CIRCUIT OPERATION

The engine is controlled by the Engine Control Module ECM (Z132). The ECM is a microprocessor–controlled device that uses the following electrical components to control engine operation:

Fuel Injectors (K141)
Engine Coolant Temperature Sensor (X126)
Engine Fuel Temperature Sensor (X128)
Idle Air Control Valve (M112)
Left and Right Heated Oxygen Sensors (X139, X160)
Fuel Pump (M109)
Mass Air Flow Sensor (X105)
Throttle Position Sensor (X171)
Vehicle Speed Sensor Buffer (Z160)
A/C Thermostat Unit (Z102)
Ignition Control Module (Z139)
Canister Purge Valve (K132)
Park/Neutral Position Switch (X167)
Tune Select Resistor (K140)
Fuel Injection Fault Display Unit (Z133)

Fuel Injectors (K141)

With the engine running, the ECM applies ground to the Fuel Injection Load Relay (K116), energizing the relay and applying battery voltage to the Fuel Injectors (K141). The Fuel Injectors are connected to the ECU in groups of 4. The ECM grounds each group of Fuel Injectors alternately.

Engine Coolant Temperature Sensor (X126)

The Engine Coolant Temperature Sensor (X126) decreases its resistance as engine coolant temperature increases. The ECM applies a voltage signal to the Coolant Temperature Sensor. The ECM detects a small current when the engine coolant is at a low temperature; it detects a larger current with a high temperature.

Engine Fuel Temperature Sensor (X128)

The Engine Fuel Temperature Sensor (X128) decreases its resistance with an increase in temperature. The ECM applies a voltage signal to the Engine Fuel Temperature Sensor (X128). The ECM detects a small current when the fuel is at a low temperature; it detects a larger current with a high temperature.

Idle Air Control Valve (M112)

The ECU controls engine idle speed by adjusting the Idle Air Control Valve (M112) to compensate for increased electrical and mechanical loads. The ECM controls the control valve by sending voltage signals to a pair of motor control windings inside the control valve. This allows the ECM to reverse the voltage signals to the control valve, moving the bypass valve in or out to vary air flow to the plenum chamber.

Left and Right Heated Oxygen Sensors (X139, X160)

A heating element and an oxygen sensor are inside each Heated Oxygen Sensors (X139, X160). When the engine is running, battery voltage is applied to both Heated Oxygen Sensors via the Fuel Pump Relay. A small voltage is generated as exhaust gas passes the sensors. The ECM senses this voltage and adjusts fuel supply to the engine.

Fuel Pump (M109)

With the engine running, the ECM provides a ground for the Fuel Pump Relay (K119), which applies battery voltage to the Fuel Pump (M109) via the Inertia Fuel Shutoff Switch (X135). The Switch opens to turn off the Fuel Pump when the vehicle experiences a sudden impact.

Air Flow Sensor (X105)

With the Ignition Switch (X134) in position II, the ECM applies ground to the Fuel Injection Load Relay (K116), energizing the relay and applying battery voltage to the Mass Air Flow Sensor (X105). The ECM applies 5 volts to the Mass Air Flow Sensor terminal 6 and the sensor sends a voltage signal to the ECM terminal 35. The greater the volume of air passing through the Mass Air Flow Sensor, the greater the voltage signal to the ECM.

Throttle Position Sensor (X171)

With the Ignition Switch (X134) in position II, the ECM provides a ground via terminal 25 and supplies 5 volts to the Throttle Position Sensor (X171) terminal 3. When the throttle is moved, the position sensor sends a voltage signal to ECM terminal 20. This signal varies between less than 1 volt at closed throttle position to more than 4 volts at will open throttle.

Vehicle Speed Sensor Buffer (Z160)

The Vehicle Speed Sensor Buffer (Z160) sends signals to the ECM in the form of voltage pulses. The voltage varies between battery voltage and 0 volts 6 times per wheel revolution.

A/C Thermostat Unit (Z102)

When Compressor Clutch (K107) operation is requested, a voltage signal is sent to the ECM from the A/C Thermostat Unit (Z102) via the A/C High and Low Pressure Switches (X102, X103). The ECM uses this signal both to engage the Compressor Clutch and to compensate for the added load placed on the engine by the Compressor Clutch. If the refrigerant pressure is too high or too low, the High or Low Pressure Switch opens, interrupting the voltage signal from the Thermostat Unit to the ECM.

Canister Purge Valve (K132)

With the engine running, the ECM provides a ground for the Fuel Pump Relay (K119). The relay applies battery voltage to the Canister Purge Valve (K132). Ground is applied to operate the Cansiter Purge Valve by the ECM when the following conditions prevail: (1) Engine is running at speeds above 1700 rev/min and temperatures above 54°C (ECM will open the valve as necessary) or (2) Engine speed is below 1700 rev/min (ECM will pulse valve open for short periods).

Park/Neutral Position Switch (X167)

The Park/Neutral Position Switch (X167) applies ground to the ECM with the transmission in P or N.

Tune Select Resistor (K140) (Not Fitted To U.S.A. Vehicles)

The Tune Select Resistor (K140) receives a 5 volt signal from the ECM. The opposite terminal of the Tune Select Resistor (K140) is grounded at all times. The Tune Select Resistor (K140) causes the 5 volt signal read at the ECM terminal 5 to decrease. The ECM determines how the engine should perform based on the amount of voltage at terminal 5. This resistor is not present on USA vehicles.

Ignition Control Module (Z139)

The ignition system consists of the Ignition Control Module (Z139) and Distributor (Z125).

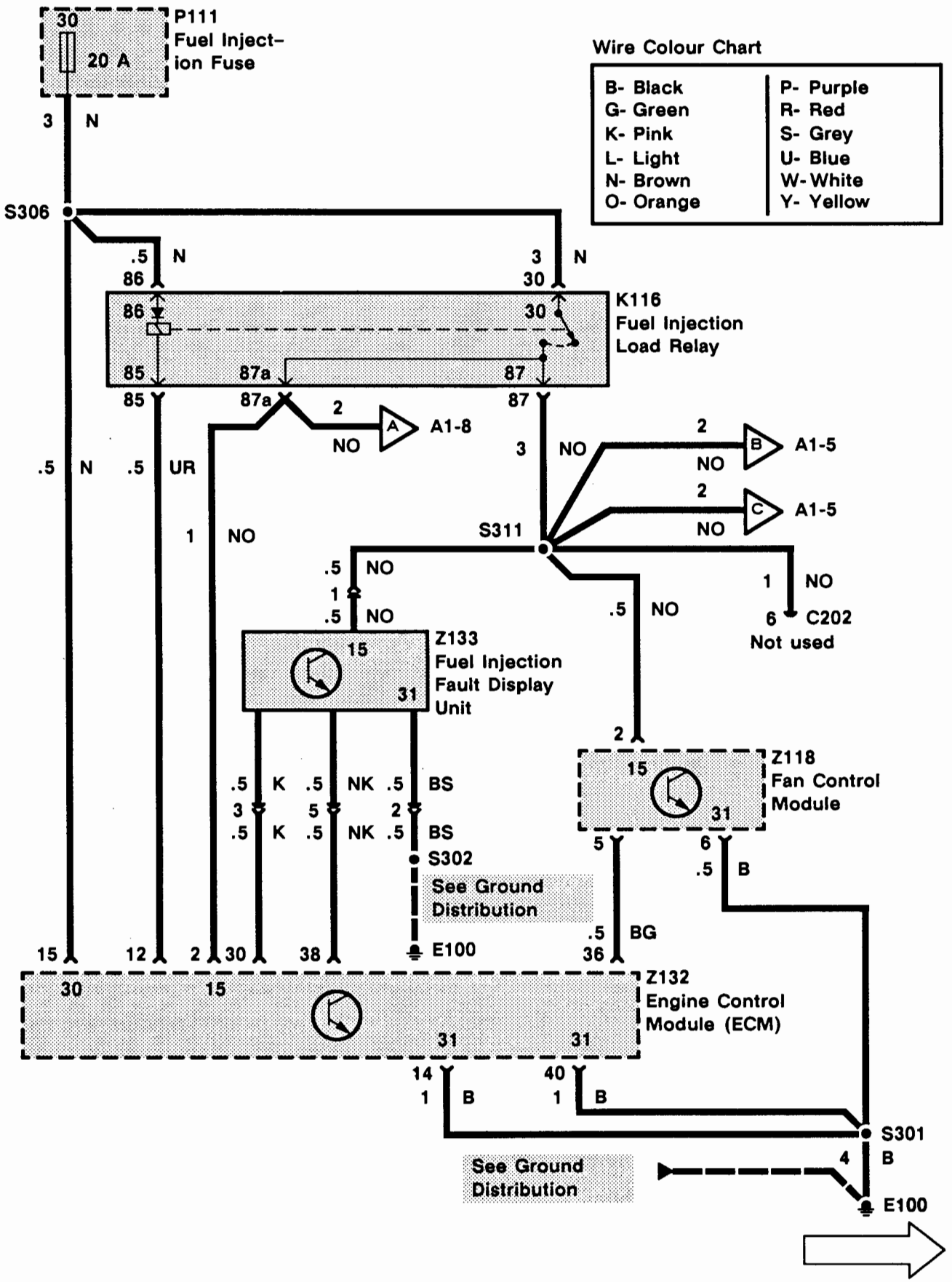
The ECM receives a pulsing ground signal from the Ignition Control Module via a 6.8K ohm resistor. The rate of these pulses corresponds to the engine speed.

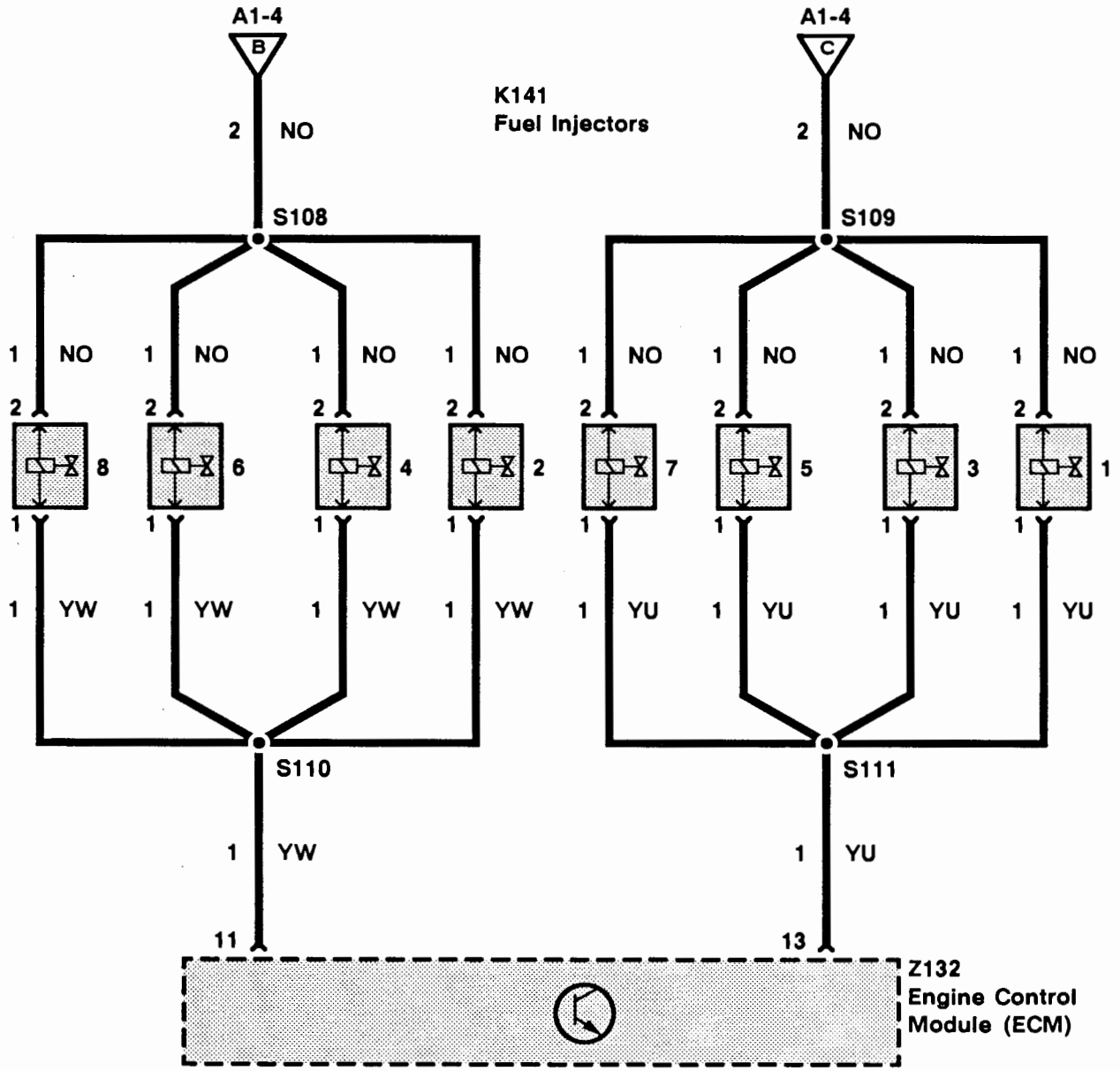
Fuel Injection Fault Display Unit (Z133) (USA Vehicles Only)

The Fuel Injection Fault Display Unit (Z133) receives battery voltage when the Ignition Switch (X134) is in position II. It is grounded at all times. Behind the dark exterior of this unit there is a 2-digit 7-segment digital display that is visible only when a diagnostic trouble code is set. The unit receives data from the ECM via the 2 wires that link them together.

A1 ETM

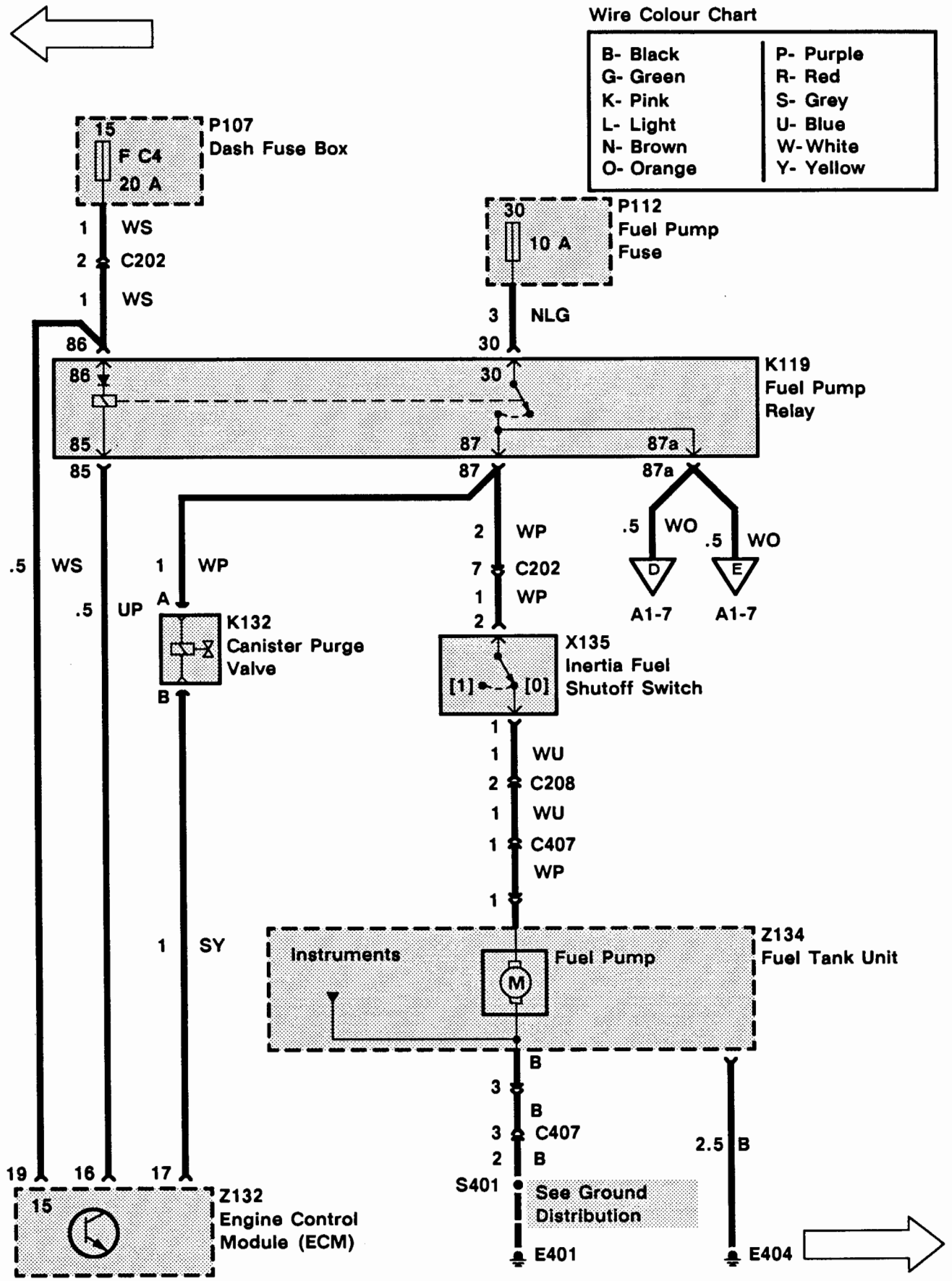
1993 RANGE ROVER

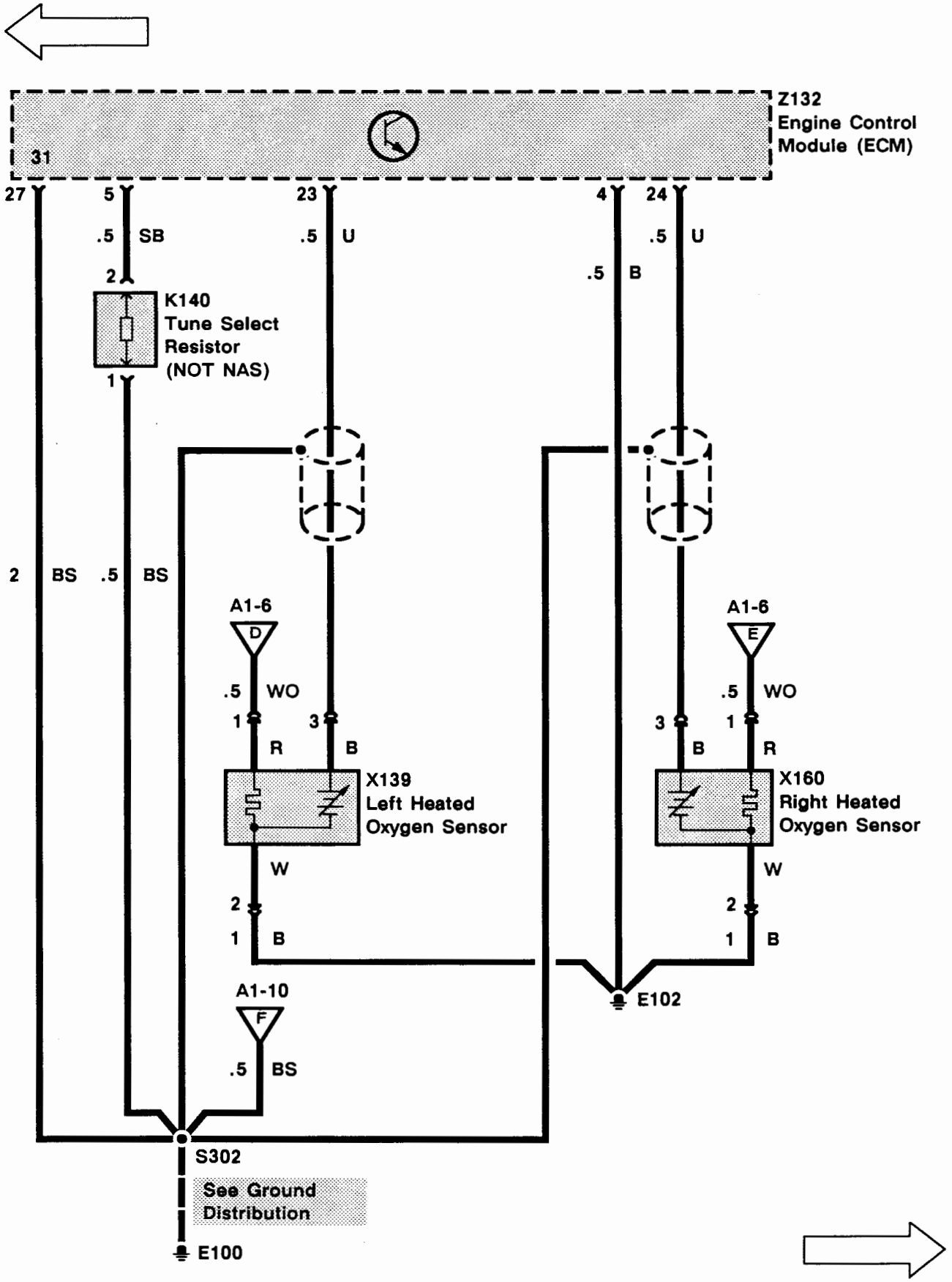



A1-4
B
2 NO
S108
A1-4
C
2 NO
S109
K141
Fuel Injectors
1 NO
2
8
1
1 YW
1 NO
2
6
1
1 YW
1 NO
2
4
1
1 YW
1 NO
2
2
1
1 YW
1 NO
2
7
1
1 YU
1 NO
2
5
1
1 YU
1 NO
2
3
1
1 YU
1 NO
2
1
1
1 YU
S110
S111
1 YW
1 YU
11
13
Z132
Engine Control
Module (ECM)

A1 ETM

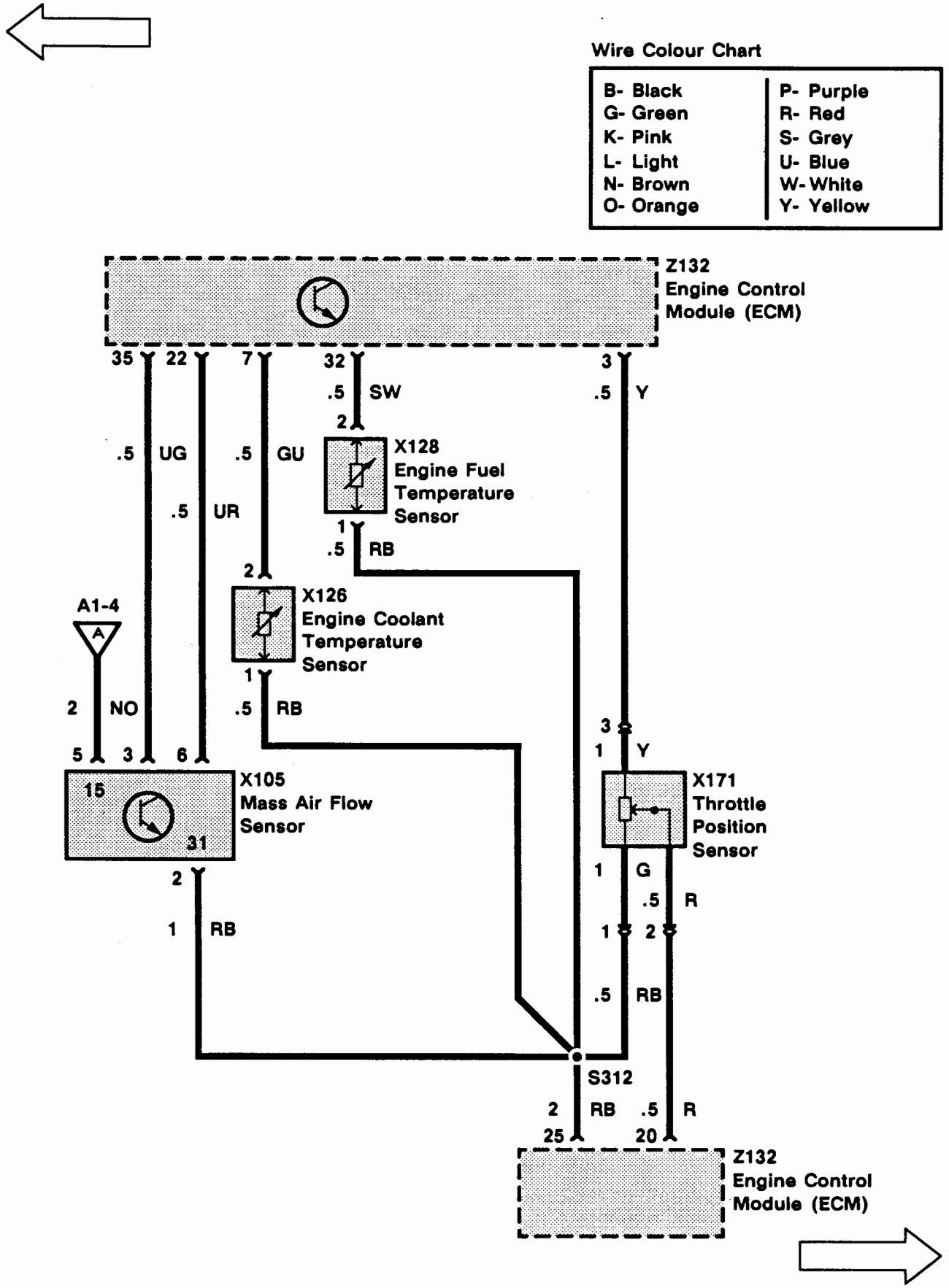
1993 RANGE ROVER

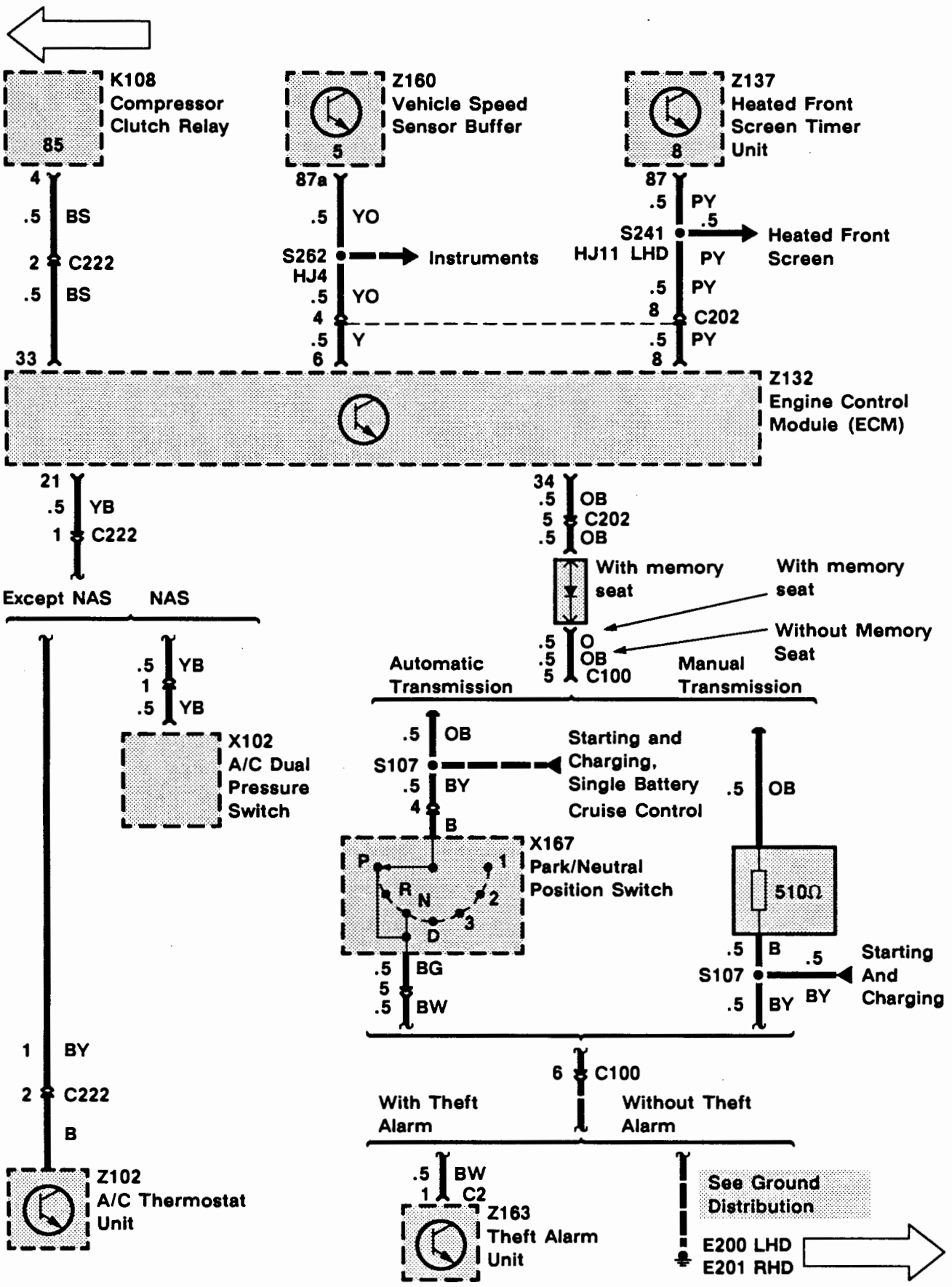



Z132
Engine Control
Module (ECM)
31
27
5
.5
SB
2
K140
Tune Select
Resistor
(NOT NAS)
1
23
.5
U
4
.5
B
24
.5
U
2
BS
.5
BS
A1-6
D
.5
WO
1
3
R
B
X139
Left Heated
Oxygen Sensor
W
2
1
B
A1-6
E
.5
WO
3
1
B
R
X160
Right Heated
Oxygen Sensor
W
2
1
B
A1-10
F
.5
BS
E102
S302
See Ground
Distribution
E100

A1 ETM

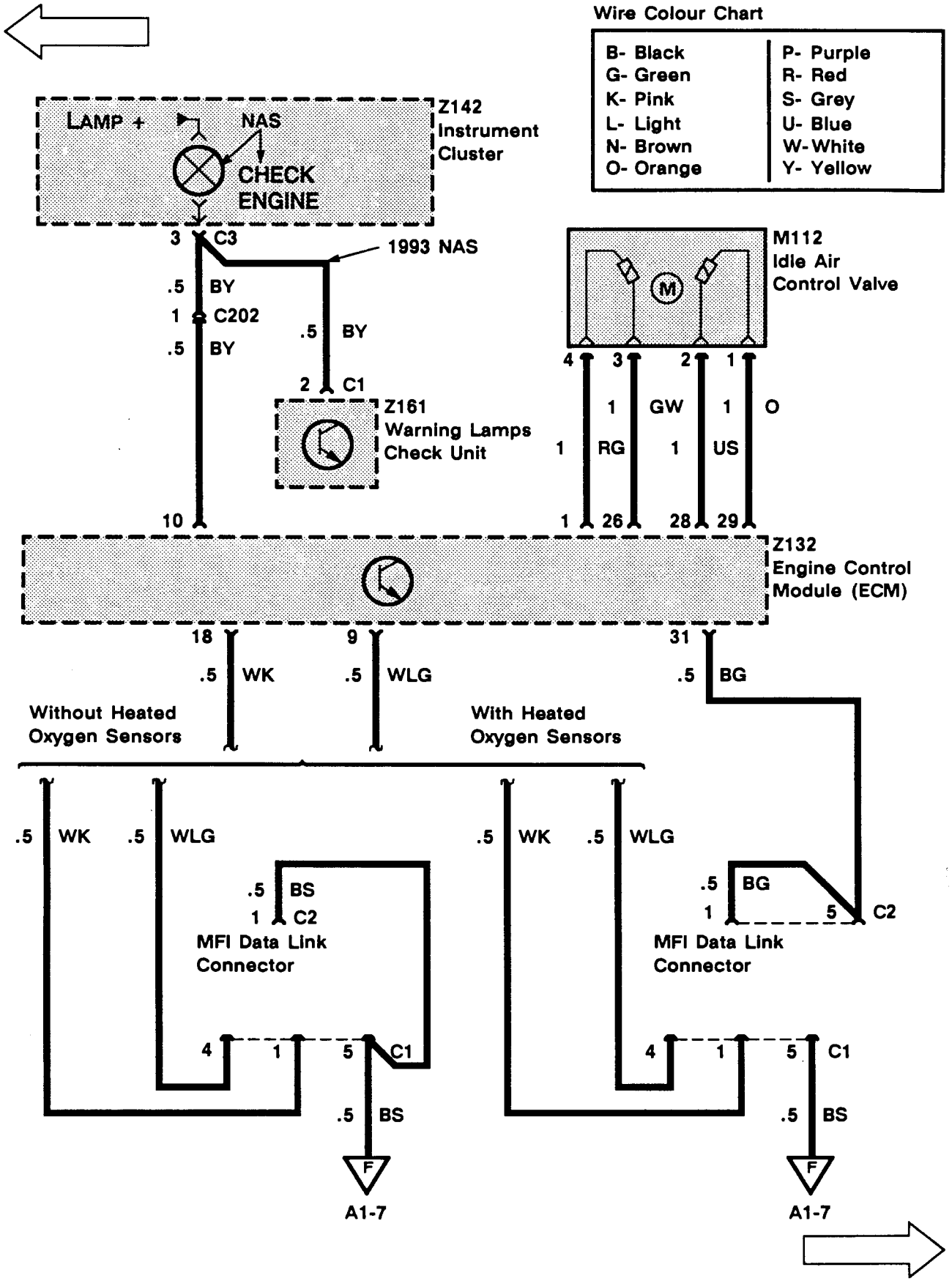
1993 RANGE ROVER

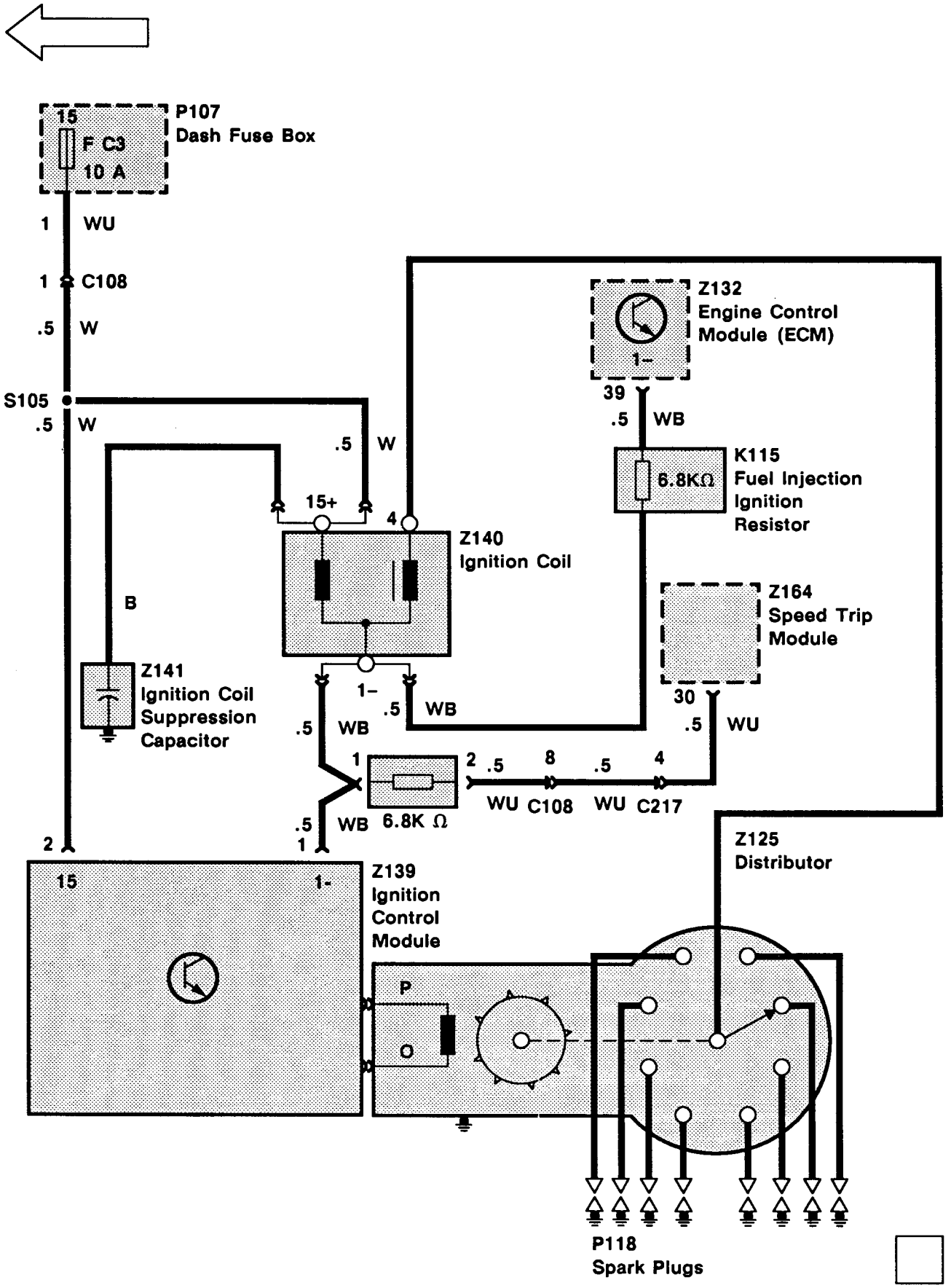



K108
Compressor
Clutch Relay
85
Z160
Vehicle Speed
Sensor Buffer
5
Z137
Heated Front
Screen Timer
Unit
8
4
.5 BS
2 C222
.5 BS
33
87a
.5 YO
S262
HJ4
Instruments
.5 YO
4
.5 Y
6
87
.5 PY
.5
S241
HJ11 LHD
Heated Front
Screen
PY
.5 PY
8 C202
.5 PY
8
Z132
Engine Control
Module (ECM)
21
.5 YB
1 C222
34
.5 OB
5 C202
.5 OB
With memory
seat
With memory
seat
Without Memory
Seat
.5 O
.5 OB
5 C100
Except NAS
NAS
Automatic
Transmission
Manual
Transmission
.5 YB
1
.5 YB
X102
A/C Dual
Pressure
Switch
.5 OB
S107
.5 BY
4
B
Starting and
Charging,
Single Battery
Cruise Control
X167
Park/Neutral
Position Switch
P
R
N
D
1
2
3
.5 OB
510Ω
.5 BG
5
.5 BW
.5 B
S107
.5 BY
.5
BY
Starting
And
Charging
1 BY
2 C222
B
6 C100
With Theft
Alarm
Without Theft
Alarm
Z102
A/C Thermostat
Unit
.5 BW
1 C2
Z163
Theft Alarm
Unit
See Ground
Distribution
E200 LHD
E201 RHD

A1 ETM

1993/1994 RANGE ROVER




15
F C3
10 A
P107
Dash Fuse Box
1 WU
1 C108
.5 W
S105
.5 W
.5 W
15+
4
Z140
Ignition Coil
Z132
Engine Control
Module (ECM)
1-
39
.5 WB
K115
6.8KΩ
Fuel Injection
Ignition
Resistor
Z164
Speed Trip
Module
30
.5 WU
B
Z141
Ignition Coil
Suppression
Capacitor
1-
.5 WB
.5 WB
1
2 .5 8 .5 4
WU C108 WU C217
.5 WB 6.8K Ω
2
1
15
1-
Z139
Ignition
Control
Module
Z125
Distributor
P
O
P118
Spark Plugs

TROUBLESHOOTING HINTS

ECM-MFI Circuit Diagnosis

Circuit fault diagnosis may be carried out on all multiport fuel injected (MFI) vehicles, using a multi-meter or the RTC 6834 handheld tester. The RTC 6834 displays the diagnostic trouble codes stored by the Engine Control Module and guides the technician through a series of diagnostic checks. Complete operational and diagnostic instructions are provided with the handheld tester's memory cards. See the Workshop Manual Section 19 service tools for details on the handheld tester and memory cards.

Whichever instrument is used to diagnose the fuel injection system problem, the following preliminary checks must be performed before proceeding with any diagnostic procedures.

CAUTION: CATALYST EXHAUST
If the engine is misfiring or fails to start within 12 seconds the cause must be rectified. Failure to do so will cause irrepairable damage to the catalysts. After rectification, the engine must be run at 1500 RPM with no load for three minutes to purge any accumulation of fuel in the system.

MFI Preliminary Checks

1. Check that the inertia fuel shutoff switch is not tripped.
2. Check Fuse C4 in the main fuse panel and fuel pump fuse (P111) under the driver's seat.
3. Check for ample fuel in the tank.
4. Check the air inlet system for any leaks or blockages.
5. Check the high tension spark plug wires for correct firing order, routing and visual damage.
6. Check ignition timing.

Only after the above checks have been carried out, should MFI circuit diagnosis using a multi-meter or handheld tester begin.

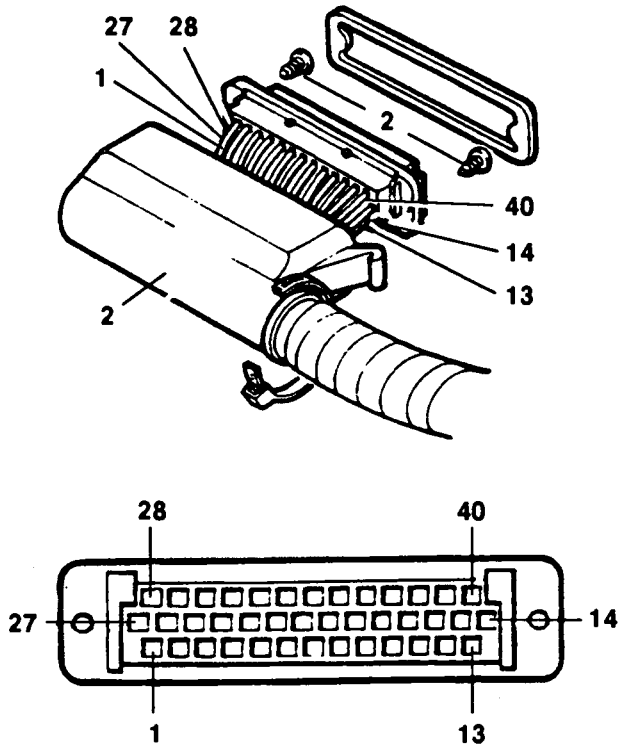
Multi-meter Checks

To carry out tests when 40 way multi-plug is connected to the ECM, it is necessary to remove the two screws securing the shroud to the plug to enable the multi-meter probes to be inserted into the back of the appropriate pin.

CAUTION: Tests requiring plug to be removed from ECM, must have meter probes inserted into back of plug. If probes are inserted into plug sockets, damage will occur to sockets resulting in poor connections when plug is reconnected.

Testing

1. Release harness plug from ECM Access is gained by removing front seat base trim of front right hand seat.
2. Remove plug shroud and manoeuvre it along harness to enable meter probes to be inserted into back of plug.
3. Only pin numbers 1, 13, 14, 27, 28 and 40 are moulded onto rear of plug.



RR2800M

View of plug - cover removed.
Pins 1 to 13 bottom row.
Pins 14 to 27 centre row.
Pins 28 to 40 top row.
For clarity, electrical leads omitted.

Reading Diagnostic Trouble Codes (USA only)

The ECM is capable of storing diagnostic trouble codes. For U.S. vehicles, these diagnostic trouble codes may be read by switching the Ignition Switch (X134) to position II and observing the Fuel Injection Fault Display Unit (Z133). If no codes are present, the display will appear blank. A lit service engine warning light indicates that a fault is present. For non-U.S. vehicles (not equipped with a Fuel Injection Fault Display), the Lucas diagnostic equipment, part number 60600965, is recommended for reading diagnostic trouble codes.

Clearing Diagnostic Trouble Codes (USA only)

When a fault has been corrected, the fault code must be cleared. This is done by performing the following procedure:

1. Put the Ignition Switch (X134) in position II.
2. Disconnect the MFI Data LInk Connectors (X127) and wait 5 seconds. Reconnect MFI Data Link Connectors.
3. Put the Ignition Switch (X134) in position 0 and wait till the load relay drops out.
4. Put the Ignition Switch (X134) in position II. The display will be blank if no other faults exist. If other codes exist, the next diagnostic trouble code will be displayed.
5. If multiple faults exist, repeat steps 1 through 4 until all faults are cleared.

Code 02 indicates that the ECM has just been reconnected. Switch the Ignition Switch (X134) to position II to clear code 02.

SYSTEM DIAGNOSIS (USA only)

1. If the engine cranks but does not start and the "check engine" warning light does not light with the Ignition Switch (X134) in position II, do Test B.
2. If the engine cranks but does not start and the "check engine" warning light does light with Ignition Switch (X134) in position II, do Test C.
3. If the engine starts but the "check engine" warning light does not light momentarily, check the bulb and BY wire.

SYSTEM DIAGNOSIS (Except USA)

1. If the handheld tester cannot communicate with the Engine Control Module (Z132) and the engine cranks but does not start do the following:
   (A) Check the handheld testers connections
   (B) Check that the memory card is correct and inserted properly
   (C) Check the handheld tester's batteries
   (D) If all of the above checks are OK, go to Test B.
2. If the engine cranks but does not start and no diagnostic trouble codes are set but the handheld testor can communicate with the Engine Control Module (Z132), go to Test C.

Multi-meter Code Diagnosis

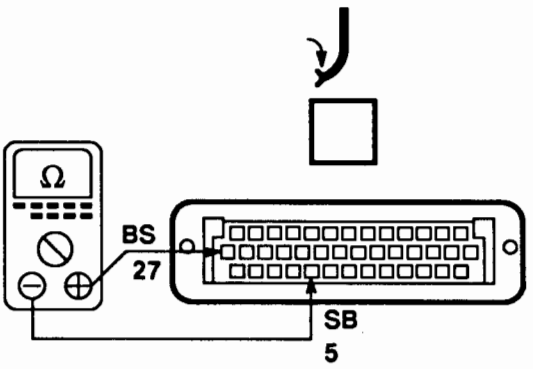
1. Code 12 indicates a Mass Air Flow Sensor (X105) fault. Do Test D.
2. Code 14 indicates an Engine Coolant Temperature Sensor (X126) fault. Do Test E.
3. Code 15 indicates an Engine Fuel Temperature Sensor (X128) fault. Do Test F.
4. Code 17 indicates a Throttle Position Sensor (X171) fault. Do Test G.
5. Code 18 indicates a high Throttle Position Sensor (X171) output versus a low Mass Air Flow Sensor (X105) output. Do Test H.
6. Code 19 indicates a low Throttle Position Sensor (X171) output versus a high Mass Air Flow Sensor (X105) output. Do Test H.
7. Code 21 indicates a Tune Select Resistor (K140) fault. Do Test A.
8. Code 23 indicates a fuel supply fault. Go to Workshop Manual Section 19 for fuel regulation tests.
9. Code 28 indicates an engine air leak. Go to Workshop Manual Section 19.
10. Code 29 indicates an ECM memory fault. Do Test I.
    NOTE: If code 29 is present, all other diagnostic trouble codes stored are unreliable and must be ignored.
11. Code 34 indicates a left bank injector fault. Do Test J.
12. Code 36 indicates a right bank injector fault. Do Test J.
13. Code 40 indicates a left bank misfire. Go to Workshop Manual Section 19.
14. Code 44 Indicates a left bank Heated Oxygen Sensor (X139, X160) fault. Do Test K.
15. Code 45 Indicates a right bank Heated Oxygen Sensor (X139, X160) fault. Do Test K.
16. Code 48 indicates an Idle Air Control Valve (M112) fault. Check engine base idle speed. If OK, do Test M.
17. Code 50 indicates a right bank misfire. Go to Workshop Manual Section 19.
18. Code 59 indicates a combination of codes 23 and 28. Go to Workshop Manual Section 19.
19. Code 68 indicates a speed signal input fault. Do Test N.
    NOTE: If speedometer does not operate, go to Instruments (Section E1).
20. Code 69 indicates a Park/Neutral Position Switch (X167) fault. Do Test O.
21. Code 88 indicates a Canister Purge Valve (K132) leak. Do Test P.

Test A

1A **code 21**

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
3700 - 4100 Ω (Euro, catalyst)
446 - 494 Ω (Euro, non-catalyst)
171 - 189 Ω (Australia)
864 - 956 Ω (Saudi)



Z132
Engine Control Module (ECM)

OK **PROBLEM CAUSE**
- **SB Wire**
- **BS Wire**
- **Tune Select Resistor**

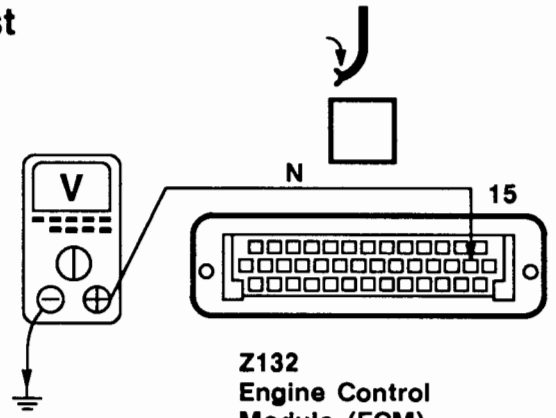
OK **PROBLEM CAUSE**
- **Connector**
- **Engine Control Module (ECM)**

Test B

1B **ECU Power and Ground Test**

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
BAT VOLT



Z132
Engine Control Module (ECM)

OK **PROBLEM CAUSE**
- **N Wire**
- **Fuel Injection Fuse**

OK

2B

A1 ETM

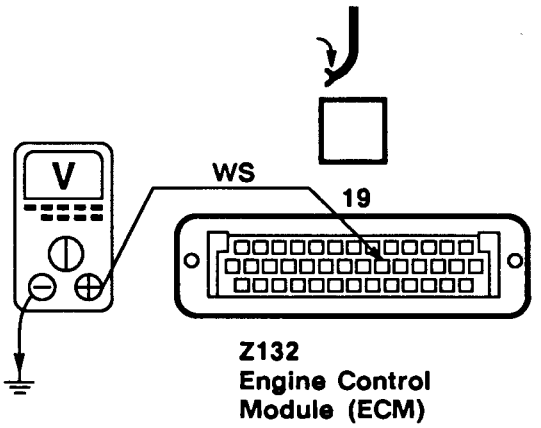
1993 RANGE ROVER

1B

2B

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



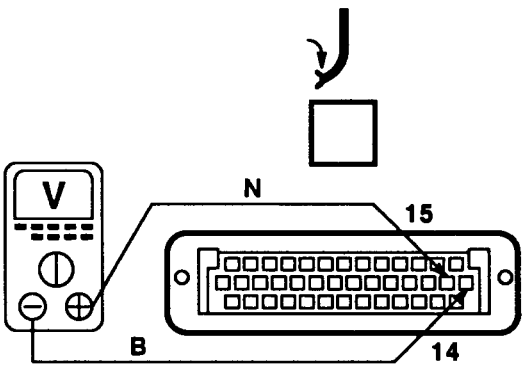
OK — **PROBLEM CAUSE**
- **WS Wire**
- **C4 Fuse**

OK → 3B

3B

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
BAT VOLT



OK — **PROBLEM CAUSE**
- **B Wire**

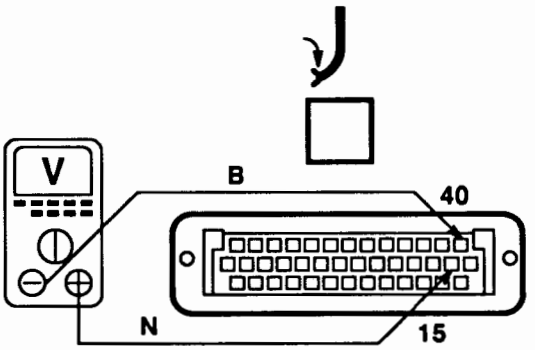
OK → 4B

3B

4B

CONDITIONS
- Ignition Switch
  Position: 0

RESULTS
BAT VOLT



Z132
Engine Control
Module (ECM)

OK — PROBLEM CAUSE
- B Wire

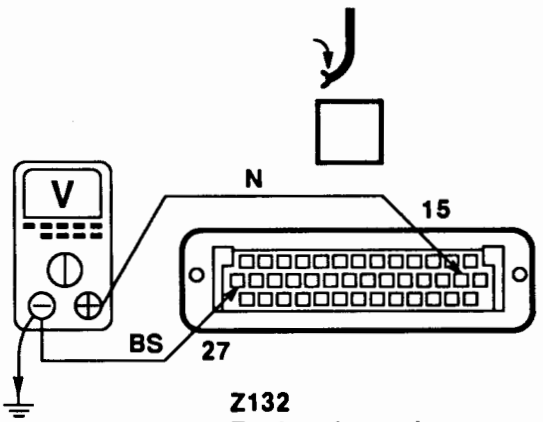
OK

5B

5B

CONDITIONS
- Ignition Switch
  Position: 0

RESULTS
BAT VOLT



Z132
Engine Control
Module (ECM)

OK — PROBLEM CAUSE
- BS Wire

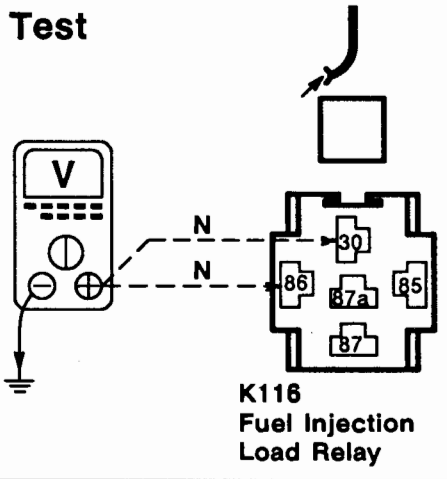
OK — PROBLEM CAUSE
- Engine Control Module (ECM)

Test C

1C No Diagnostic Trouble Code Test

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
BAT VOLT



K116
Fuel Injection
Load Relay

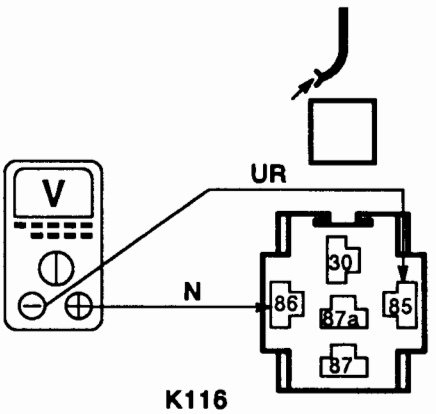
OK **PROBLEM CAUSE**
- **N Wire**

OK → 2C

2C

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



K116
Fuel Injection
Load Relay

OK **PROBLEM CAUSE**
- **UR Wire**
- **Engine Control Module (ECM)**

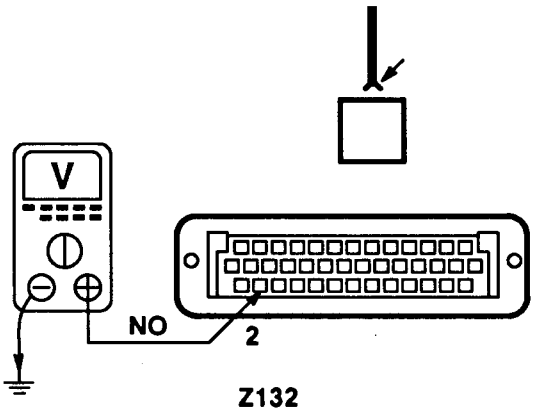
OK → 3C

2C

3C

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



Z132
Engine Control
Module (ECM)

OK **PROBLEM CAUSE**
- NO Wire
- Fuel Injection Load Relay

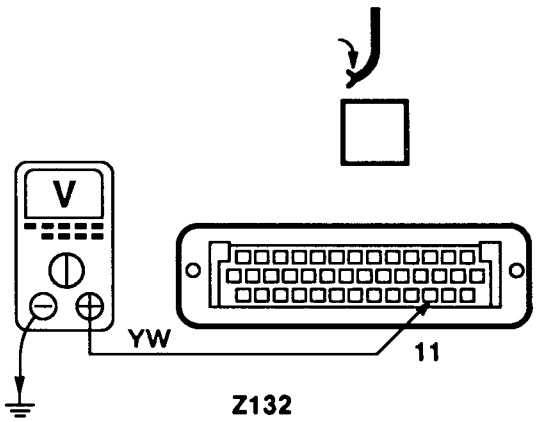
OK

4C

4C

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



Z132
Engine Control
Module (ECM)

OK **PROBLEM CAUSE**
- NO Wire
- YW Wire

OK

5C

A1 ETM

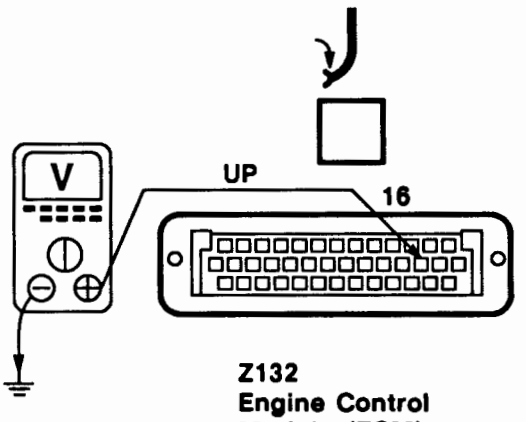
1993 RANGE ROVER

4C

5C

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



Z132
Engine Control Module (ECM)

OK

PROBLEM CAUSE
- **C4 Fuse**
- **UP Wire**
- **Fuel Pump Relay**

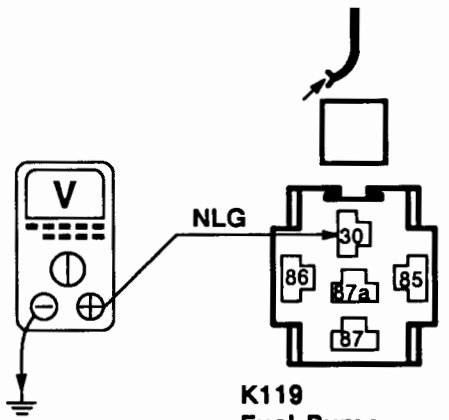
OK

6C

6C

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
BAT VOLT



K119
Fuel Pump Relay

OK

PROBLEM CAUSE
- **NLG Wire**
- **Fuel Pump Fuse**

OK

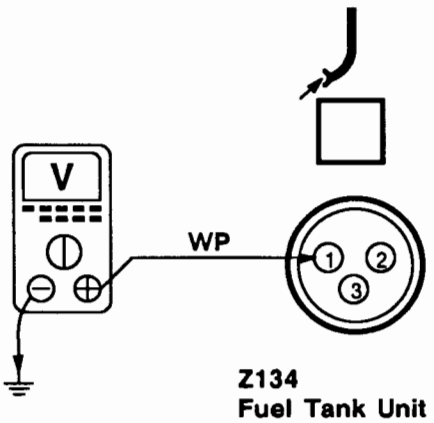
7C

6C

7C

CONDITIONS
- **Ignition Switch**
  Position: III

RESULTS
BAT VOLT



Z134
Fuel Tank Unit

OK **PROBLEM CAUSE**
- WP Wire
- WU Wire
- Inertia Fuel Shutoff Switch
- Fuel Pump Relay

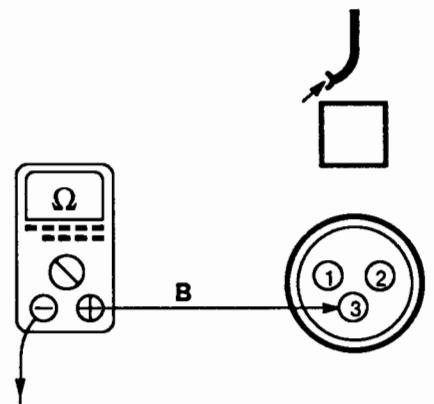
OK

8C

8C

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
Less than 2 ohms



Z134
Fuel Tank Unit

OK **PROBLEM CAUSE**
- B Wire

OK

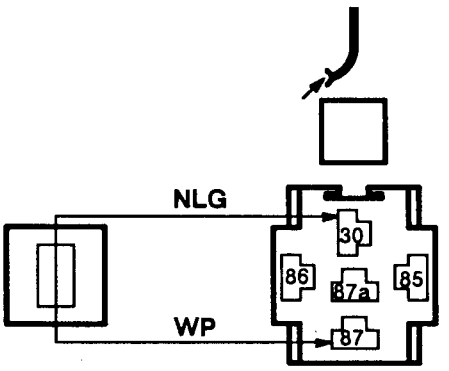
9C

8C

9C

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
- **Fuel Pump**
  Operates



K119
Fuel Pump
Relay

OK **PROBLEM CAUSE**
- **Fuel Pump**

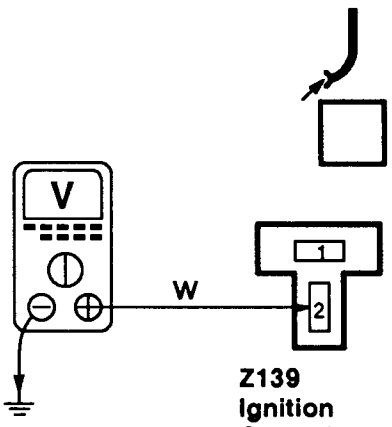
OK

10C

10C

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



Z139
Ignition
Control
Module

OK **PROBLEM CAUSE**
- **F C3 Fuse**
- **W Wire**
- **WU Wire**

OK

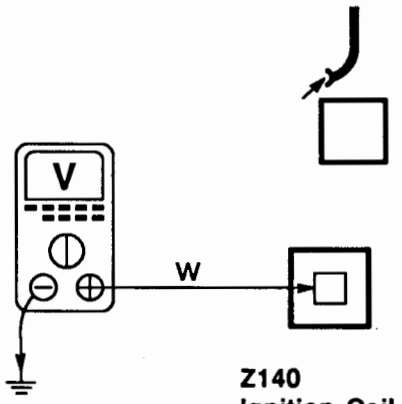
11C

10C

11C

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



OK **PROBLEM CAUSE**
- **W Wire**

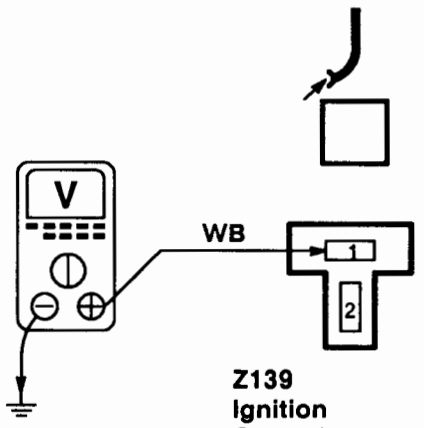
OK

12C

12C

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



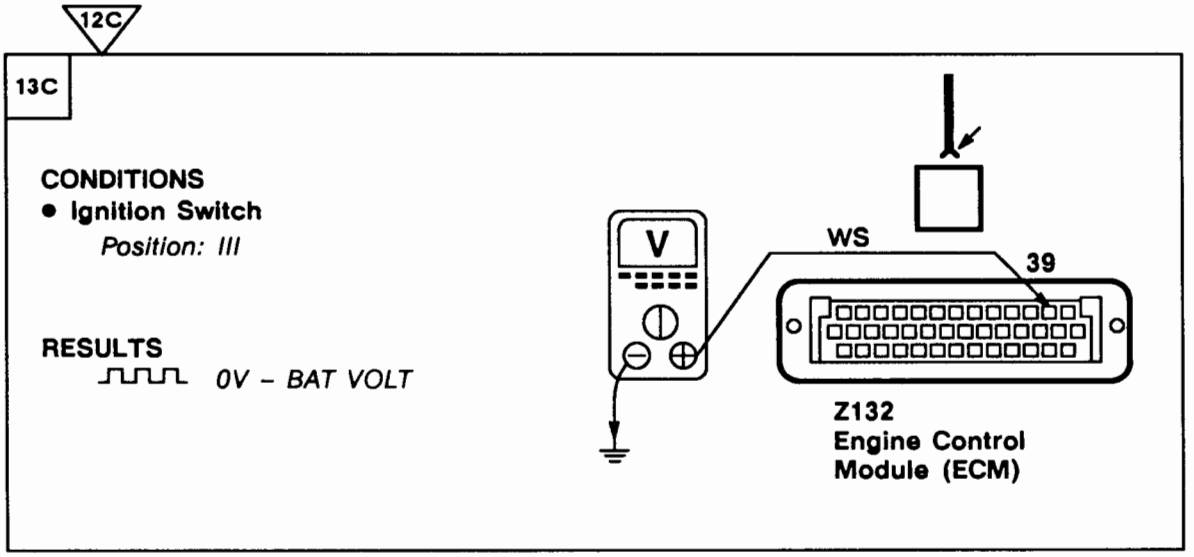
OK **PROBLEM CAUSE**
- **WB Wire**
- **Ignition Coil**

OK

13C

A1 ETM

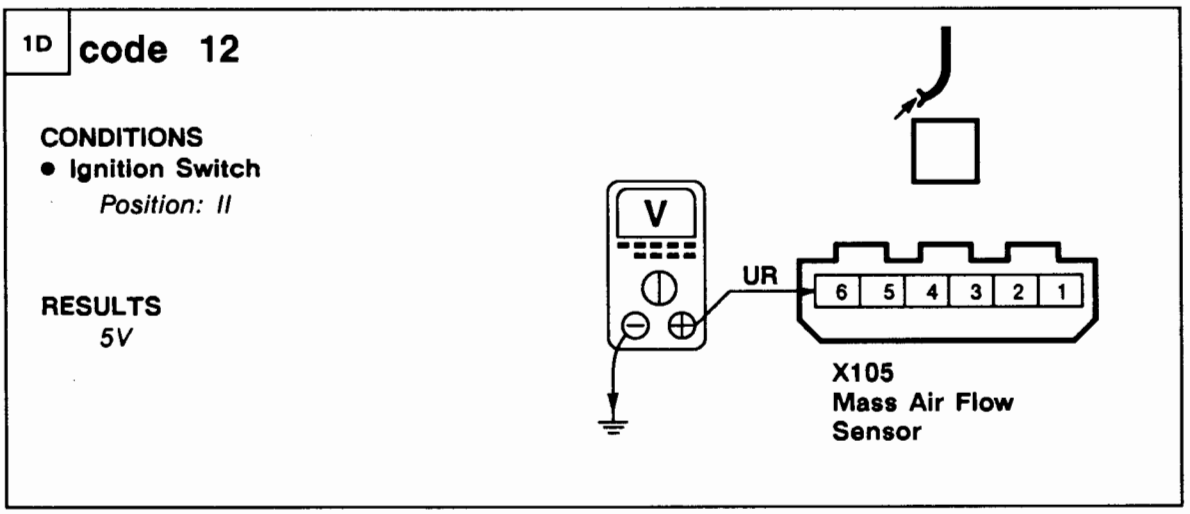
1993 RANGE ROVER



OK **PROBLEM CAUSE**
- WB Wire
- Distributor
- Fuel Injection Ignition Resistor
- Ignition Control Module

OK **PROBLEM CAUSE**
- Engine Control Module (ECM)

Test D



OK **PROBLEM CAUSE**
- UR Wire
- Engine Control Module (ECM)

OK

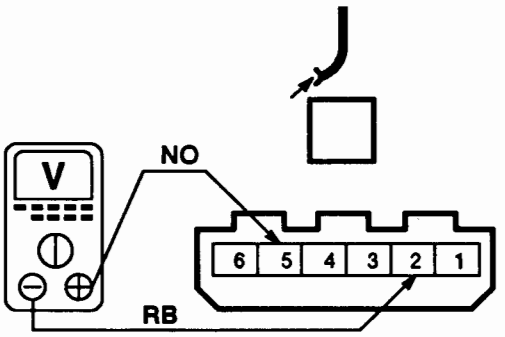
2D

1D

2D

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



X105
Mass Air Flow Sensor

OK **PROBLEM CAUSE**
- **NO Wire**
- **RB Wire**

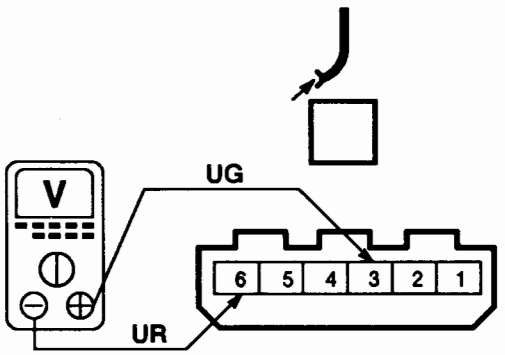
OK

3D

3D

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
More than 4V



X105
Mass Air Flow Sensor

OK **PROBLEM CAUSE**
- **UG Wire**
- **Engine Control Module (ECM)**

OK

4D

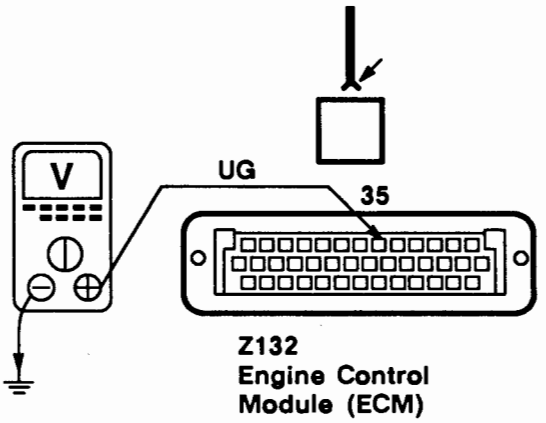
A1 ETM

3D

4D

CONDITIONS
- **Ignition Switch**
  Position: II
- **Engine**
  ON

RESULTS
1.4V – 1.8V



OK **PROBLEM CAUSE**
- **Mass Air Flow Sensor**

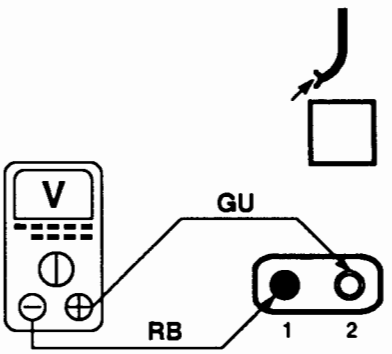
OK **PROBLEM CAUSE**
- **Engine Control Module (ECM)**

Test E

1E **code 14**

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
5V



OK **PROBLEM CAUSE**
- **GU Wire**
- **RB Wire**
- **Engine Control Module (ECM)**

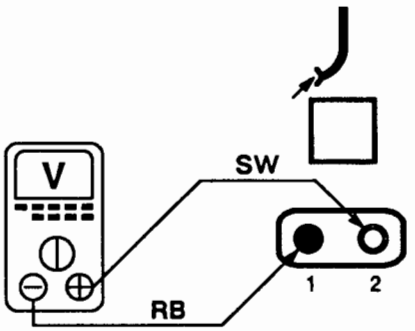
OK **PROBLEM CAUSE**
- **Engine Coolant Temperature Sensor**

Test F

1F **code 15**

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
5V



X128
Engine Fuel Temperature Sensor

OK **PROBLEM CAUSE**
- SW Wire
- RB Wire
- Engine Control Module (ECM)

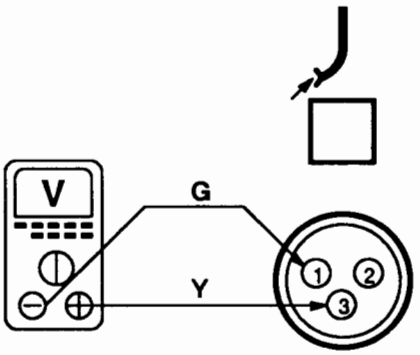
OK **PROBLEM CAUSE**
- Engine Fuel Temperature Sensor

Test G

1G **code 17**

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
5V



X171
Throttle Position Sensor

OK **PROBLEM CAUSE**
- RB Wire
- Y Wire
- Engine Control Module (ECM)

OK

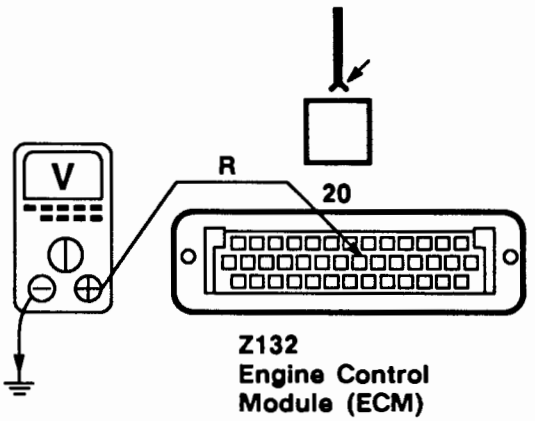
2G

1G

2G

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
- **Closed throttle position**
  .085V – .545V
- **Wide open throttle**
  4.2V – 4.9V



OK **PROBLEM CAUSE**
- R Wire
- Throttle Position Sensor

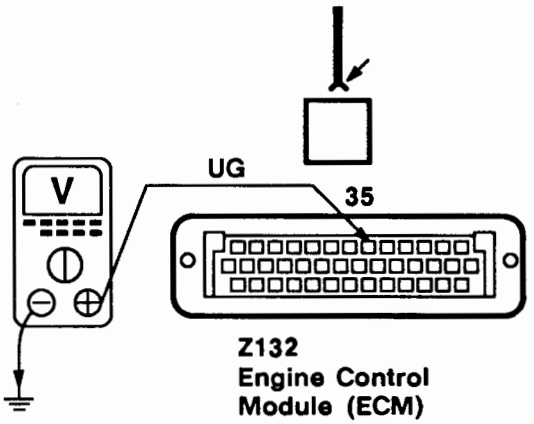
OK **PROBLEM CAUSE**
- Engine Control Module (ECM)

Test H

1H **code 18**

CONDITIONS
- **Ignition Switch**
  Position: II
- **Engine**
  ON (1.4V – 1.8V)

RESULTS
RPM
1000 = 1.9V
2000 = 2.1V
3000 = 2.5V
4000 = 3.0V



OK **PROBLEM CAUSE**
- Air filter
- Engine air leak
- Mass Air Flow Sensor

OK

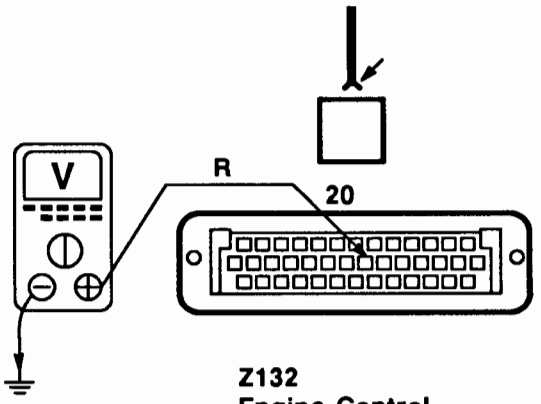
2H

1H

2H

CONDITIONS
- Ignition Switch
  Position: II

RESULTS
- Closed throttle position
  0.85V – 5.45V
- Wide open throttle
  4.2V – 4.9V



Z132
Engine Control
Module (ECM)

OK PROBLEM CAUSE
- Throttle Position Sensor

OK GO TO WORKSHOP MANUAL SECTION 19 FAULT DIAGNOSIS FOR THROTTLE POTENTIOMETER TESTS

Test I

11 **code 19**

CONDITIONS
1. Ignition Switch
   Position: 0
2. Wait 5 seconds
3. Disconnect and then reconnect Engine Control Module (Z132)
4. Ignition Switch
   Position: II

RESULTS
Code 29 is not displayed

OK PROBLEM CAUSE
- Engine Control Module (ECM)

OK PROBLEM CAUSE
- Electrical noise

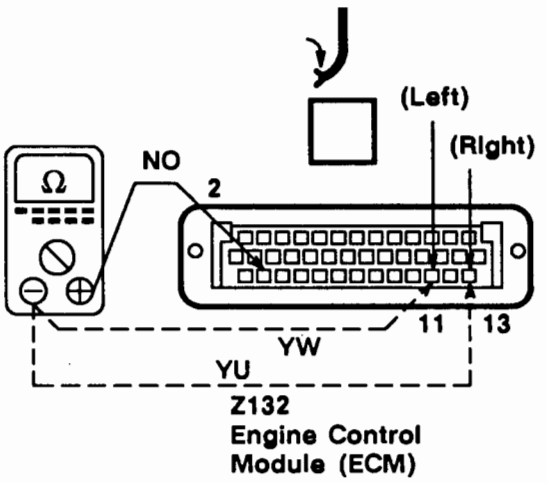
A1 ETM

Test J

1J **code 34 & 36**

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
4 – 4.5 Ω



OK **PROBLEM CAUSE**
8 Ω = 1 open injector
12 Ω = 2 open injectors
16 Ω = 2 open injectors

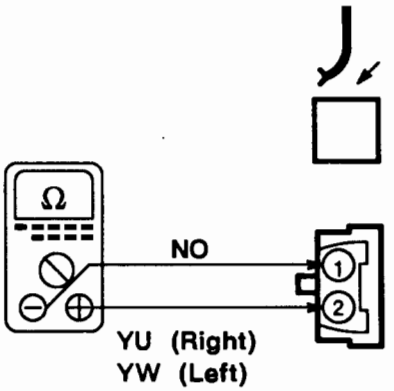
OK **GO TO WORKSHOP MANUAL SECTION 19 FOR FUEL REGULATOR TESTS**

2J

2J

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
16 Ω



OK **PROBLEM CAUSE**
- Fuel Injector

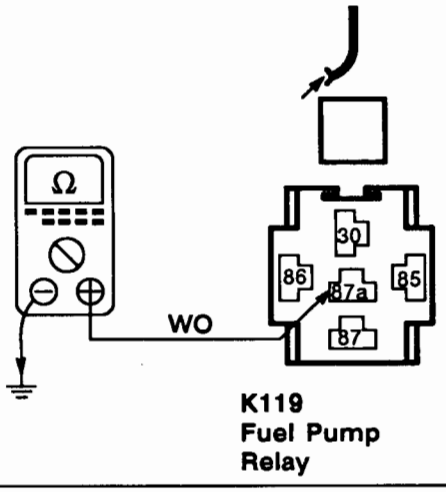
OK **PROBLEM CAUSE**
- NO Wire
- YU/YW Wire

Test K

1K **code 44 & 45**

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
2.5 - 6.0 Ω



OK GO TO TEST L

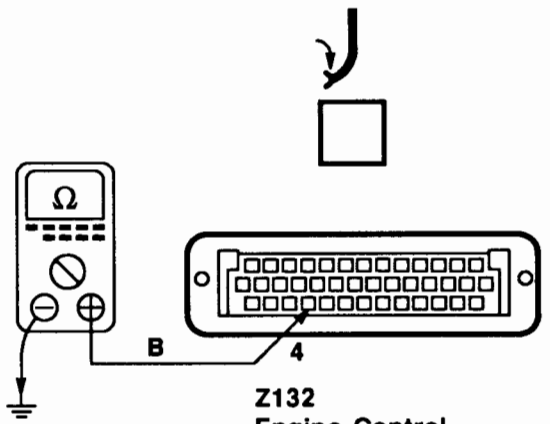
OK

2K

2K

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
Less than 2 ohms



OK PROBLEM CAUSE
- **B Wire**

OK

3K

A1 ETM

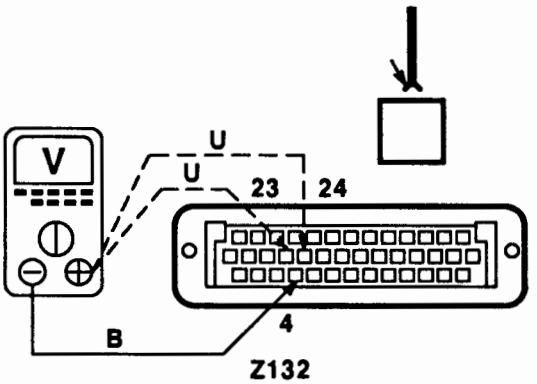
2K

3K

CONDITIONS
- **Ignition Switch**
  Position: II
- **Engine at normal operating temperature**

RESULTS
RPM

1000 = ⎍⎍⎍ 0.5V - 1.0V



Z132
Engine Control Module (ECM)

OK **PROBLEM CAUSE**
- U Wire
- X139, X160 Heated Oxygen Sensor

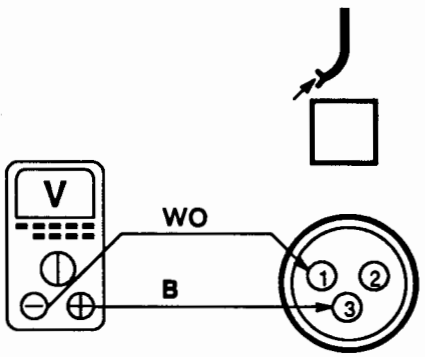
OK **PROBLEM CAUSE**
- Connector
- Engine Control Module (ECM)

Test L

1L **Oxygen Sensor Test**

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



X139, X160
Heated Oxygen Sensor

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

OK

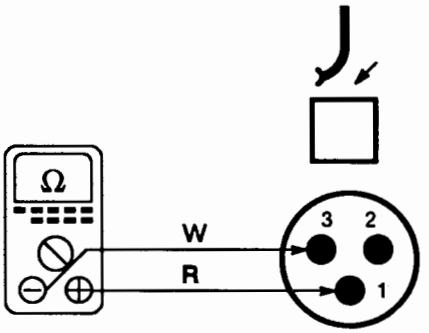
2L

1L

2L

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
5 – 12.5 Ω



X139, X160
Heated Oxygen
Sensor

OK **PROBLEM CAUSE**
- **X139, X160 Heated Oxygen Sensor**

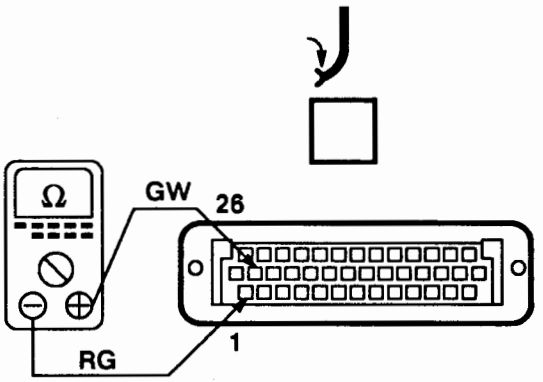
OK **PROBLEM CAUSE**
- **WO Wire**
- **B Wire**

Test M

1M **code 48**

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
40 – 60 Ω



Z132
Engine Control
Module (ECM)

OK **PROBLEM CAUSE**
- **RG Wire**
- **GW Wire**
- **Idle Air Control Valve**

OK

2M

A1 ETM

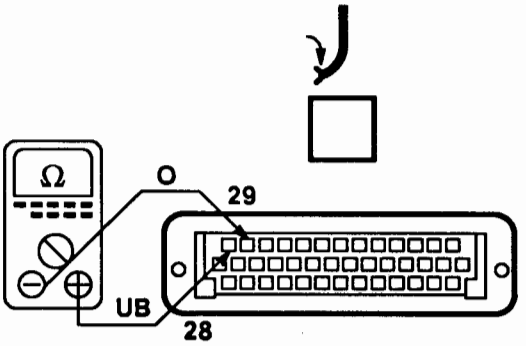
1993 RANGE ROVER

1M

2M

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
40 – 60 Ω



Z132
Engine Control
Module (ECM)

OK **PROBLEM CAUSE**
- O Wire
- UB Wire
- Idle Air Control Valve

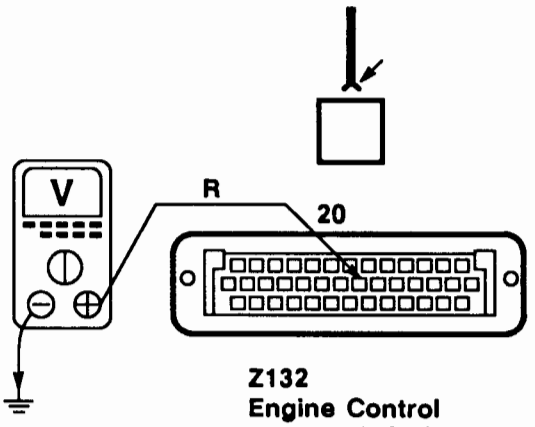
OK

3M

3M

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
- **Closed throttle position**
  .085V – 0.545V
- **Wide open throttle**
  4.2V – 4.9V



Z132
Engine Control
Module (ECM)

OK **PROBLEM CAUSE**
- R Wire
- RB Wire
- Y Wire
- Throttle Position Sensor

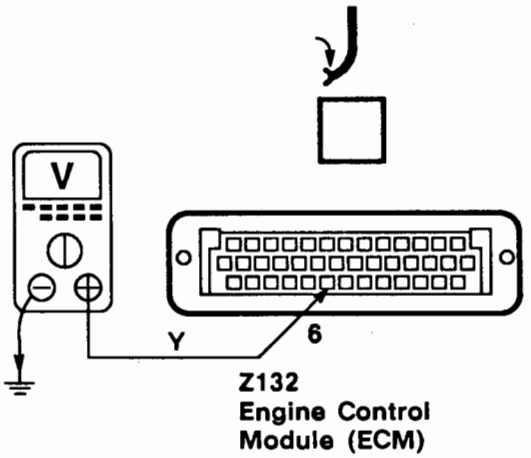
OK **GO TO TEST N**

Test N

1N **code 68**

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
- **Right rear wheel on ground**
- **Rotate left rear wheel**
  0V – BAT VOLT



OK **PROBLEM CAUSE**
- Y Wire
- YO Wire
- Vehicle Speed Sensor Buffer

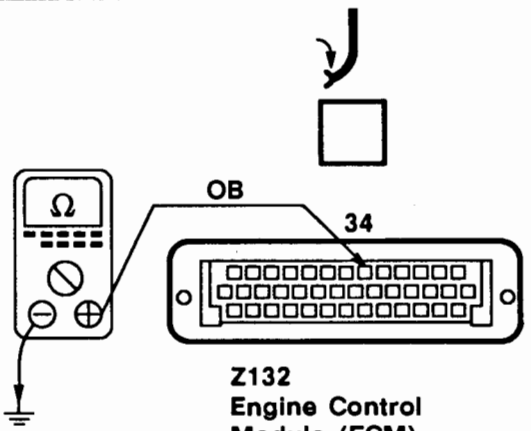
OK **PROBLEM CAUSE**
- Connector
- Engine Control Module (ECM)

Test O

1O **code 69**

CONDITIONS
- **Ignition Switch**
  Position: 0

RESULTS
- **Park/Neutral Position Switch**
  P, N = Less than 2 ohms
  R, D, 3, 2, 1 = More than 10K ohms



OK **PROBLEM CAUSE**
- OB Wire
- B Wire
- Park/Neutral Position Switch
- Theft Alarm Unit

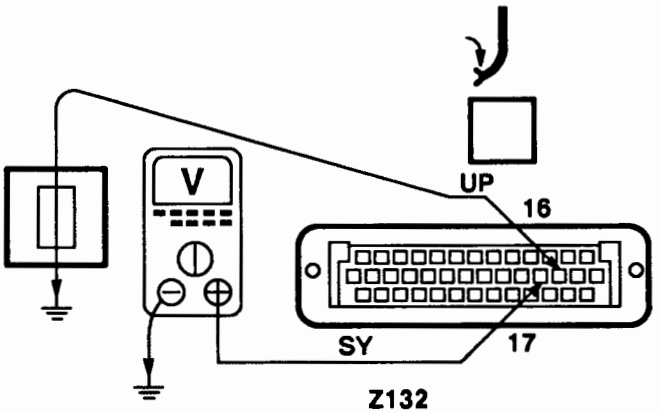
OK **PROBLEM CAUSE**
- Connector
- Engine Control Module (ECM)

Test P

1P **code 88**

CONDITIONS
- **Ignition Switch**
  Position: II

RESULTS
BAT VOLT



Z132
Engine Control Module (ECM)

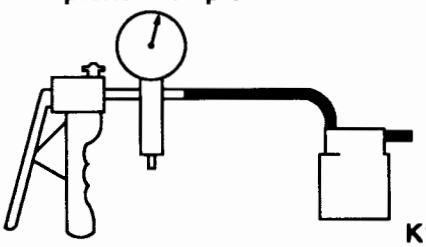
OK **PROBLEM CAUSE**
- **UP Wire**
- **SY Wire**
- **Canister Purge Valve**

OK → 2P

2P

CONDITIONS
1. **Disconnect pipe from purge valve to plenum at plenum**
2. **Connect vacuum pump to pipe**
3. **Apply vacuum of 2.5 In/Hg**

RESULTS
Vacuum holds for 2.5 minutes



Vacuum pump

K132
Canister Purge Valve

OK **PROBLEM CAUSE**
- **Vacuum pipe**
- **Canister Purge Valve**

OK → 3P

2P

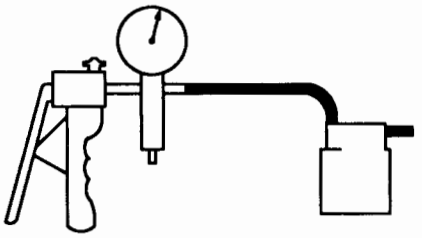
3P

CONDITIONS

- **Ignition Switch**
  Position: 0
- **Vacuum pump connected from previous step**
- **Vacuum pump holding 2.5 In/Hg**
- **Ignition Switch**
  Position: II

RESULTS

Vacuum drops to 0 in/Hg



Vacuum pump

K132 Canister Purge Valve

OK

PROBLEM CAUSE

- **Canister Purge Valve**
- **Engine Control Module (ECM)**

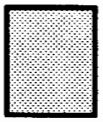
OK

System OK

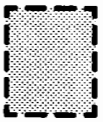
KEY INFORMATION

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

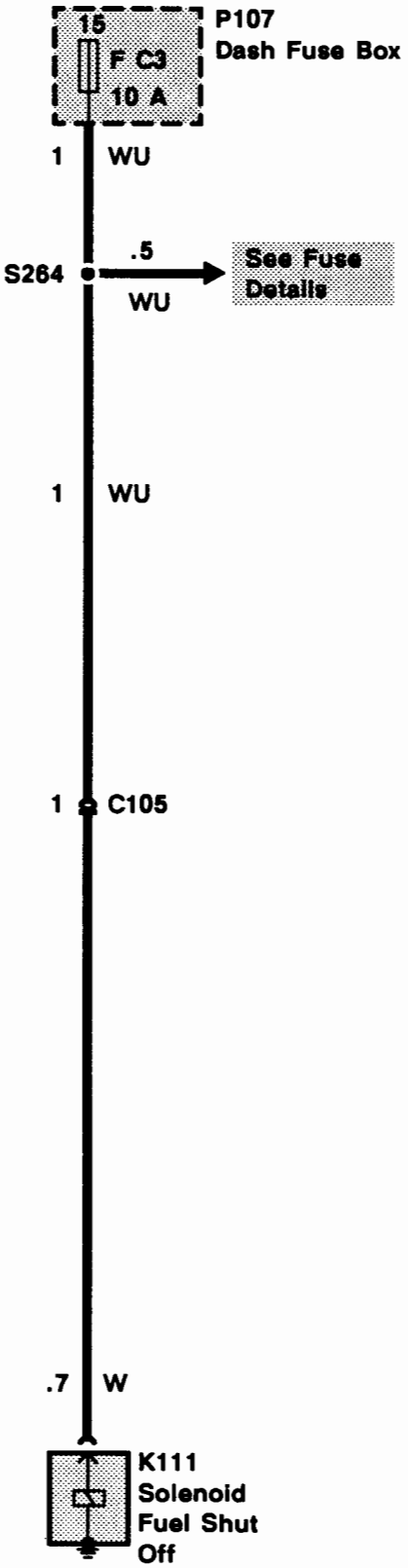
Component is disconnected.
Probe component

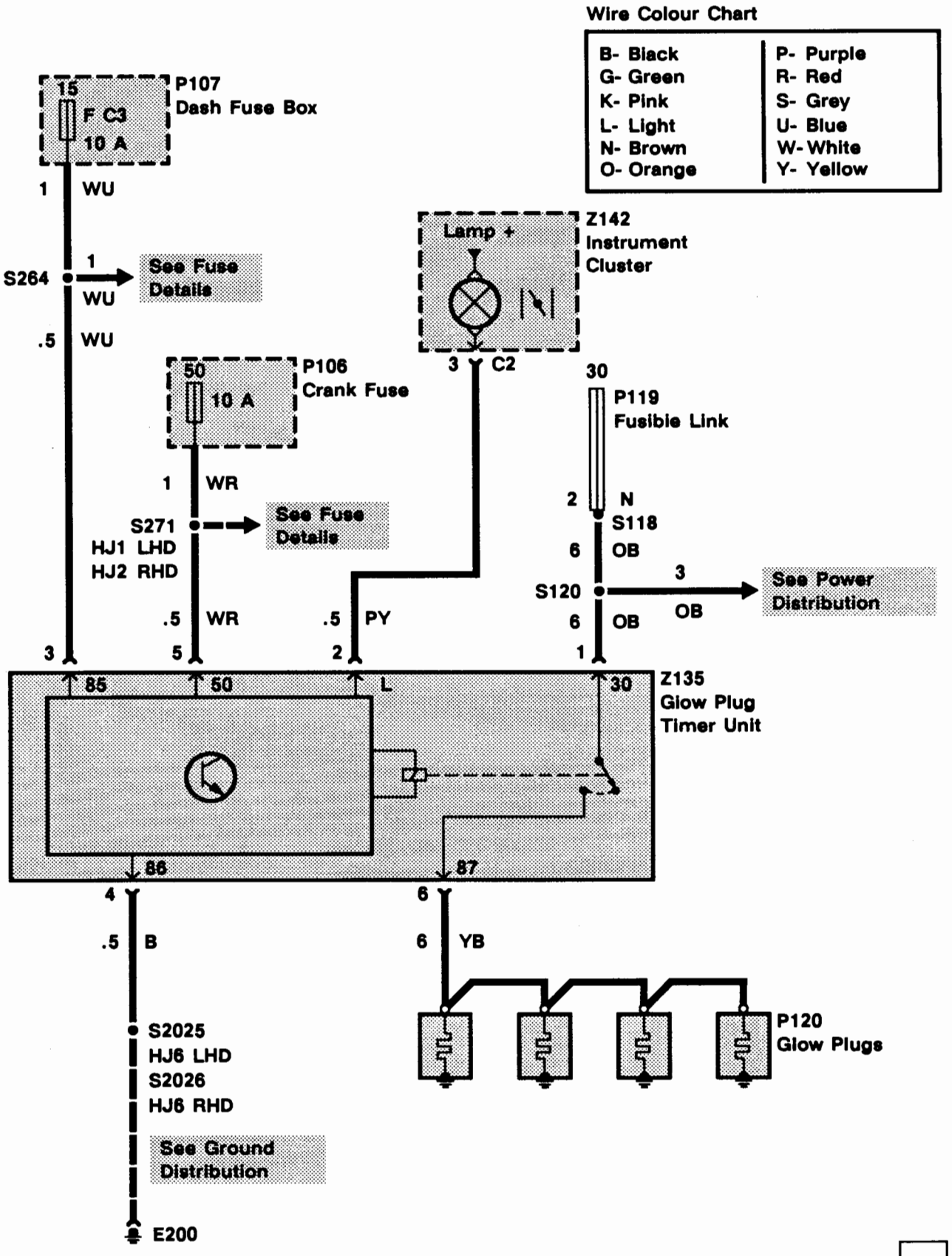
Component is disconnected.
Probe harness connector

Probe in-line connector

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




Wire Colour Chart
B- Black
G- Green
K- Pink
L- Light
N- Brown
O- Orange
P- Purple
R- Red
S- Grey
U- Blue
W- White
Y- Yellow
15
F C3
10 A
P107
Dash Fuse Box
1
WU
S264
1
WU
See Fuse Details
.5
WU
50
10 A
P106
Crank Fuse
1
WR
S271
HJ1 LHD
HJ2 RHD
See Fuse Details
.5
WR
5
3
Lamp +
Z142
Instrument Cluster
3
C2
.5
PY
2
30
P119
Fusible Link
2
N
S118
6
OB
S120
3
See Power Distribution
6
OB
1
85
50
L
30
Z135
Glow Plug
Timer Unit
86
87
4
6
.5
B
6
YB
S2025
HJ6 LHD
S2026
HJ6 RHD
See Ground Distribution
E200
P120
Glow Plugs