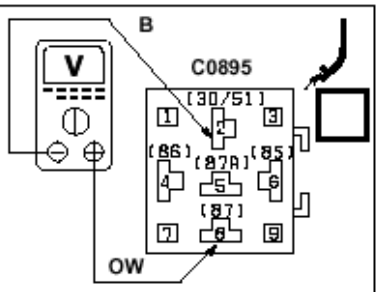
Test E

1E

CONDITIONS

- **Ignition Switch**
  Position: II
- **Cruise Control Switch**
  On
- **Gear Selector**
  Forward Gear
- **Clutch Pedal**
  Released

RESULTS
BAT VOLT



OK

2E

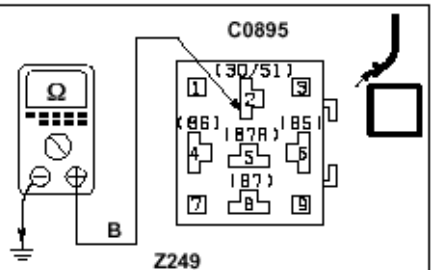
OK **GO TO TEST F**

1E

2E

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
- **Less than 1 ohm**



OK **PROBLEM CAUSE**
- **B Wire**

OK

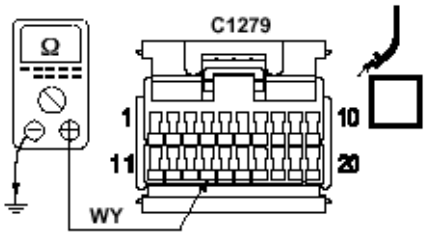
3E

3E

CONDITIONS
- **Ignition Switch**
  Position: 0
- **Cruise Control Switch**

  On

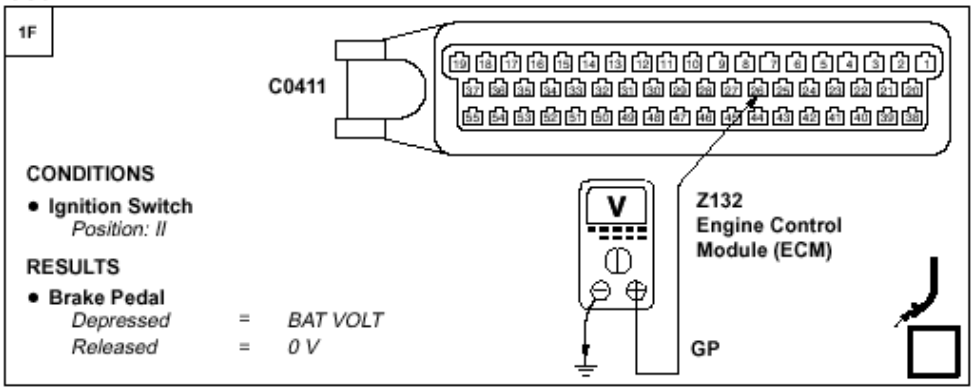
RESULTS
- **Less than 1 ohm**



OK **PROBLEM CAUSE**
- **WY Wire**
- **B Wire**
- **Cruise Control Switch**

OK **PROBLEM CAUSE**
- **OW Wire**
- **Body Electrical Control Module (BECM)**

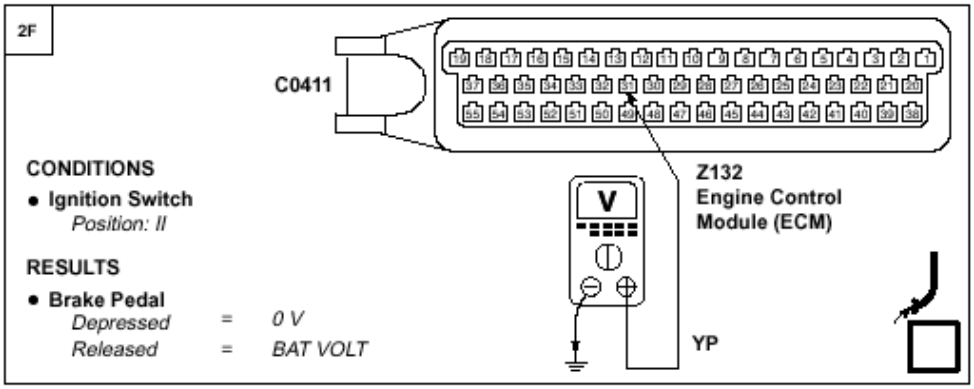
Test F



OK PROBLEM CAUSE
- GB Wire
- Stop Lamp Switch

OK

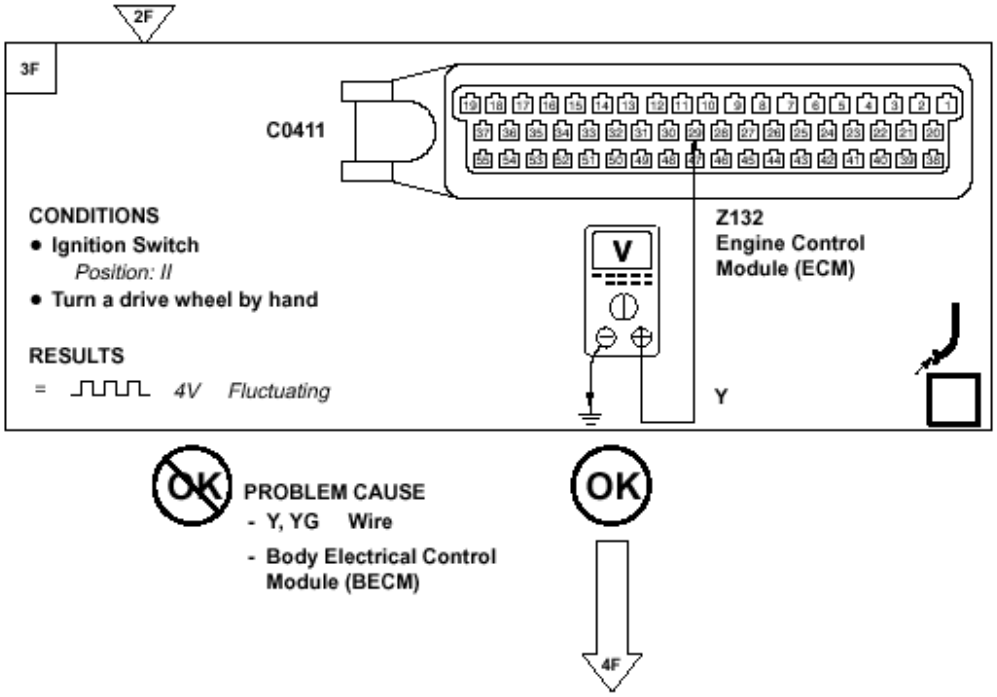
2F

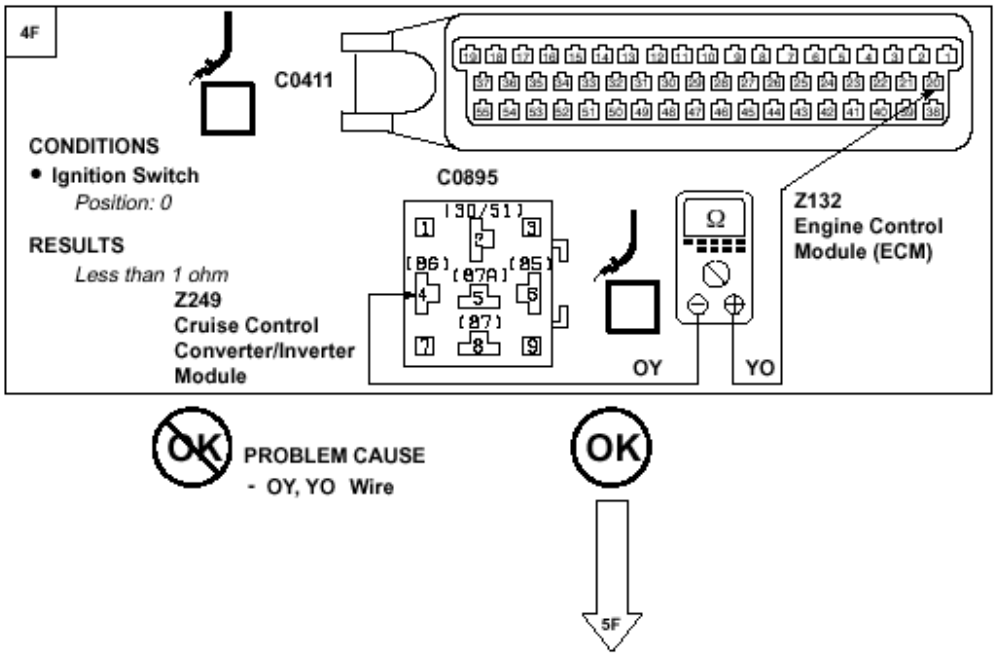


OK PROBLEM CAUSE
- YP Wire
- Stop Lamp Switch

OK

3F


2F
3F
C0411
CONDITIONS
• Ignition Switch
Position: II
• Turn a drive wheel by hand
RESULTS
= 4V Fluctuating
V
Z132
Engine Control
Module (ECM)
Y
OK
PROBLEM CAUSE
- Y, YG Wire
- Body Electrical Control
Module (BECM)
OK
4F


4F
C0411
CONDITIONS
• Ignition Switch
Position: 0
RESULTS
Less than 1 ohm
Z249
Cruise Control
Converter/Inverter
Module
C0895
[30/51]
[86]
[87A]
[85]
[87]
Ω
OY
YO
Z132
Engine Control
Module (ECM)
OK
PROBLEM CAUSE
- OY, YO Wire
OK
5F

4F

5F

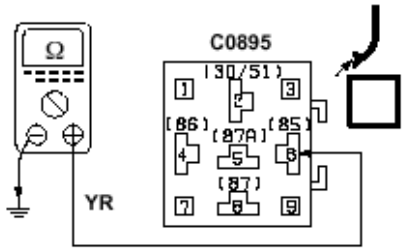
CONDITIONS

- **Ignition Switch**
  Position: 0

RESULTS

- **Steering Wheel Switches**
  RES/DECEL Switch

On	=	*Less than 1 ohm*
Off	=	*More than 10K ohms*



Z249
Cruise Control
Converter/Inverter
Module

OK **PROBLEM CAUSE**
- **YR, W Wire**
- **B, PB Wire**
- **Rotary Coupler**

- **Steering Wheel Switches**

OK → 6F

6F

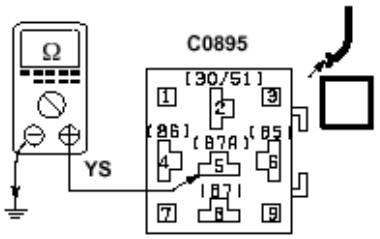
CONDITIONS

- **Ignition Switch**
  Position: 0

RESULTS

- **Steering Wheel Switches**
  SET/ACCEL Switch

On	=	*Less than 1 ohm*
Off	=	*More than 10K ohms*



Z249
Cruise Control
Converter/Inverter
Module

OK **PROBLEM CAUSE**
- **YS, R Wire**
- **Rotary Coupler**

- **Steering Wheel Switches**

OK **PROBLEM CAUSE**
- **Cruise Control Converter/ Inverter Module**

- **Body Electrical Control Module (BECM)**