

CIRCUIT OPERATION**Starting System**

When the Park/ Neutral Position Switch (X167) is in P or N, ground is applied to the Starter Solenoid Relay (K137). Putting the Ignition Switch (X134) in position III applies battery voltage to the Starter Solenoid Relay (K137). The Starter Solenoid Relay (K137) energizes and applies battery voltage to the Starter Solenoid (K136) and Starter (M134).

On vehicles equipped with a theft alarm, the Theft Alarm Unit (Z163) provides a ground circuit to the Starter Solenoid Relay's (K137) 86 terminal.

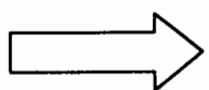
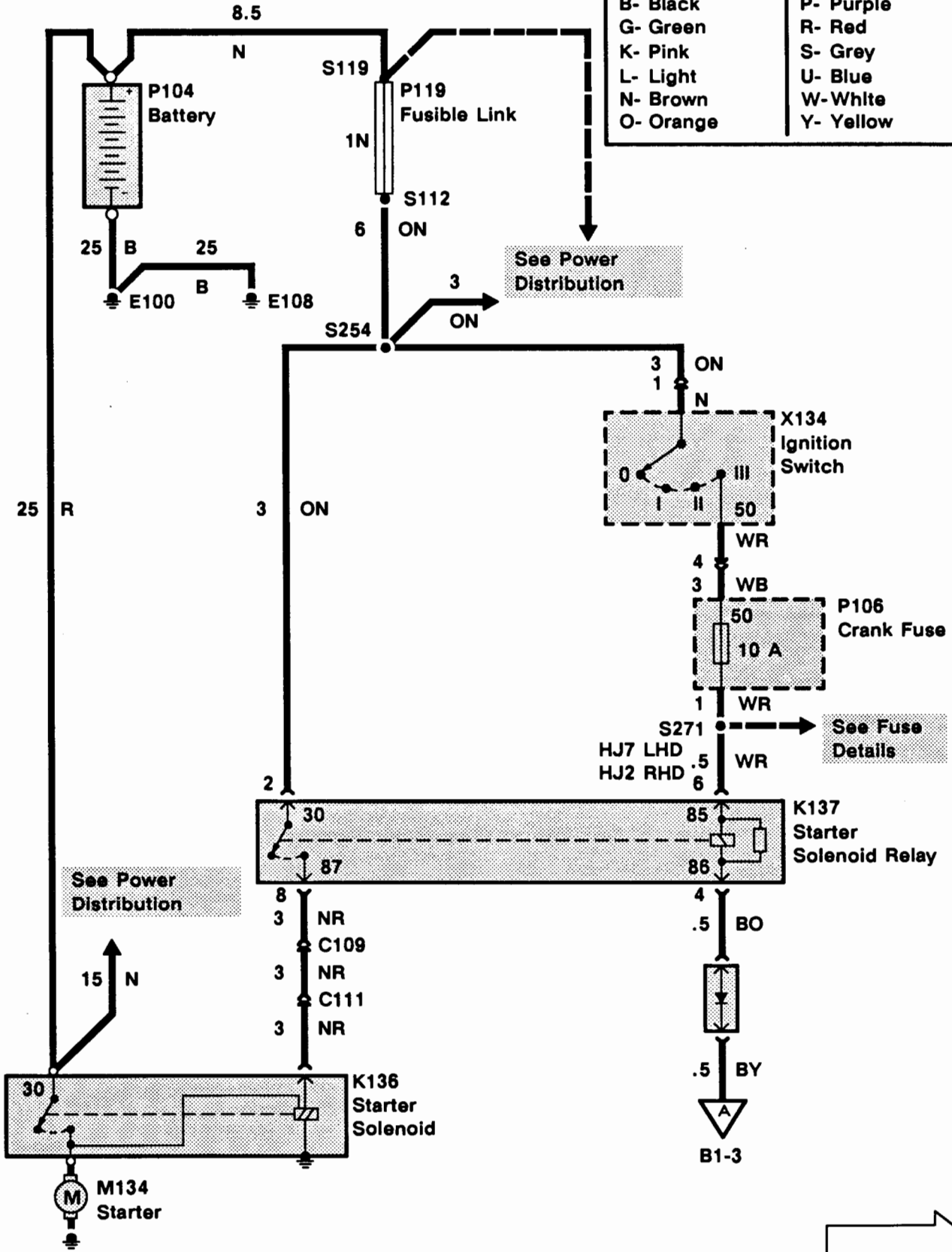
If the theft alarm is activated, the Theft Alarm Unit (Z163) will interrupt the Starter Solenoid Relay's (K137) ground path and prevent starting the engine.

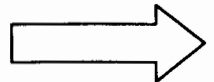
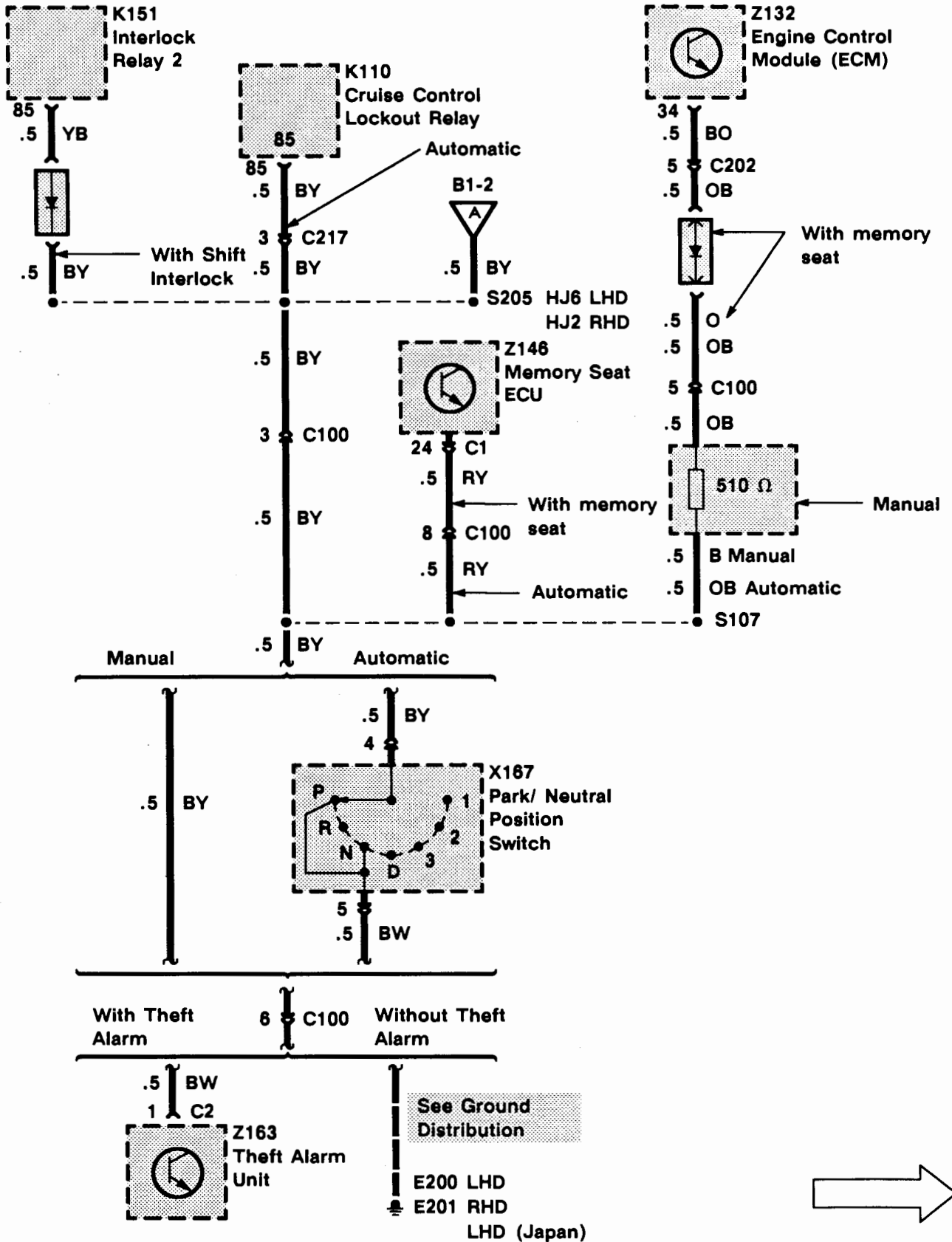
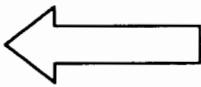
Charging System

When the Ignition Switch (X134) is in position II, battery voltage is applied to the charging system fault light. When the Generator (Z106) is being turned by the engine, its stator windings are excited by voltage applied to the Generator via the charging system fault light. The Generator begins to produce electricity in order to charge the vehicle Battery (P104). If the Generator fails to produce power, the Generator grounds the fault light control wire, causing the charging system fault light to glow.

Wire Colour Chart

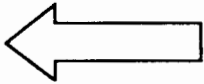
B- Black	P- Purple
G- Green	R- Red
K- Pink	S- Grey
L- Light	U- Blue
N- Brown	W- White
O- Orange	Y- Yellow





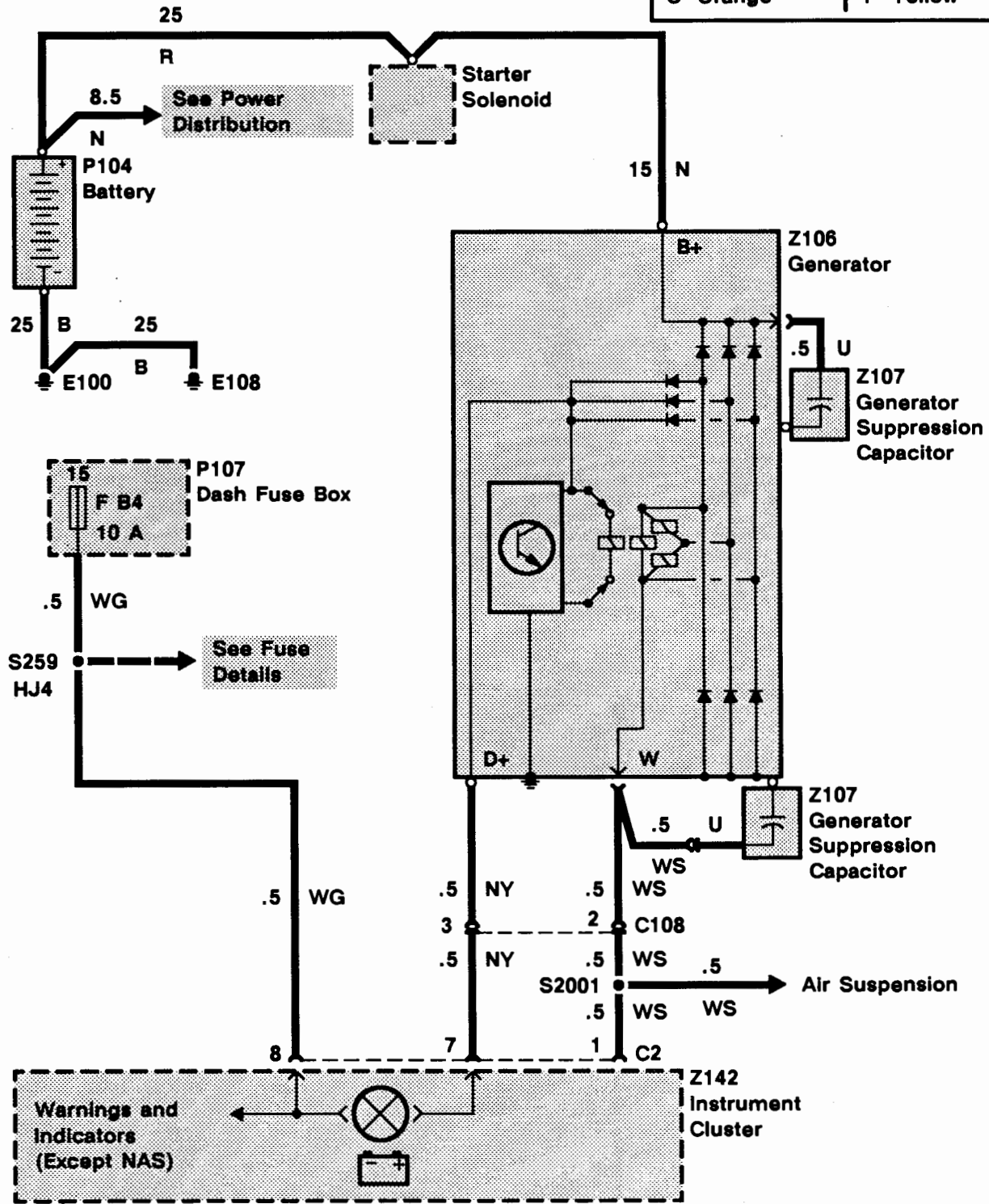
B1 ETM

1993 RANGE ROVER



Wire Colour Chart

B- Black	P- Purple
G- Green	R- Red
K- Pink	S- Grey
L- Light	U- Blue
N- Brown	W- White
O- Orange	Y- Yellow



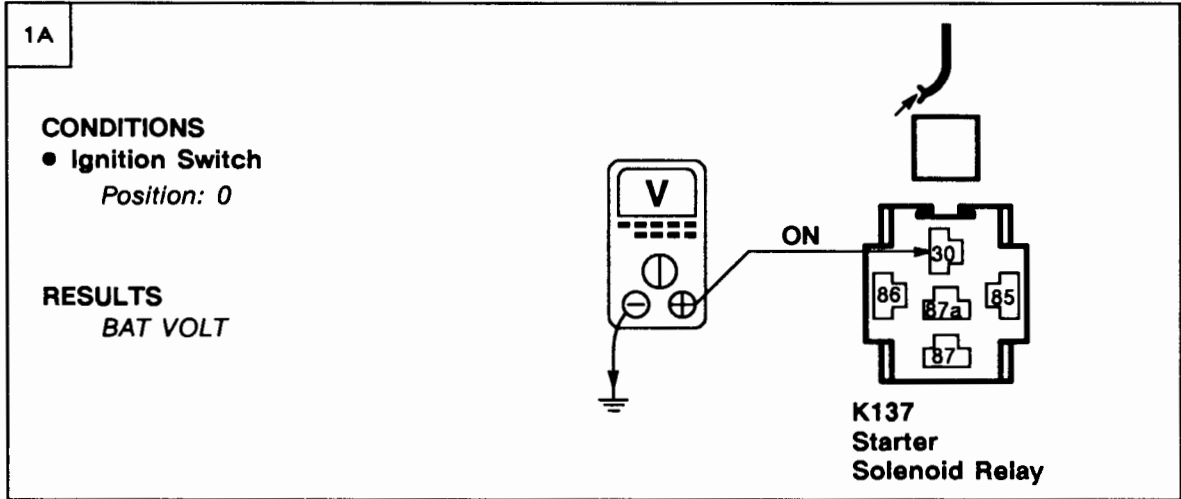
TROUBLESHOOTING HINTS

1. If the Starter Solenoid (K136) does not click and the vehicle is equipped with a memory seat, check seat operation. If the seat does not operate, check the Park/ Neutral Position Reverse Switch (X167) and the Theft Alarm Unit (Z163).

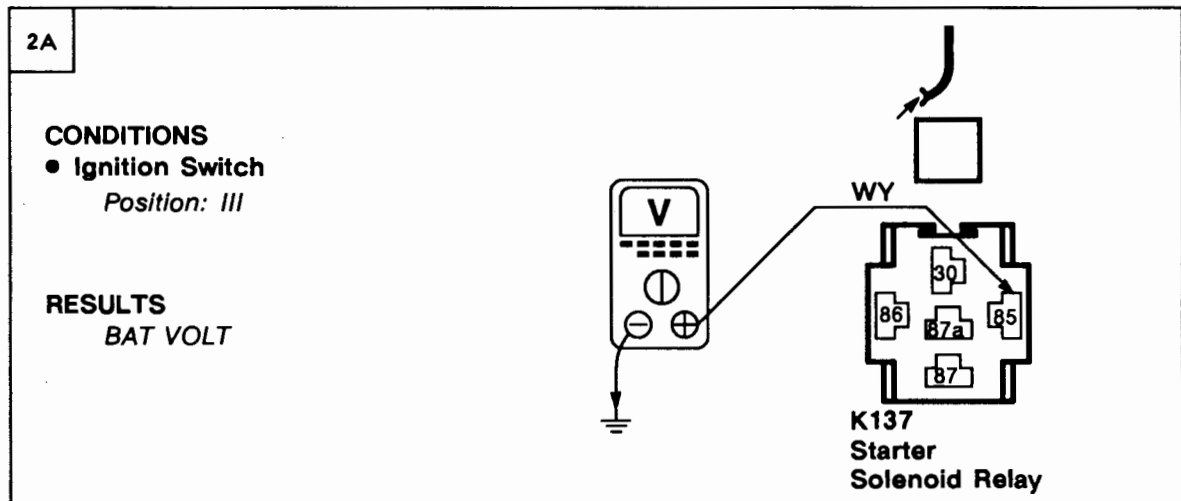
SYSTEM DIAGNOSIS

1. If the Starter Solenoid (K136) does not click and the engine does not crank, do Test A.
2. If the Starter Solenoid (K136) clicks but the engine does not crank or cranks slowly, do Test B.
3. If the charge warning light does not light with the engine off and the Ignition Switch (X134) in position II, do Test C.
4. If the charge warning light stays lit with the engine running, do Test D.

Test A

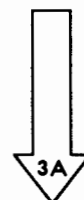


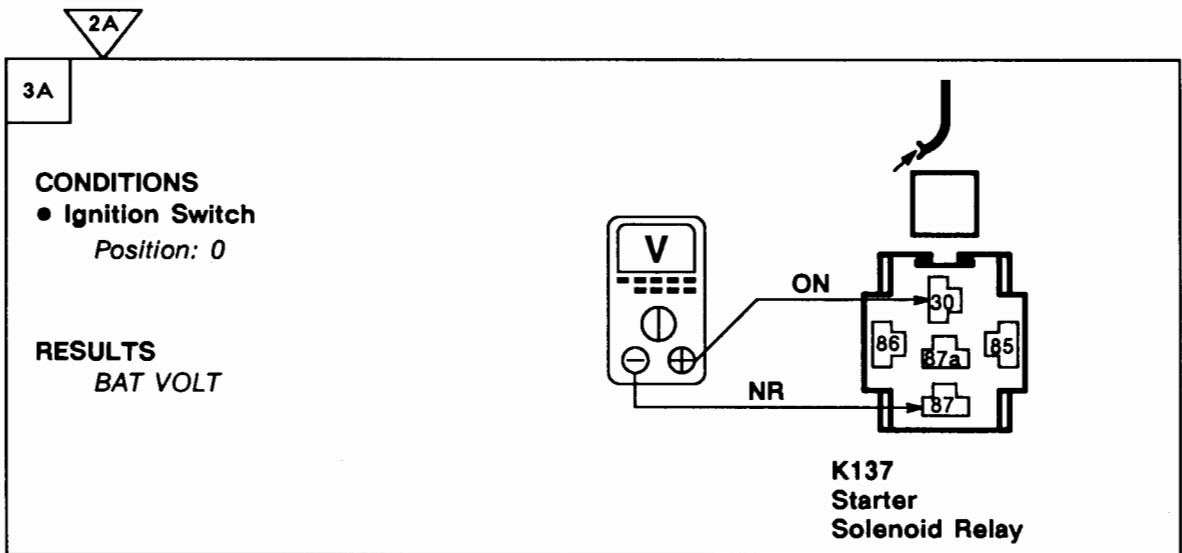
PROBLEM CAUSE
- ON Wire



PROBLEM CAUSE

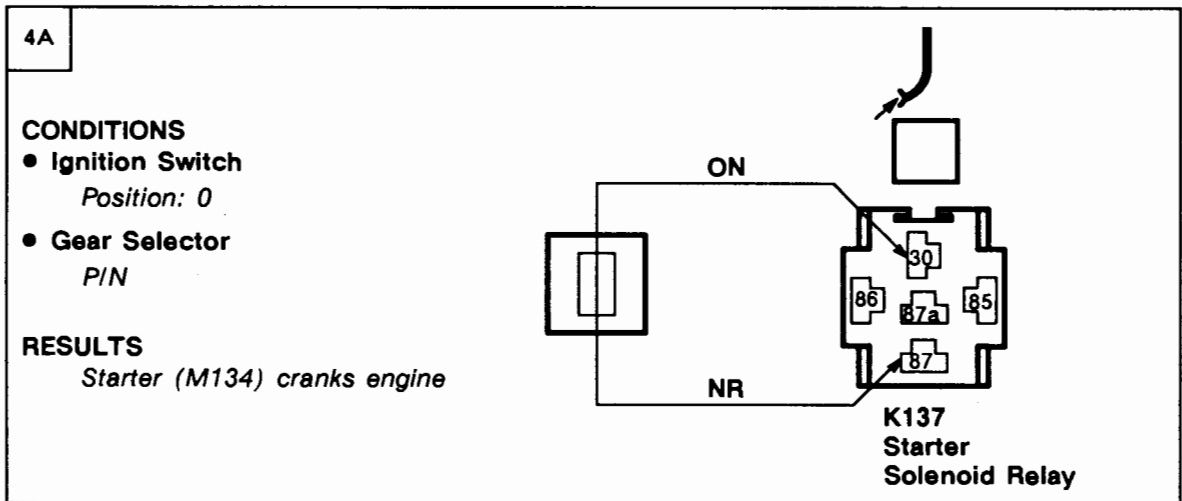
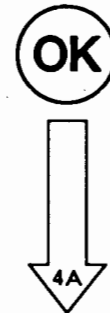
- Crank Fuse
- WR Wire
- WB Wire
- Ignition Switch





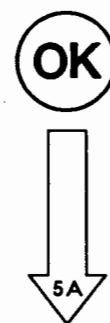
~~OK~~ **PROBLEM CAUSE**

- NR Wire
- Starter Solenoid



~~OK~~ **PROBLEM CAUSE**

- NR Wire
- Starter Solenoid
- Starter



B1 ETM

1993 RANGE ROVER

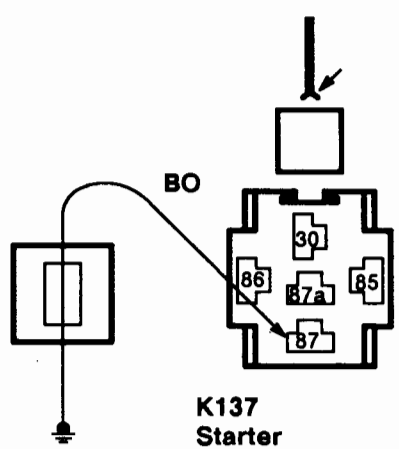
4A

5A

CONDITIONS

- Ignition Switch
Position: III
- Gear Selector
P/N

RESULTS
Starter (M134) cranks engine



**K137
Starter
Solenoid Relay**



PROBLEM CAUSE

- BY Wire
- BO Wire
- BW Wire
- Starter Inhibit/ Reverse Switch
- Theft Alarm Unit



PROBLEM CAUSE

- Starter Solenoid Relay

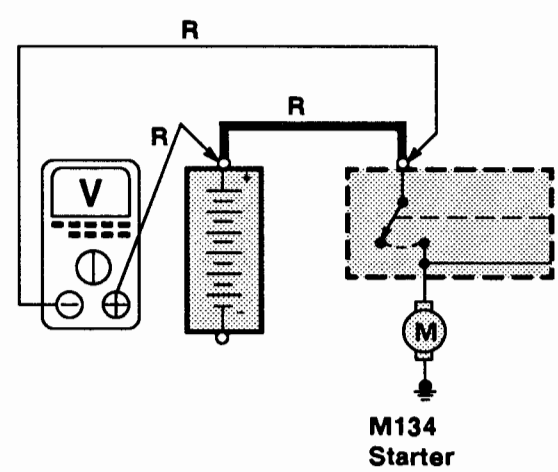
Test B

1B

CONDITIONS

- Ignition Switch
Position: III

RESULTS
Less than 0.5V

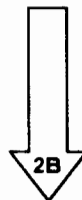


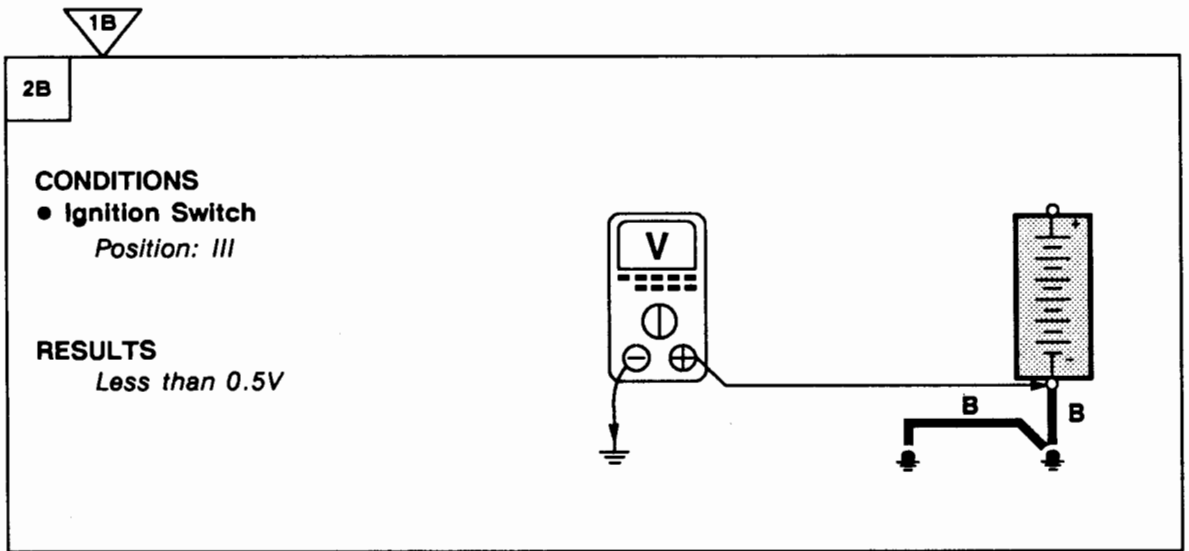
**M134
Starter**



PROBLEM CAUSE

- R Wire
- Battery terminal connection
- Starter Solenoid (K136) terminal connection





PROBLEM CAUSE

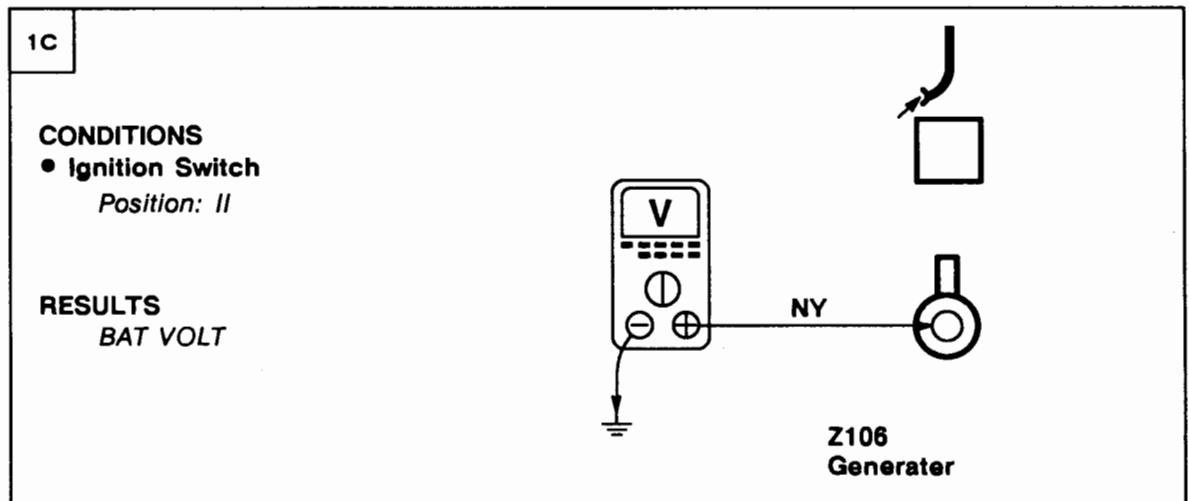
- B Wire
- Battery terminal connection
- Ground Connections



PROBLEM CAUSE

- Starter Solenoid
- Starter

Test C



PROBLEM CAUSE

- NY Wire
- Bulb



PROBLEM CAUSE

- Generator

B1 ETM

1993 RANGE ROVER

Test D

1D

CONDITIONS
 • Ignition Switch
 Position: 0

RESULTS
 BAT VOLT

Z106
Generator

~~OK~~ PROBLEM CAUSE
 - N Wire

OK



2D

CONDITIONS
 • Ignition Switch
 Position: 0

RESULTS
 More than 1000 ohms

Z106
Generator

~~OK~~ PROBLEM CAUSE
 - NY Wire
 - Instrument Cluster

OK PROBLEM CAUSE
 - Generator

CIRCUIT OPERATION

With the Cruise Control Switch (X115) in 1, voltage from Fuse F 2 is applied to the Cruise Control ECU (Z121), Cruise Control Vacuum Pump (M103), RES/DECEL Switch (X156), and the SET/ACCEL Switch (X166) through the WY wire, Cruise Cassette (Z104) and SY wire. The Cruise Control ECU (Z121) is grounded at terminal 8 through the B wire to E200.

Cruise Control Vacuum Pump (M103)

With the Cruise Control Switch (X115) in 1, voltage is applied to the Cruise Control Vacuum Pump (M103) through the WY wire. When a cruise speed is set, the Cruise Control ECU (Z121) applies ground through the BR wire to operate the pump motor and applies ground through the BY wire to close the normally open solenoid valve in the pump. The pump applies vacuum to the actuator.

SET/ACCEL Switch (X166)

To set a cruise speed, the Cruise Control Switch (X115) must be in 1 and vehicle speed must exceed 28 mph (45 km/h). When the SET/ACCEL Switch (X166) is depressed under these conditions, voltage from Fuse F2 is applied to terminal 2 of the Cruise Control ECU (Z121) through the closed Cruise Control Switch (X115) and SET/ACCEL Switch (X166), causing the vacuum pump to operate. When the SET/ACCEL Switch (X166) is released, voltage is removed from terminal 2, signalling the ECU to set the speed.

RES/DECEL Switch (X156)

When the RES/DECEL Switch (X156) is depressed, voltage is applied to terminal 6 of the Cruise Control ECU (Z121). This voltage signals the ECU to disengage the system and the vehicle slows down. When the switch is depressed a second time, voltage is again applied to the ECU and the vehicle returns to the previously set speed.

Speed Input

Terminal 5 of the Cruise Control ECU (Z121) monitors the Vehicle Speed Sensor Buffer

(Z160) speed output signal through the YK wire. This 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 power from the Cruise Control ECU (Z121) and vacuum pump, and erasing the set speed memory.
2. The RES/DECEL Switch (X156) is depressed, signalling the Cruise Control ECU (Z121) to disengage the system.
3. The brake pedal is depressed and a vacuum valve in the Brake Switch Vent Valve opens (X112). This vents vacuum to the actuator valve and releases the throttle.
4. The Voltage applied to Cruise Control ECU (Z121) terminal 9 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, the vehicle is in the Park/ Neutral Position or the clutch pedal is depressed. With the brake pedal depressed, the Brake Switch Vent Valve (X112) moves to 1 and the circuit is interrupted. With the vehicle in the Park/ Neutral Position Switch (X167) energizes the Cruise Control Lockout Relay (K110) by grounding the relay's coil. The relay then opens its contacts, interrupting the circuit. With the clutch pedal depressed, the Clutch Switch (X200) moves to 1 and the circuit is interrupted.

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 a constant speed cannot be maintained.

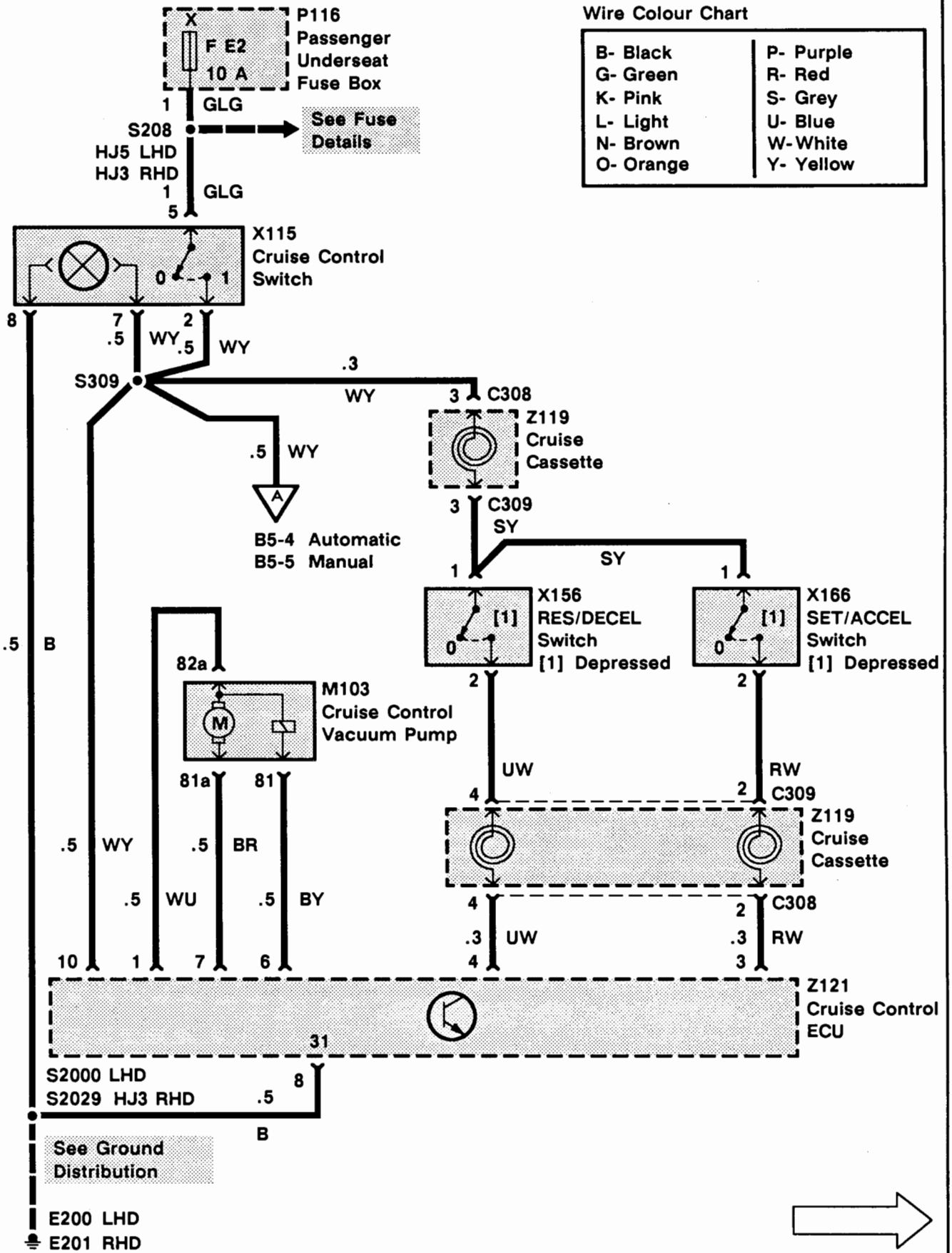
1. Start the engine and depress the Cruise Control Switch (X115) to activate the Cruise Control System. Accelerate to approximately

30 mph (50 km/h) and press the SET/ACCEL Switch (X166). Immediately release the switch and remove foot from the accelerator pedal. The vehicle should maintain the speed at which the SET/ACCEL Switch (X166) was pressed.

2. Press the SET/ACCEL Switch (X166) 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 (X166) was released.
3. Press the RES/DECEL Switch (X156) while the vehicle is in the cruise control mode. The cruise control should disengage. Slow to approximately 35 mph (55 km/h) and press the RES/DECEL Switch (X156). 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 (X156) and the vehicle should accelerate to the previously set speed without operation of the accelerator pedal.
5. Press the RES/DECEL Switch (X156) and allow the vehicle to decelerate to below 26 mph (42 km/h). Press the RES/DECEL Switch (X156) and the Cruise Control System should remain disengaged.
6. Press the SET/ACCEL Switch (X166) below 28 mph (45 km/h) and the Cruise Control System should remain disengaged. Accelerate the vehicle above 28 mph (45 km/h), press the RES/DECEL Switch (X156) 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 ECU memory.

Wire Colour Chart

B- Black	P- Purple
G- Green	R- Red
K- Pink	S- Grey
L- Light	U- Blue
N- Brown	W- White
O- Orange	Y- Yellow

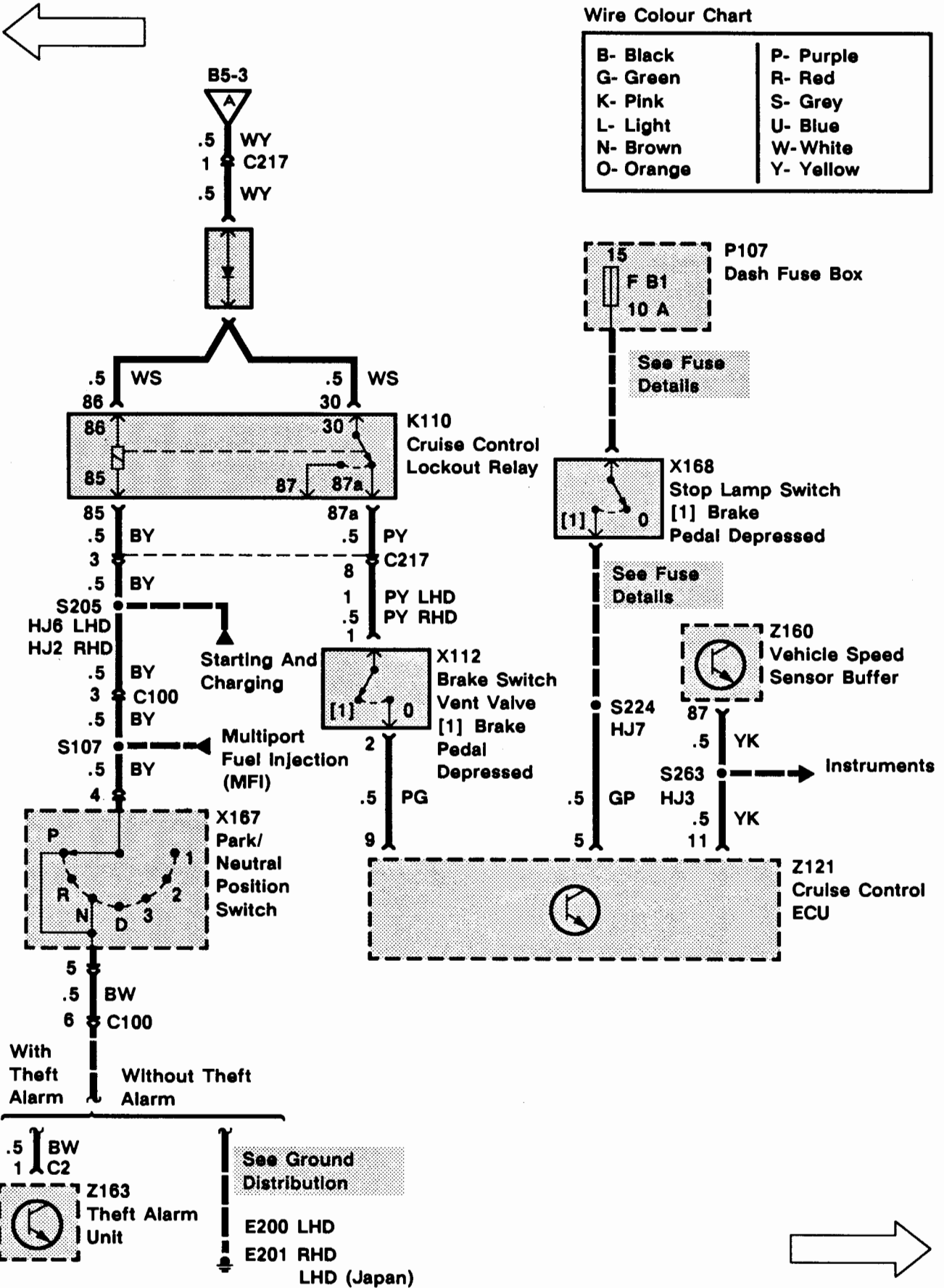


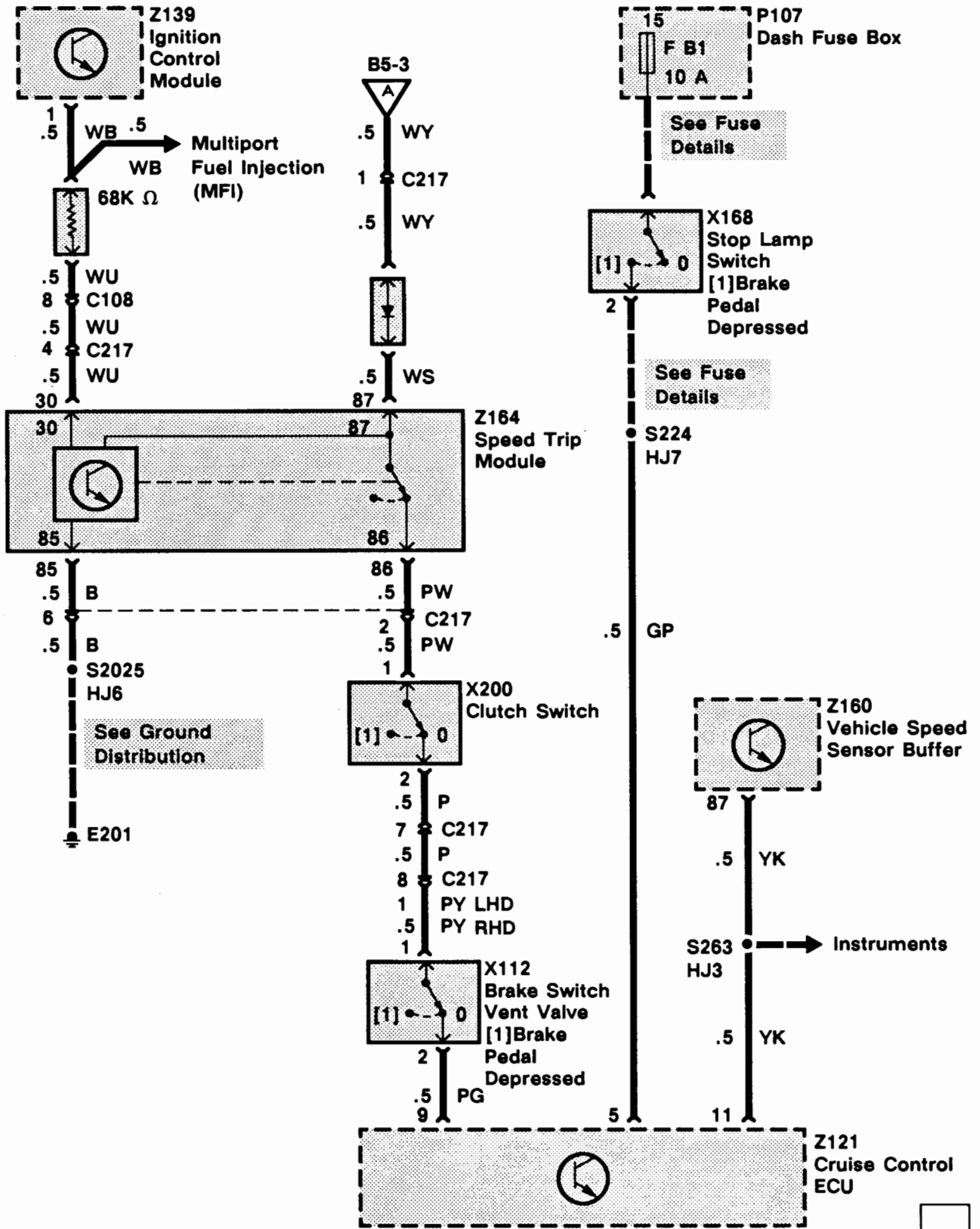
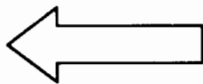
B5 ETM

CRUISE CONTROL (AUTOMATIC TRANSMISSION)

Wire Colour Chart

B- Black	P- Purple
G- Green	R- Red
K- Pink	S- Grey
L- Light	U- Blue
N- Brown	W- White
O- Orange	Y- Yellow





TROUBLESHOOTING HINTS

1. If the cruise control system operates but the cruise warning light does not illuminate, check the bulb, B wire and WY wire.
2. Inspect vacuum hoses for kinks and restrictions.
3. Inspect actuator linkage for restrictions and adjustment.

SYSTEM DIAGNOSIS

1. If the cruise control system does not operate correctly and the vehicle is equipped with a manual transmission, do Test A.
2. If the cruise control system does not operate correctly and the vehicle is equipped with an automatic transmission, do Test B.

Test A

1A

CONDITIONS

- Ignition Switch
Position: II

RESULTS

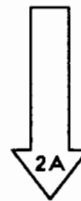
- Cruise Control Switch
ON = BAT VOLT
OFF = 0V

Z121
Cruise Control
ECU



PROBLEM CAUSE

- F E2 Fuse
- WY Wire
- GLG Wire
- Cruise Control Switch



2A

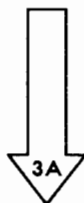
CONDITIONS

- Ignition Switch
Position: II
- Cruise Control Switch
ON
- engine running

RESULTS

- Brake Switch Vent Valve
- Clutch Switch
BAT VOLT = Released
0V = Depressed

Z121
Cruise Control
ECU



GO TO TEST C

2A

3A

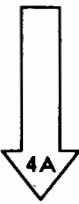
CONDITIONS

- Ignition Switch
Position: II
- Cruise Control Switch
ON
- engine running

RESULTS

- Clutch Switch
BAT VOLT = Released
0V = Depressed

X112
Brake Switch
Vent Valve



PROBLEM CAUSE

- PG Wire
- Brake Switch Vent Valve

4A

CONDITIONS

- Ignition Switch
Position: II
- Cruise Control Switch
ON
- engine running

RESULTS

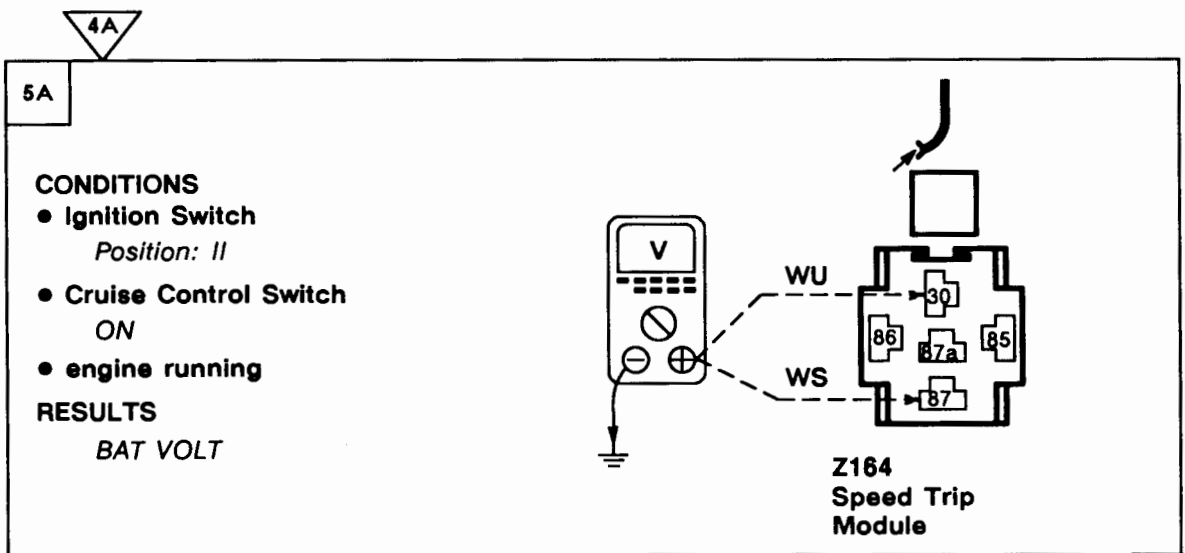
- Clutch Switch
BAT VOLT = Released
0V = Depressed

X200
Clutch Switch



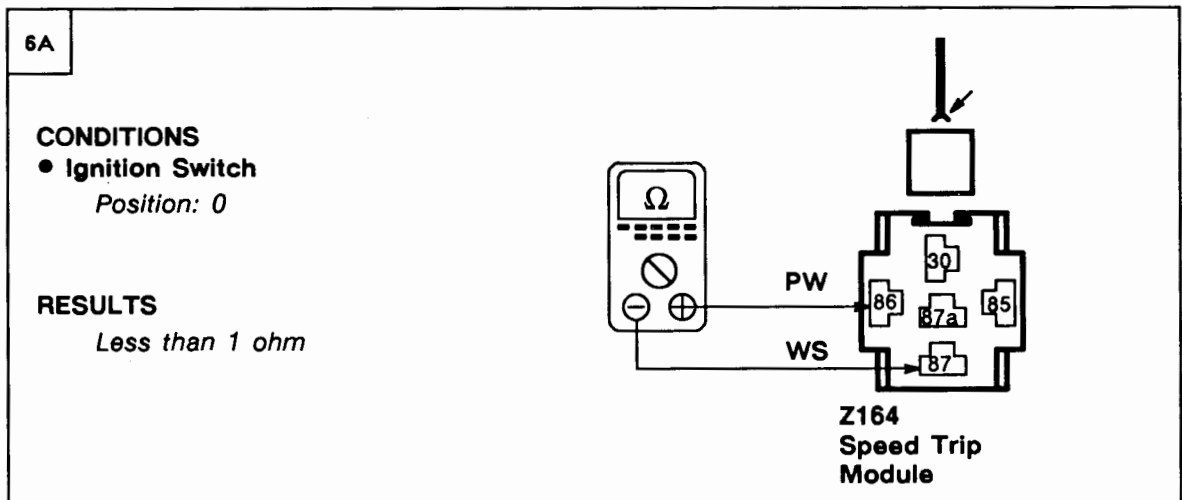
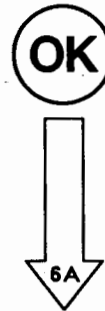
PROBLEM CAUSE

- PW Wire
- Clutch Switch



~~OK~~ **PROBLEM CAUSE**

- WU Wire
- Resistor
- WS Wire
- Diode
- BY Wire



~~OK~~ **PROBLEM CAUSE**

- Speed Trip Module

~~OK~~ **PROBLEM CAUSE**

- PW Wire

Test B

1B

CONDITIONS

- Ignition Switch
Position: II

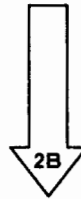
RESULTS

- Cruise Control Switch
ON = BAT VOLT
OFF = 0V

Z121
Cruise Control
ECU



- PROBLEM CAUSE**
- F E2 Fuse
 - WY Wire
 - GLG Wire
 - Cruise Control Switch



2B

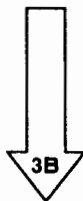
CONDITIONS

- Ignition Switch
Position: II
- Cruise Control Switch
ON
- Gear Selector
D

RESULTS

- Brake Switch Vent Valve
BAT VOLT = Released
0V = Depressed

Z121
Cruise Control
ECU



GO TO TEST C

2B

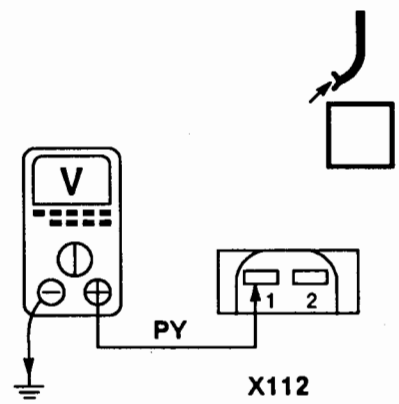
3B

CONDITIONS

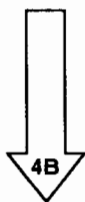
- Ignition Switch
Position: II
- Gear Selector
D

RESULTS

- Cruise Control Switch
ON = BAT VOLT
OFF = 0V



X112
Brake Switch
Vent Valve



PROBLEM CAUSE

- PG Wire
- Brake Switch Vent Valve

4B

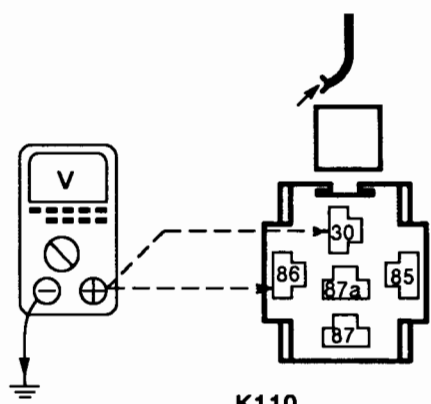
4B

CONDITIONS

- Ignition Switch
Position: II

RESULTS

- Cruise Control Switch
ON = BAT VOLT
OFF = 0V

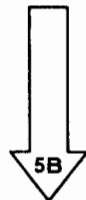


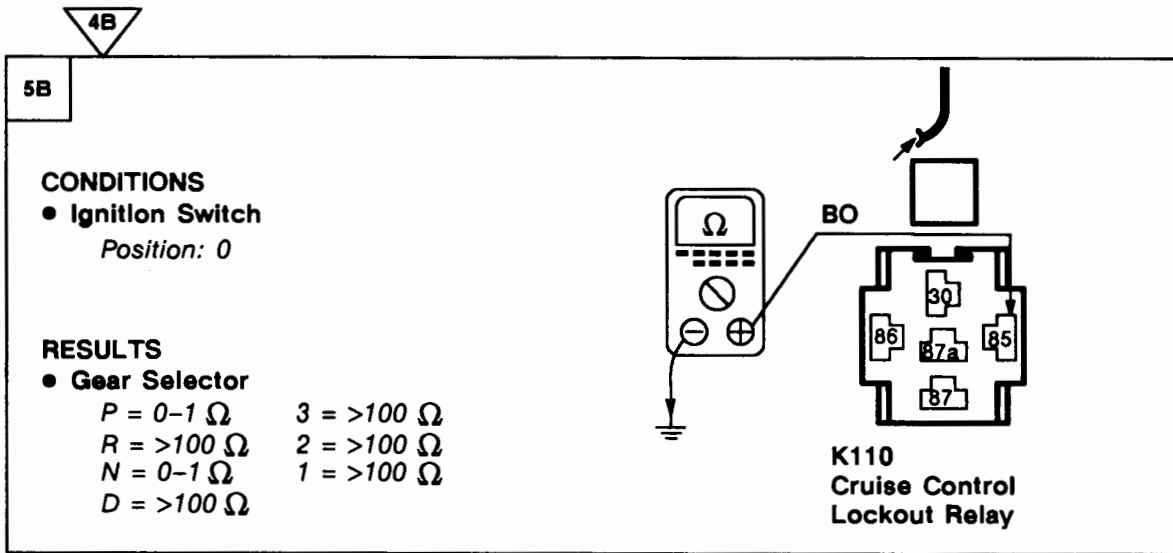
K110
Cruise Control
Lockout Relay



PROBLEM CAUSE

- WS Wire
- Diode
- WY Wire





PROBLEM CAUSE

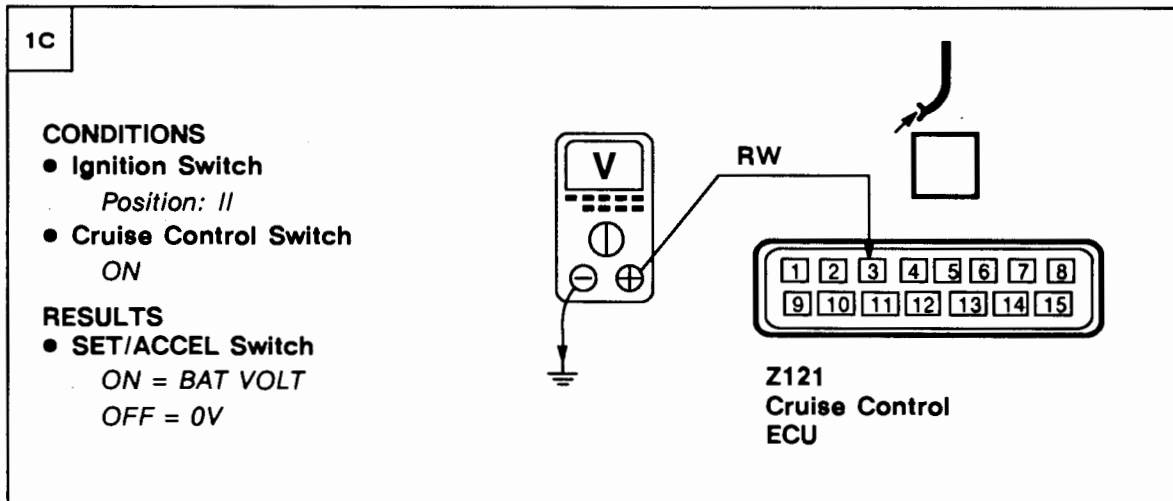
- BY Wire
- Starter Inhibit/ Reverse Switch



PROBLEM CAUSE

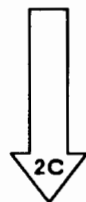
- PY Wire
- Starter Inhibit/ Reverse Switch

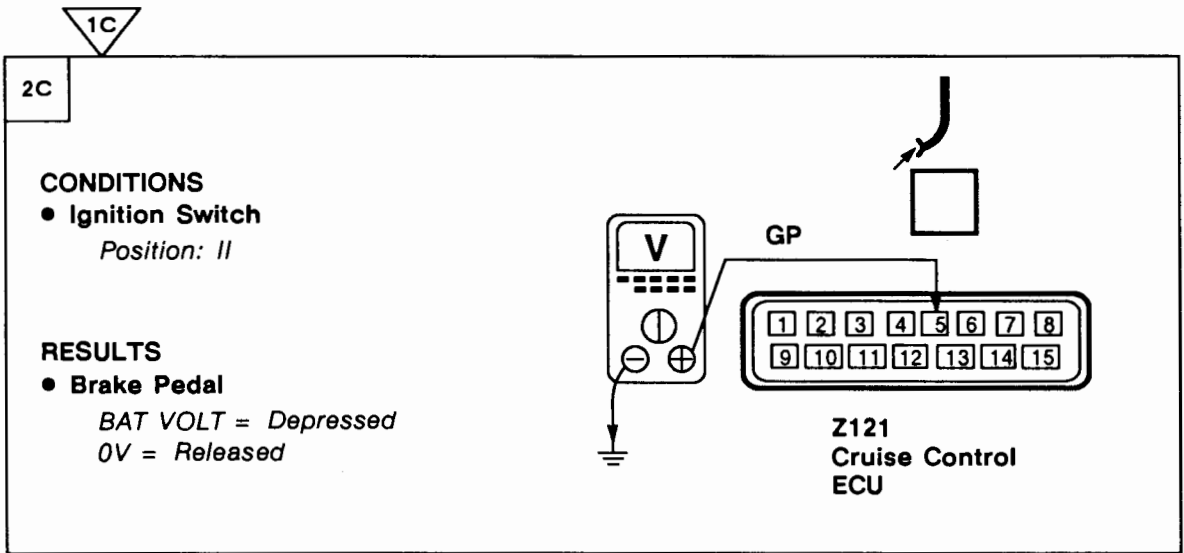
Test C



PROBLEM CAUSE

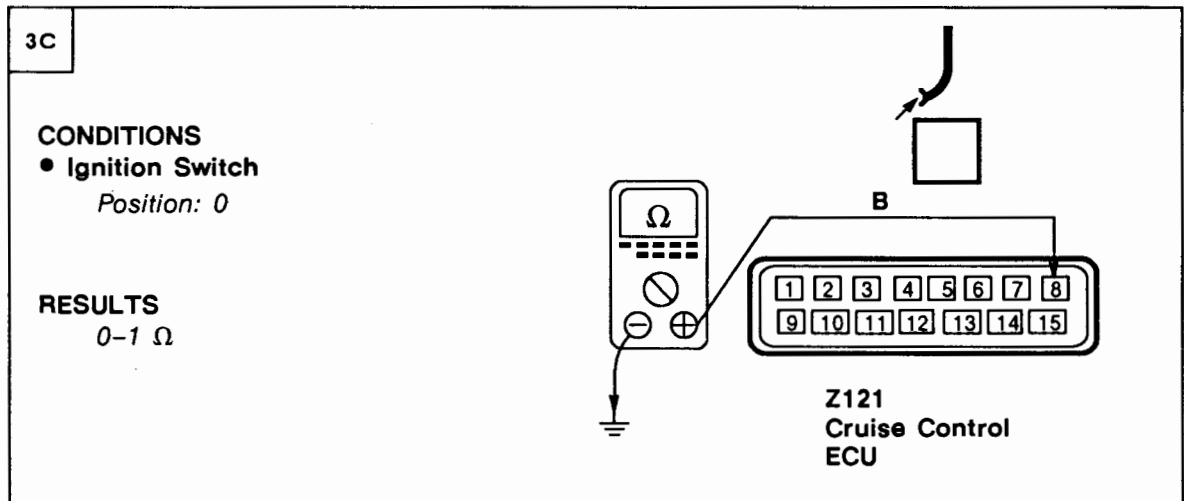
- RW Wire
- SY Wire
- WY Wire
- Cruise Cassette
- SET/ACCEL Switch





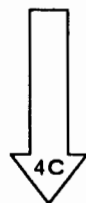
PROBLEM CAUSE

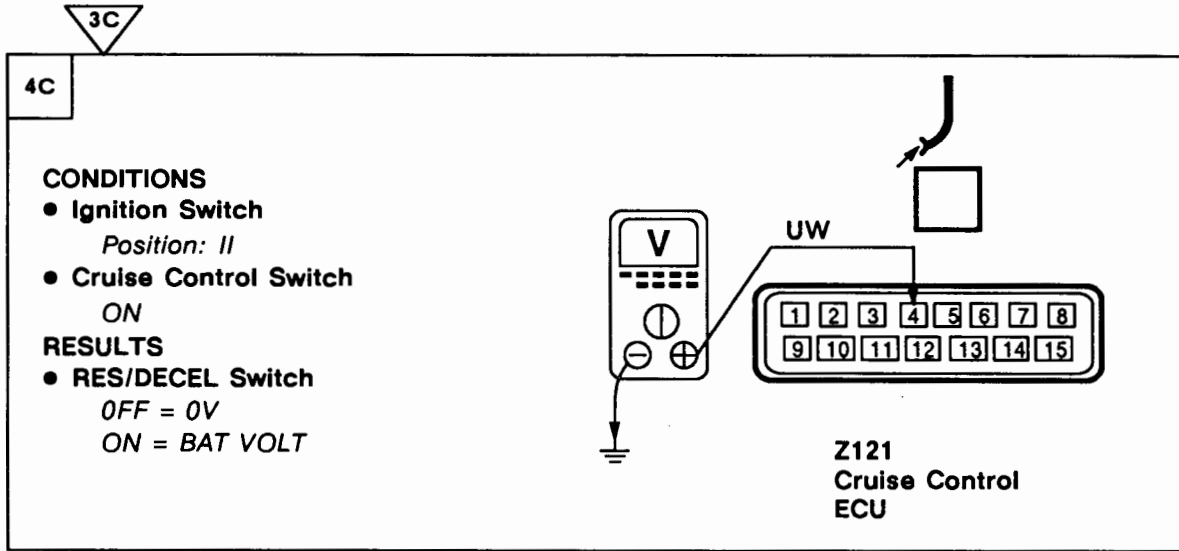
- GP Wire
- Stop Lamp Switch
- F B1 Fuse



PROBLEM CAUSE

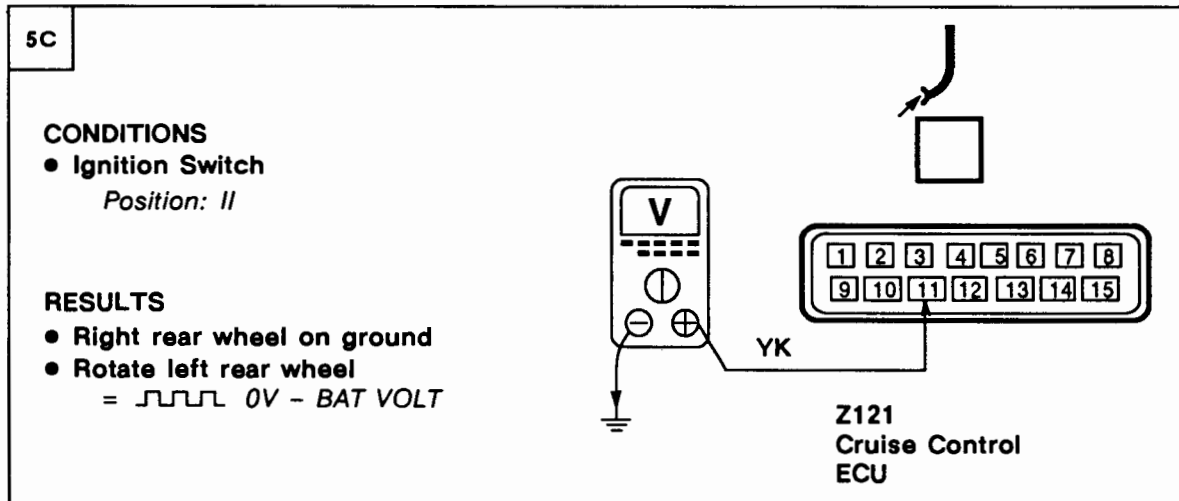
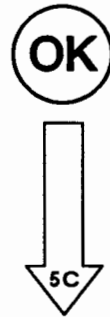
- B Wire





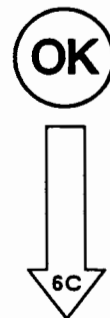
OK PROBLEM CAUSE

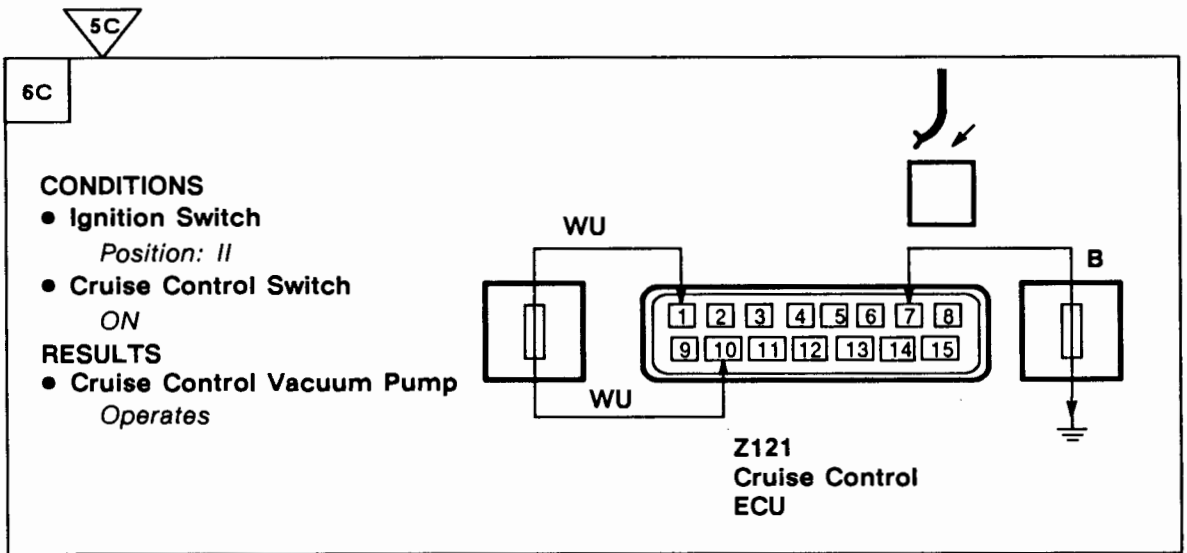
- UW Wire
- Cruise Cassette
- RES/DECEL Switch



OK PROBLEM CAUSE

- YK Wire

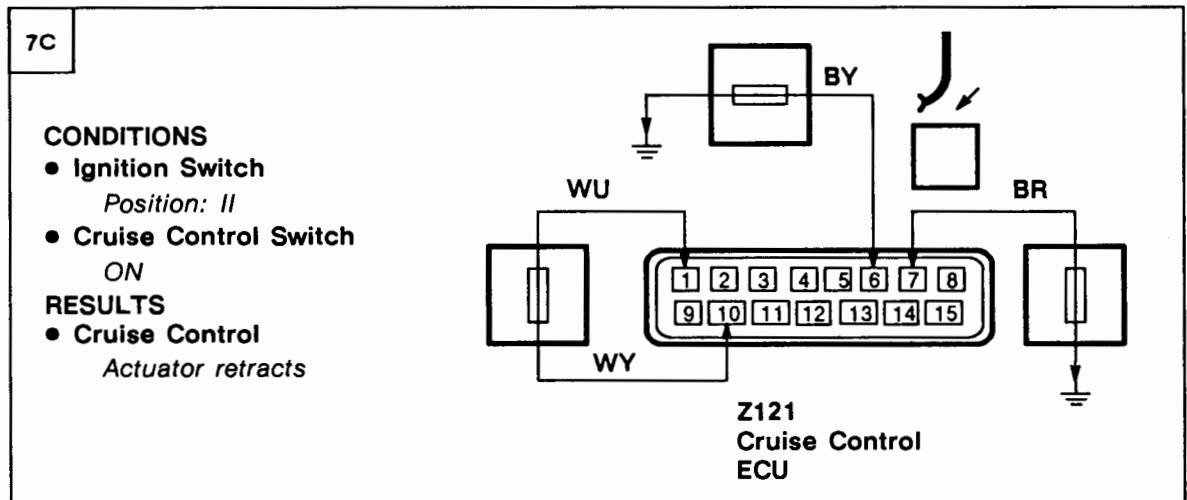




GO TO TEST D



PROBLEM CAUSE
- BY Wire

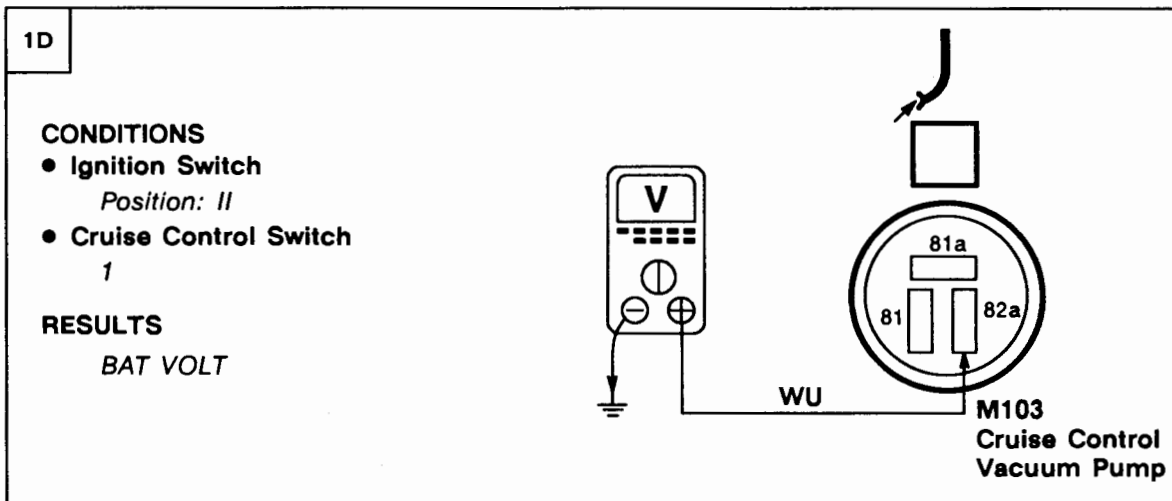


GO TO TEST D

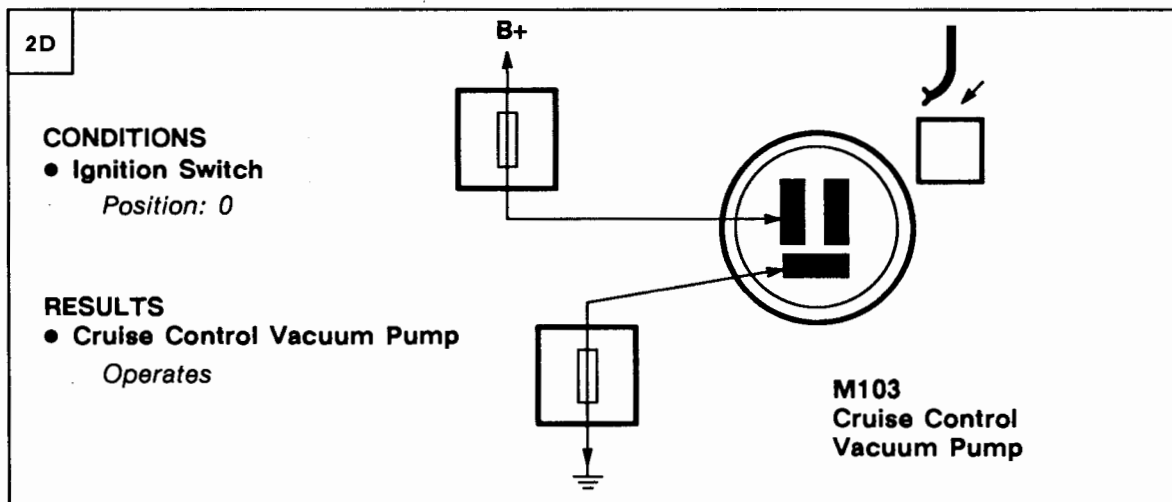


PROBLEM CAUSE
- Cruise Control ECU

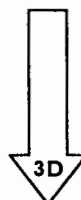
Test D

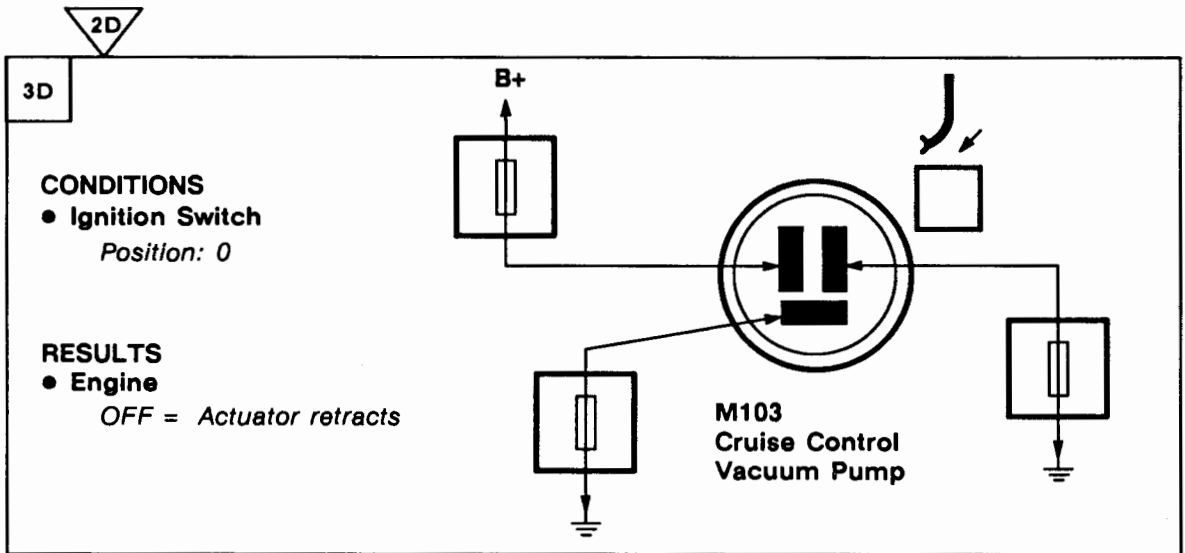


PROBLEM CAUSE
- WY Wire



PROBLEM CAUSE
- BR Wire
- Cruise Control Vacuum Pump





PROBLEM CAUSE

- Vacuum leak or restriction
- Brake Switch Vent Valve
- Cruise Control Vacuum Pump



PROBLEM CAUSE

- BY Wire

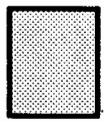
1993 RANGE ROVER

KEY INFORMATION

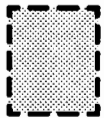
CIRCUIT DIAGRAMS

- Circuit diagrams are arranged so that current flow is from the top of the diagram (current source) to the bottom of the diagram (ground).
- Only those components that work together in the circuit are shown. If only part of a component is used in the circuit, then only that part of the component is shown.

● Remember:



Entire component



Part of a component

TERMINAL NUMBER

DESIGNATION

50	Battery voltage: Ignition Switch in position III
30	Battery voltage: supplied constantly
15	Battery voltage: Ignition Switch in position II or III
R	Battery voltage: Ignition Switch in positions I, II
31	Ground

See Introduction (i) for additional circuit diagram symbols.

DIAGNOSIS

- If the diagram is accompanied by text:
 - Read the Circuit Operation before proceeding with the electrical diagnosis.
 - Read the Troubleshooting Hints before performing the System Diagnosis.
 - Tests follow the System Diagnosis.
 - When performing the System Diagnosis, be certain that all components disconnected in previous steps are reconnected unless otherwise directed.



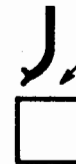
Component is disconnected.
Backprobe harness connector



Component is connected.
Backprobe harness connector



Component is disconnected.
Probe component



Component is disconnected.
Probe harness connector



Probe in-line connector