

### ELECTRICAL EQUIPMENT AND TESTS

Approved multimeters.

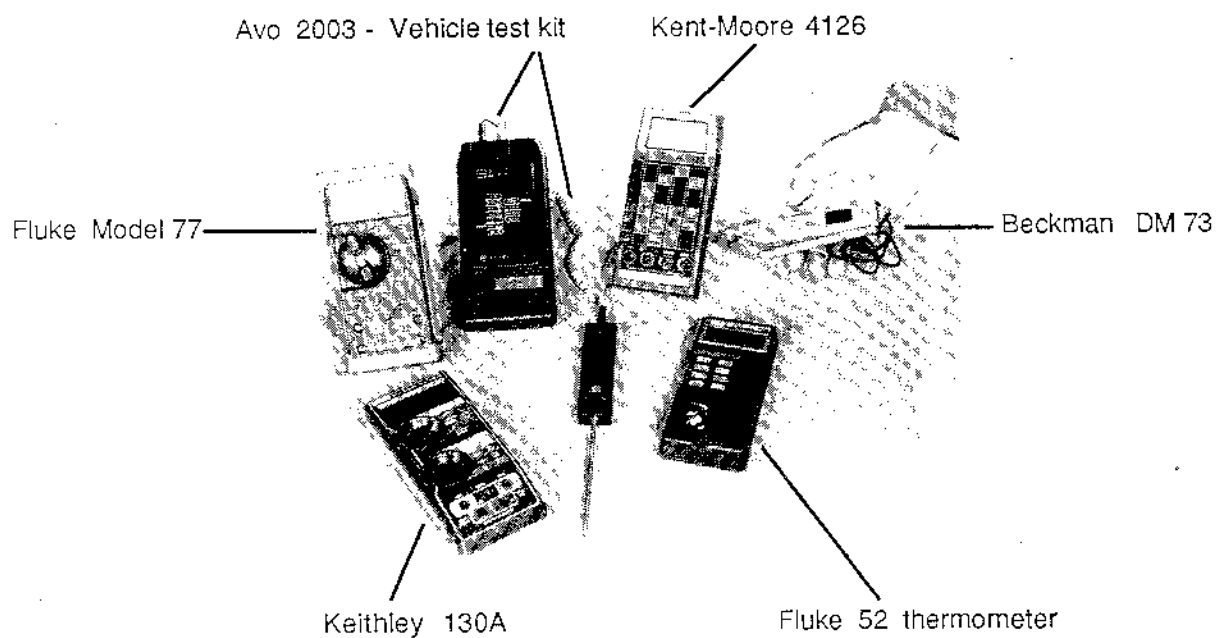





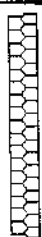
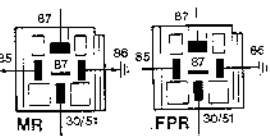
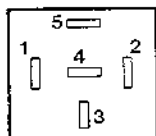
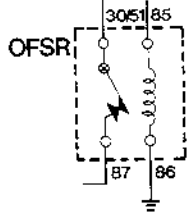
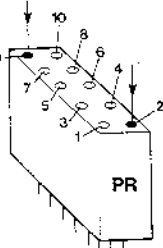
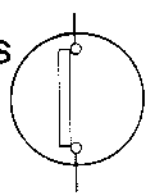
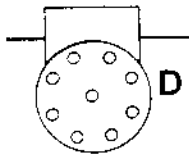

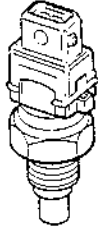
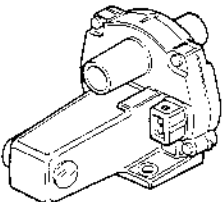
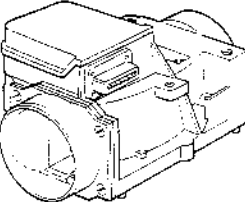

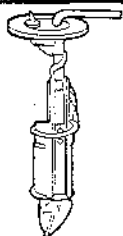
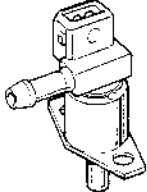
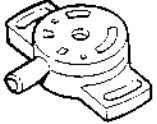


Fig. 1 Digital multimeters

# KEY TO SYMBOLS

 Ignition Off  Ignition On	  Ω- Ohmmeter V- Voltmeter	 Temporary Connection	 ECU - 35 way Harness Multi Plug
 MR- Main Relay FPR- Pump Relay	 SM- Steering Module	 OFSR- Overrun Fuel Shut Off Relay	 PR- Power Resistor
 VS- Vacuum Switch	 D- Distributor	 Injector	 CTS- Coolant Temp. Sensor
 EAV- Extra Air Valve	 AFM- Airflow Meter	 TT- Thermotime Switch	 FP- Fuel Pump
 CSI- Cold Start Injector	 TP- Throttle Potentiometer		

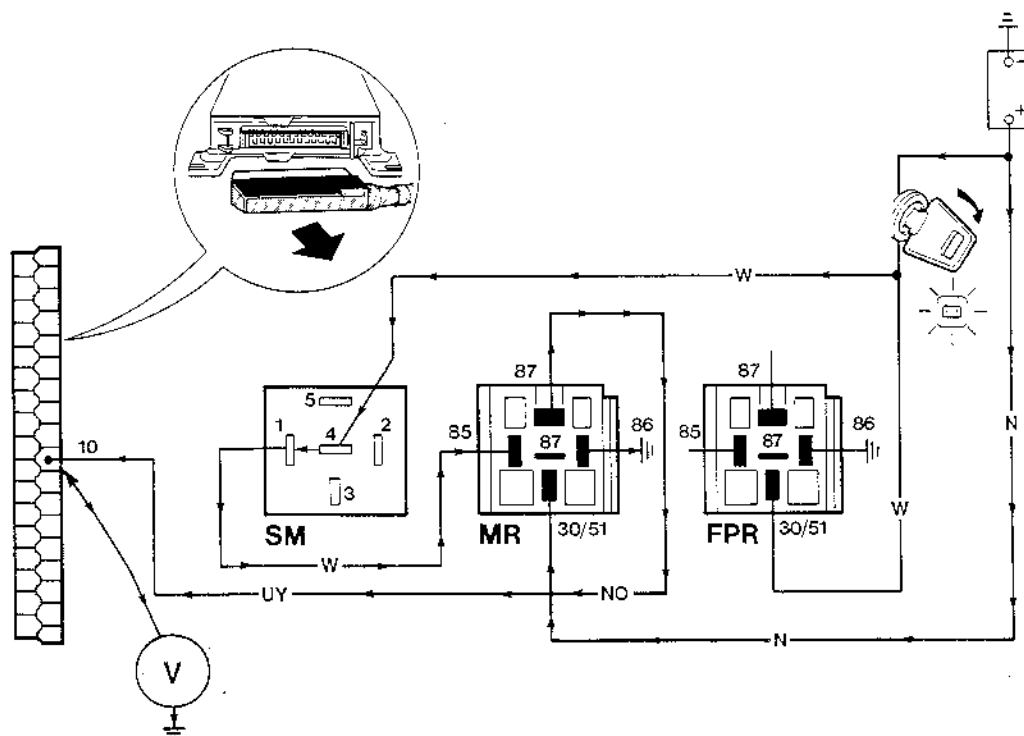
TEST 1            VOLTS

To check permanent voltage supply to the main relay.



## TEST 2 VOLTS

To check voltage supply to ECU via steering module and main relay.



Disconnect ECU multiplug.  
Connect voltmeter between ECU multiplug terminal 10 and earth.

Ignition OFF.  
Reading should be zero.

If voltmeter reads voltage- - renew main relay

Turn ignition ON (as shown in diagram above).  
Main relay should be heard to operate, and voltmeter should read 11 to 12.5 volts.

If below 11 volts, check-

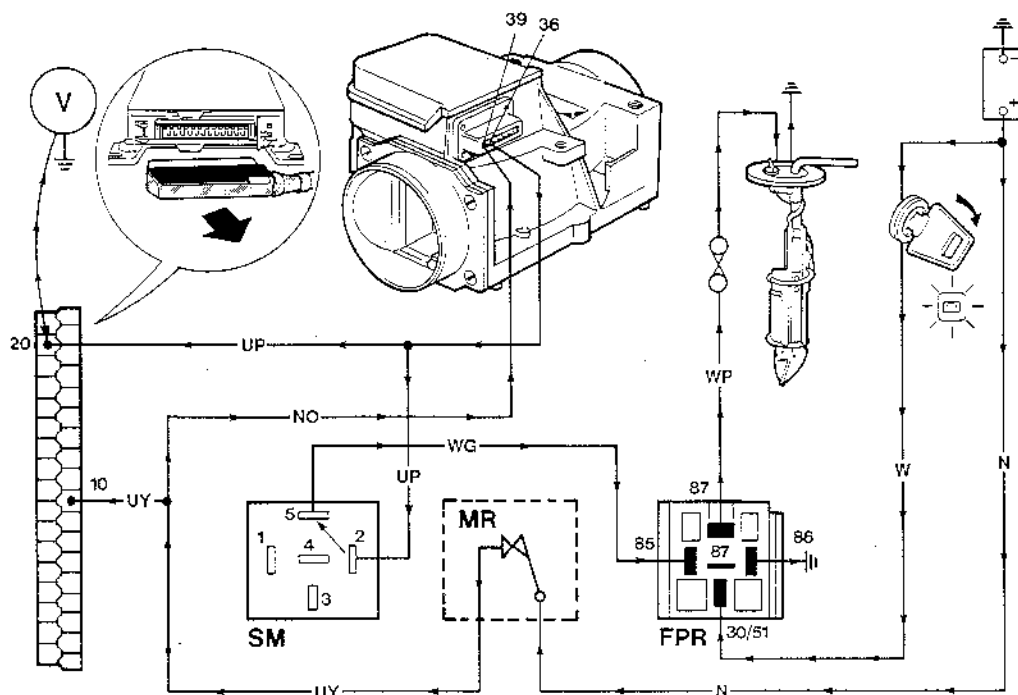
- all white wire (W) connections to the steering module and relays.
- good earth at terminal 86 on both relays.
- good connection of brown & orange wire (NO) at main relay terminal 87.
- good connection of blue & yellow wire (UY) at main relay terminal 87 and ECU pin 10.

If still below 11 volts- - substitute steering module and main relay.

If OK, continue with Test 3.

### TEST 3 VOLTS

To check voltage to fuel pump via air flow meter switch, steering module and fuel pump relay.



ECU multiplug disconnected.  
Connect voltmeter between ECU multiplug terminal 20 and earth.

Ignition ON.  
Air flow meter flap closed voltmeter should read zero volts.

Manually open air flow meter flap.  
Listen for fuel pump and relay operation.  
Voltmeter should read 11 to 12.5 volts. (\*see below)

If below 11 volts, check- - All wiring and connections shown in test 3 diagram.

If still below 11 volts- - substitute steering module.

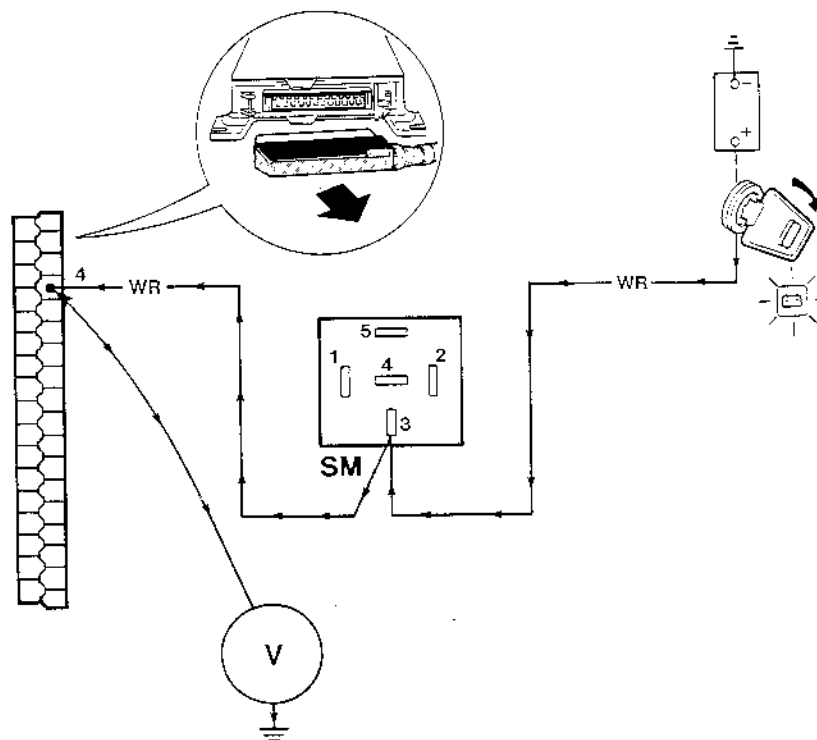
\* If voltmeter reads correctly but relay or pump are not heard to operate. - substitute steering module and then pump relay.

If pump still fails to operate- - suspect faulty fuel pump.

If OK, continue with Test 4.

## TEST 4 VOLTS

To check cranking voltage and signal circuit to ECU pin 4.



ECU multiplug disconnected.  
Connect voltmeter between ECU multiplug terminal 4 and earth.

Ignition ON and CRANKING.  
Voltmeter should read 8 to 12 volts.

If no reading but starter motor operates, check-

- white & red wiring (WR).
- connections to ECU pin 4 via the steering module and wiring loom multiplug.

If below 8 volts, check-

- battery and starter motor.

If no reading and starter motor does not operate, check-

- black & orange wiring (BO), connections and starter circuit.

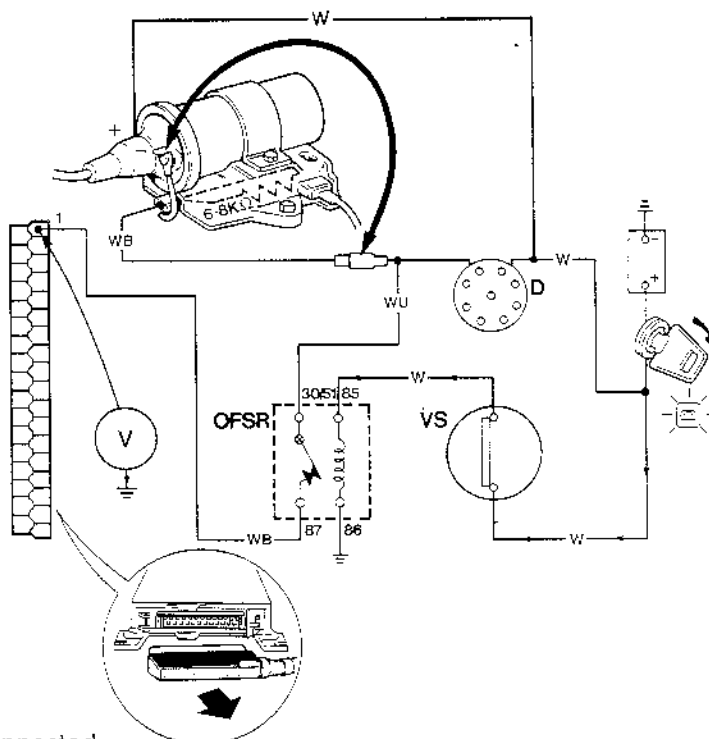
If OK, continue with Test 5.

### TEST 5      VOLTS

To check voltage - speed signal circuit  
- fuel shut-off relay and vacuum switch.

**NOTE:** This test procedure varies slightly dependent on whether the ignition amplifier is fitted separately under the coil (early installations) or is mounted on the distributor (later installations). Therefore the procedure is given under two separate headings - **5A** or **5B**.

#### 5A      FOR SEPARATE AMPLIFIER INSTALLATIONS:



ECU multiplug disconnected.

Connect a jump lead between the coil negative terminal and the white/blue (WU) and white/black (WB) lucar connector adjacent to the coil.

Connect voltmeter between ECU multiplug terminal 1 and earth.

Ignition ON.

Listen for operation of fuel shut-off relay and check for voltage reading thus indicating that the relay winding and contacts are in good condition.

The volt meter will not read if relay fails to operate, in which case check -

- white wiring (W) and connections.
- relay earth 86.
- continuity through the vacuum switch; substitute if necessary.

CRANK engine.

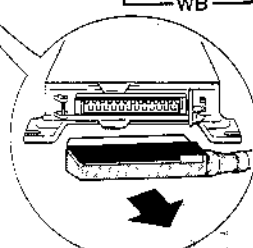
Voltage should fluctuate between 6 and 9 volts.

If higher than 9 volts or lower than 6 volts, check

- electronic ignition system

If OK remove jump lead and continue with Test 6

## 58



ECU multiplug disconnected

Disconnect the lucar connector from the resistor at the coil negative terminal and connect voltmeter between the resistor and the lucar connector.

Ignition ON.

Listen for operation of fuel shut-off relay.

If relay fails to operate, check-

- white wiring (W) and connections.
- relay earth 86.
- continuity through the vacuum switch; substitute if necessary.

CRANK.engine.

Voltage should fluctuate between 6 and 9 volts.

If higher than 9 volts or lower than 6 volts, check

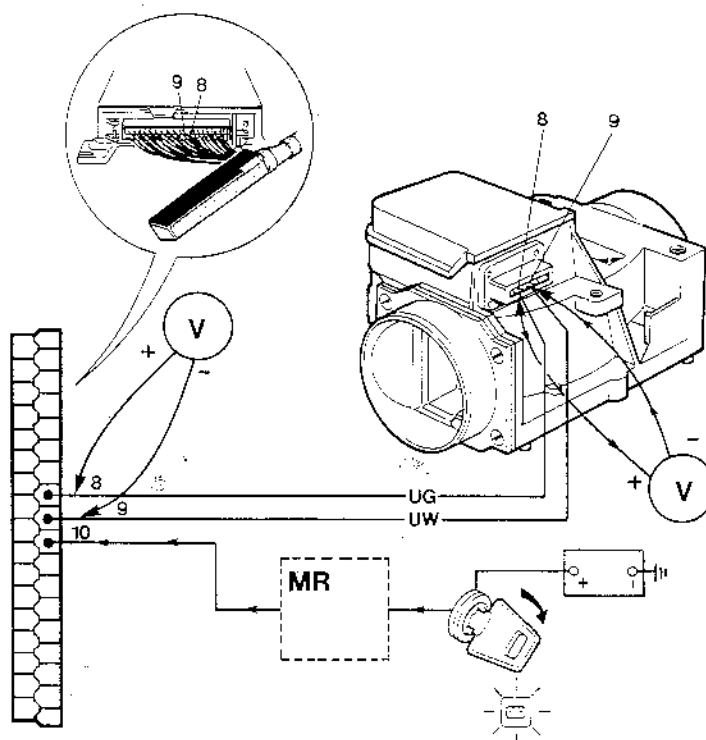
- electronic ignition system

If OK, reconnect lucar connector and continue with Test 6



### TEST 6 VOLTS

To check voltage across resistor wire in air flow meter potentiometer.



To gain access to the ECU terminals with the multiplug fitted, disconnect the multiplug, release its cover and refit the multiplug.

Ignition ON.

Connect voltmeter +ve to ECU multiplug pin 8 and -ve to pin 9.

Air flow meter flap closed, meter should read  $1.55 \pm 0.1$  volts.

If reading is incorrect-

- peel back rubber boot covering connections at air flow meter and connect voltmeter to terminals 8 and 9.

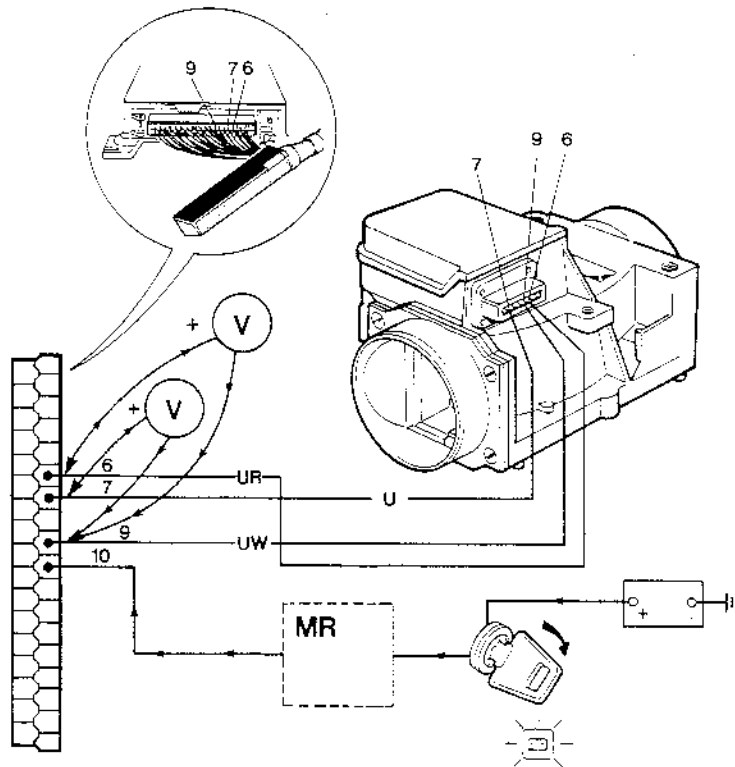
If reading is still incorrect-

- substitute air flow meter.

If OK, leave ECU connections exposed and continue with Test 7.

## TEST 7 VOLTS

To check voltage through air flow meter potentiometer and the wiring to the ECU.



ECU multiplug connected (cover removed).

Ignition ON.

Connect voltmeter +ve to ECU pin 6, and -ve to pin 9.  
Voltmeter should read  $4.3 \pm 0.2$  volt.

If voltmeter reads 0, check-	- all wiring and connections seen in diagram above.
------------------------------	---

Leave voltmeter - ve connected to pin 9 and  
move voltmeter +ve from pin 6 to pin 7.  
Voltmeter should read  $3.7 \pm 0.1$  volt.

If voltmeter reads low, check-	- wiring for high resistance.
--------------------------------	-------------------------------

With voltmeter still connected to pins 7 & 9, slowly open  
the air flap.

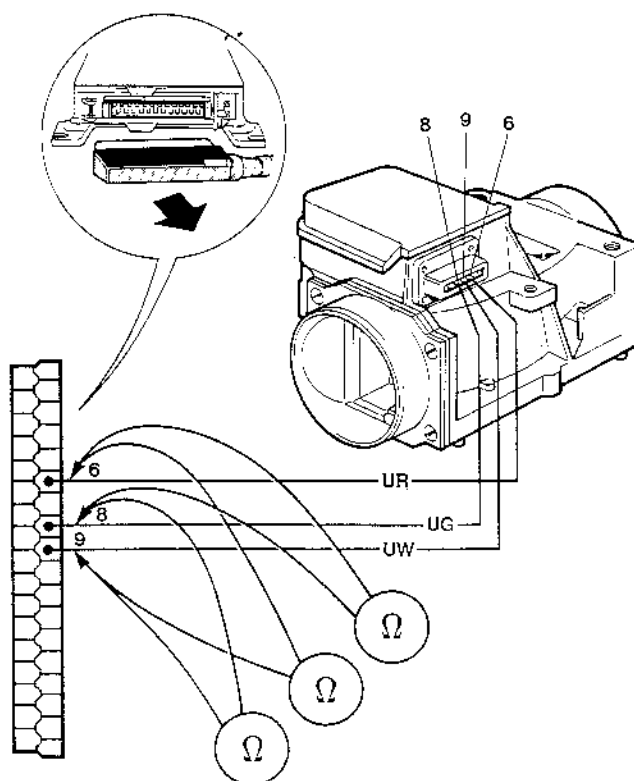
Voltage should gradually decrease to  $1.6 \pm 0.1$  volts.

If results are not within those specified above-	- renew air flow meter.
--	-------------------------

If OK, refit ECU multiplug cover and continue with Test 8.

### TEST 8 OHMS

To check internal resistance (ohms) of air flow meter and wiring to ECU.



ECU multiplug disconnected.

Ignition OFF.

Air flow meter flap closed.

Connect ohmmeter to ECU multiplug terminals and note readings.

PINS		K OHMS
6 and 8	should be	$360K \pm 10$
6 and 9	should be	$560K \pm 10$
8 and 9	should be	$200K \pm 10$

If readings are incorrect-

- peel back rubber boot covering connections at air flow meter: repeat the tests at the air flow meter plug, and then at the air flow meter socket.

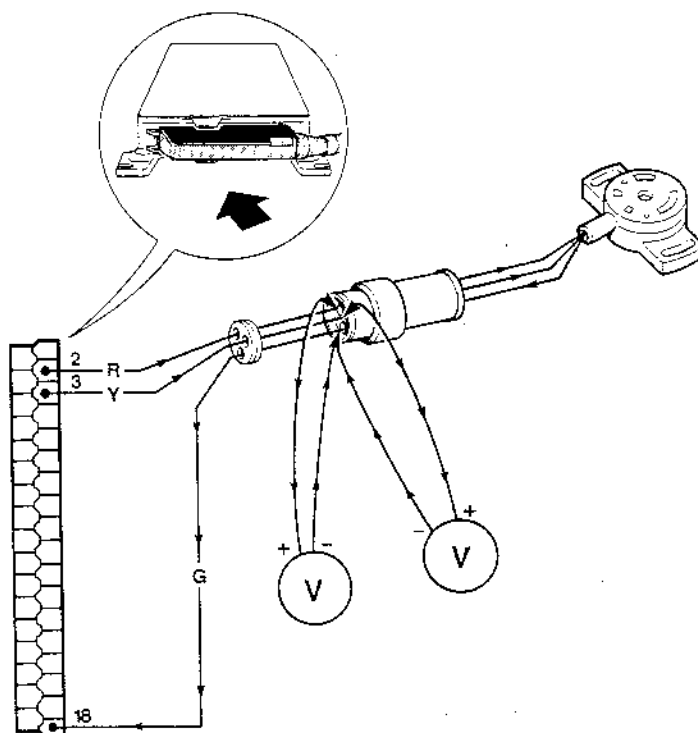
If readings are still incorrect-

- substitute air flow meter.

If OK, continue with Test 9.

## TEST 9 VOLTS

To check voltage at throttle potentiometer.



ECU multiplug connected.

Ignition ON.

At throttle potentiometer multiplug...

connect voltmeter +ve to yellow wire and -ve to green wire.

Voltmeter should read  $4.3 \pm 0.2$  volts. (ECU control voltage)

If zero or low reading, check-

- wiring and connections.

Move-voltmeter +ve to red wire.

Voltmeter should read  $0.325 \pm 0.025$  volts. (0.30 to 0.35 v)

If incorrect, reset potentiometer-

- slacken potentiometer body retaining screws, rotate body in either direction until meter reads  $0.325 \pm 0.025$  volts and tighten screws.

Slowly open the throttle; the injectors should be heard to operate and the voltmeter should register a smooth increase up to 4.5 volts maximum.

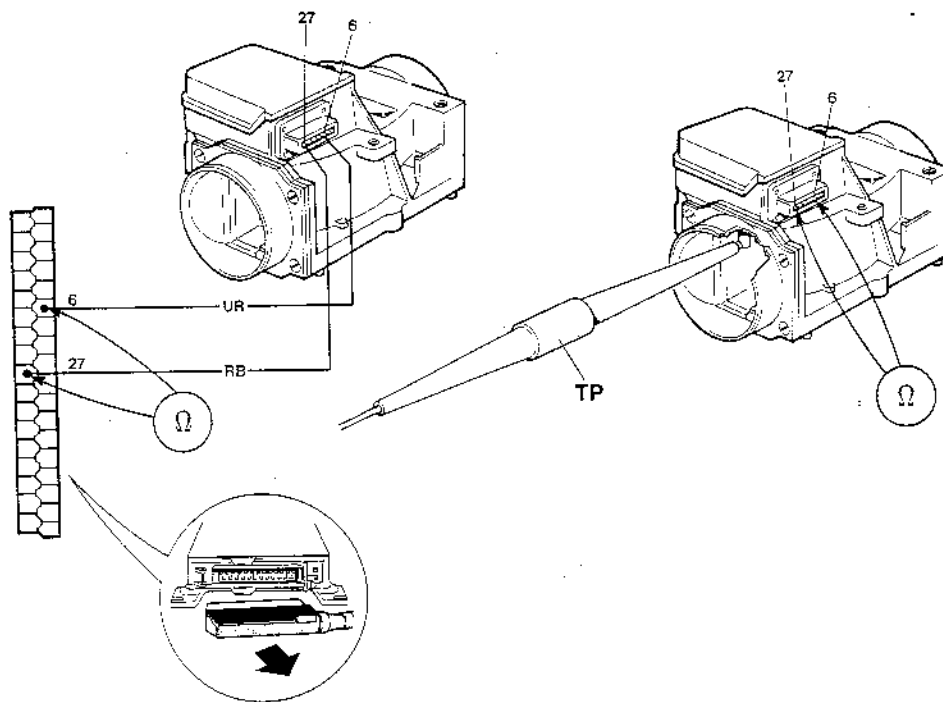
If the recommended voltages cannot be obtained or if the voltage reading is erratic when throttle is opened

- renew throttle potentiometer

If OK, continue with Test 10.

**TEST 10 OHMS**

To check resistance of air temperature sensor.



**WARNING:** When carrying out this test the ohmmeter must only be connected for a short period, as the ohmmeter battery will cause the sensor winding to heat up and give an incorrect reading.

Disconnect ECU multiplug.

Ignition OFF.

Remove air filter housing and trunking to gain access to air flow meter inlet.

Check temperature of air sensor using suitable temperature probe (TP).

Peel back rubber boot to gain access to air flow meter terminals and connect ohmmeter to terminals 6 & 27.

Meter should read as follows:

TEMPERATURE	OHMS
-10°C ±0.5°C	8.26 to 10.56
+20°C ±0.5°C	2.28 to 2.72
+50°C ±0.5°C	0.76 to 0.91

If readings are incorrect-

- substitute air flow meter and recheck.

If the readings are correct, repeat the resistance check at the ECU harness pins 6 and 27 to check continuity.

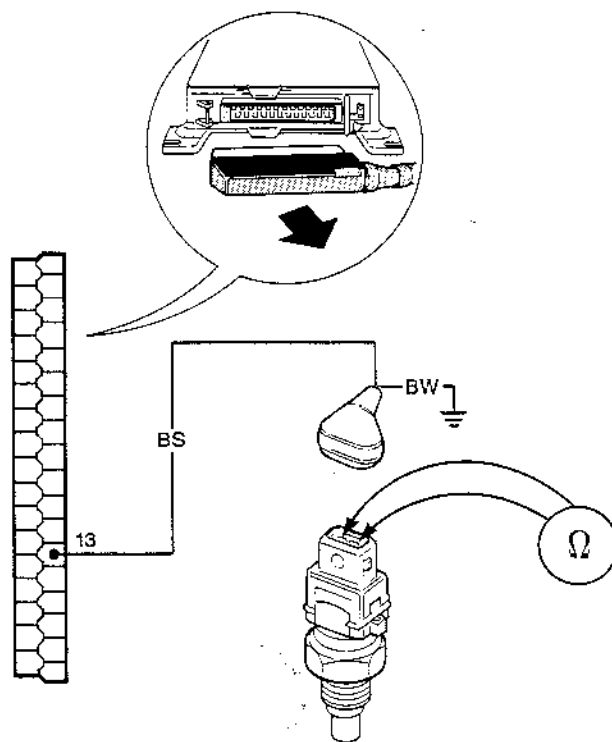
If the readings are incorrect, check-

- red & brown wiring (RB) and connections.  
- blue & red wiring (UR) and connections.

If OK, continue with Test 11.

## TEST 11 OHMS

To check resistance of coolant temperature sensor.



**WARNING;** When carrying out this test the ohmmeter must only be connected for a short period, as the ohmmeter battery will cause the sensor winding to heat up and give an incorrect reading.

ECU multiplug disconnected.

Ignition OFF.

Measure coolant temperature with thermometer probe.

Disconnect temperature sensor electrical socket and connect ohmmeter across sensor terminals.

Readings should be as follows:

TEMPERATURE	OHMS		(k $\Omega$ )
-10°C	9100 to 9300	=	(9.1k $\Omega$ > 9.3k $\Omega$ )
0°C	5700 to 5900	=	(5.7k $\Omega$ > 5.9k $\Omega$ )
20°C	2400 to 2600	=	(2.4k $\Omega$ > 2.6k $\Omega$ )
40°C	1100 to 1300	=	(1.1k $\Omega$ > 1.3k $\Omega$ )
60°C	500 to 700	=	(0.5k $\Omega$ > 0.7k $\Omega$ )
80°C	300 to 400	=	(0.3k $\Omega$ > 0.4k $\Omega$ )
100°C	150 to 200	=	(0.15k $\Omega$ > 0.2k $\Omega$ )

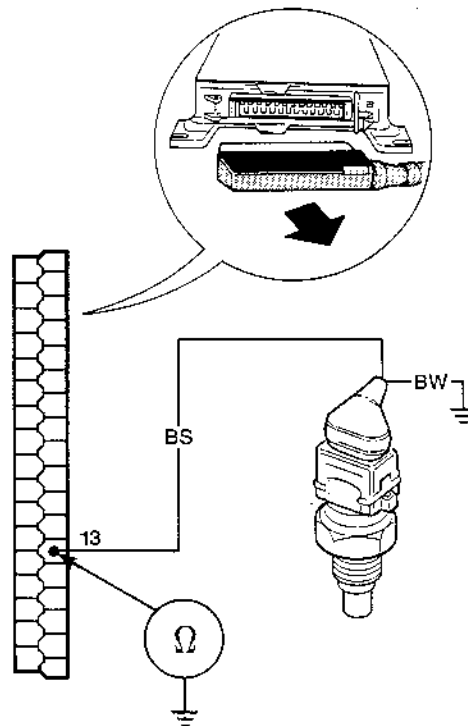
If the readings are incorrect-

- remove the sensor and check it in a controlled test. i.e. suspend it in cold water and bring to the boil, checking resistance at each stated temperature.

If the readings are still incorrect-

- substitute the coolant temperature sensor and recheck.

### TEST 11A



If the readings are correct, reconnect the temperature sensor and check continuity to the ECU pin 13 and earth.

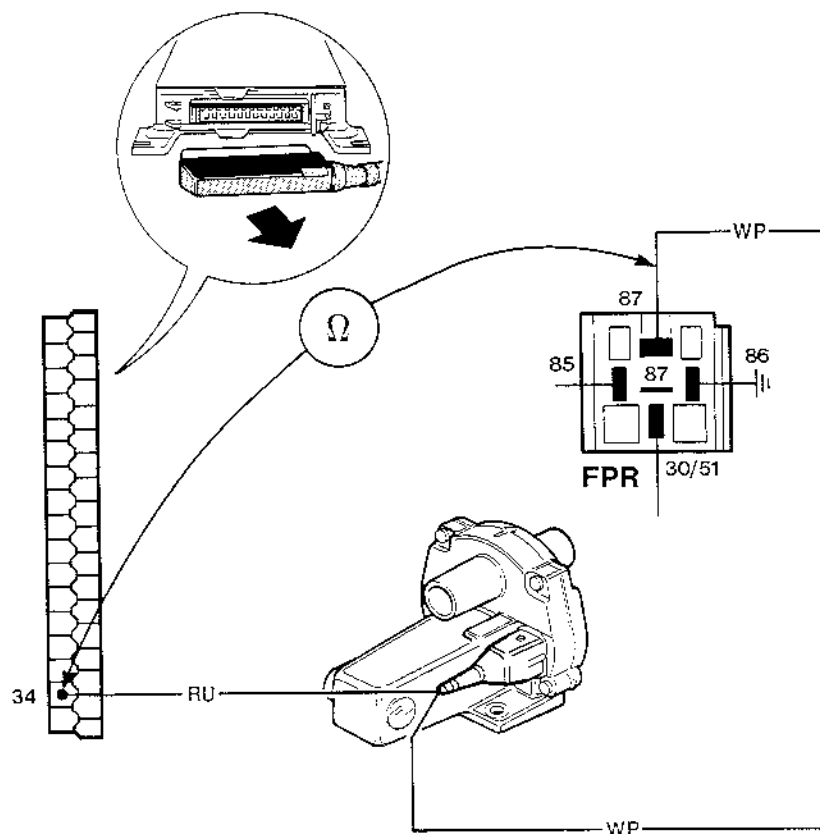
If this reading is incorrect, check-

- black & slate wiring (BS) and connections
- black & white wiring (BW) and connections
- pay particular attention to the earthing of the black and white wire (BW).

If OK, continue with Test 12.

## TEST 12 OHMS

To check resistance of extra air valve.



ECU multiplug disconnected.

Ignition OFF.

Connect ohmmeter between terminal 87 on fuel pump relay and pin 34 on ECU multiplug.

Ohmmeter reading should be 30-40 ohms.

If reading is outside these limits-

- renew extra air valve.

If meter shows infinity, check-

- white & purple wiring (WP) and connections

- red & blue wiring (RU) and connections

If necessary connect a substitute extra air valve and recheck reading.

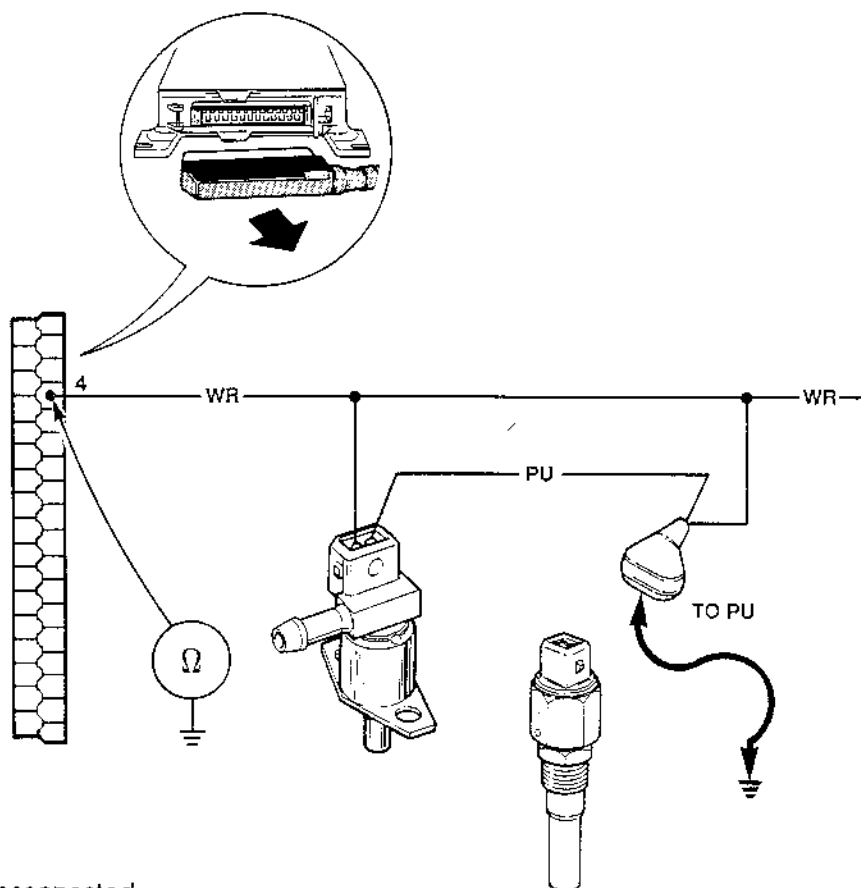
NOTE: It is easier to connect a substitute air valve than to attempt to connect the ohmmeter to the original valve in situ where access to the terminals is restricted.

If OK, continue with Test 13.



### TEST 13 OHMS

To check resistance (ohms) of cold start injector.



ECU multiplug disconnected.

Ignition OFF.

Disconnect the thermotime switch, and temporarily connect the purple and blue wire (PU) to a good earth. Measure the resistance between the ECU multiplug pin 4 and earth.

The reading should be 0 to 5 ohms.

If the reading is incorrect, check-

- the temporary earth for good connections.
- white & red wire (WR) and connections.
- purple & blue wire (PU) and connections.

If reading is still incorrect-

- disconnect the cold start injector and check its resistance.

Resistance should be 0 to 5 ohms.

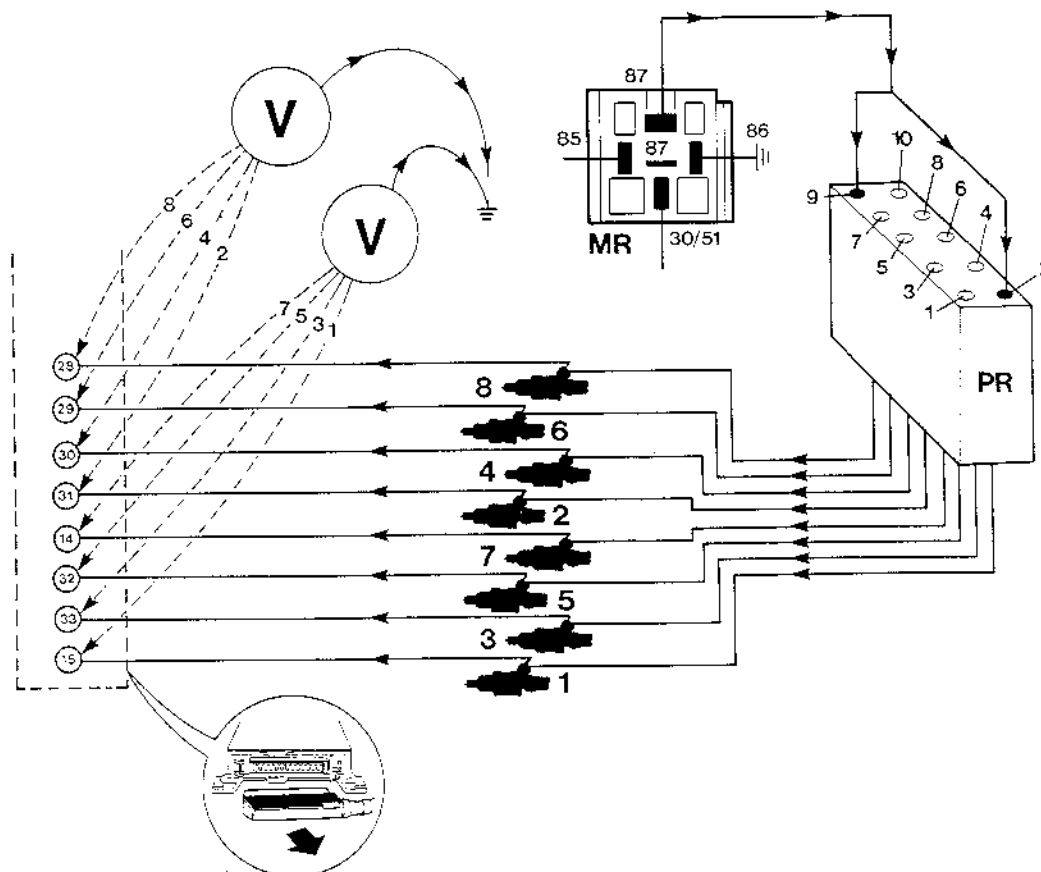
If incorrect-

- renew the cold start injector.

If OK, continue with Test 14.

## TEST 14 VOLTS

To check the integrity of the injector solenoids, resistor pack, wiring and ECU connections.



ECU multiplug disconnected.

Ignition ON.

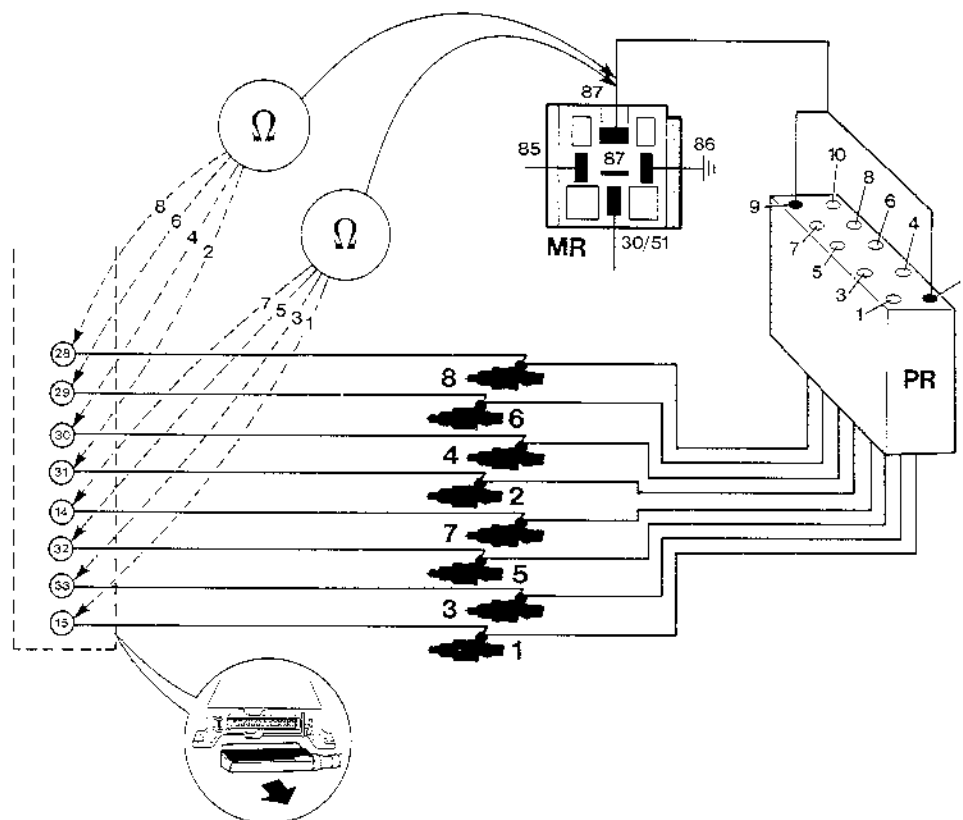
Connect voltmeter between a good earth (ECU pin 5) and each injector ECU multiplug connector in turn; readings should not differ by more than 1/2 volt on battery voltage.

If variation is in excess of 1/2 volt

investigate by carrying out continuity resistance check - see Test 15.

**TEST 15 OHMS**

To check the continuity and resistance of each injector and its resistor.



ECU multiplug disconnected.

Ignition OFF

Connect the ohmmeter between terminal 87 or 87A on the main relay and each injector ECU multiplug terminal in turn.

A reading of 7-10 ohms indicates  
Infinity reading indicates  
A high resistance reading indicates

- no fault
- a broken connection / component
- a poor connection, faulty wiring or a faulty injector or resistor.

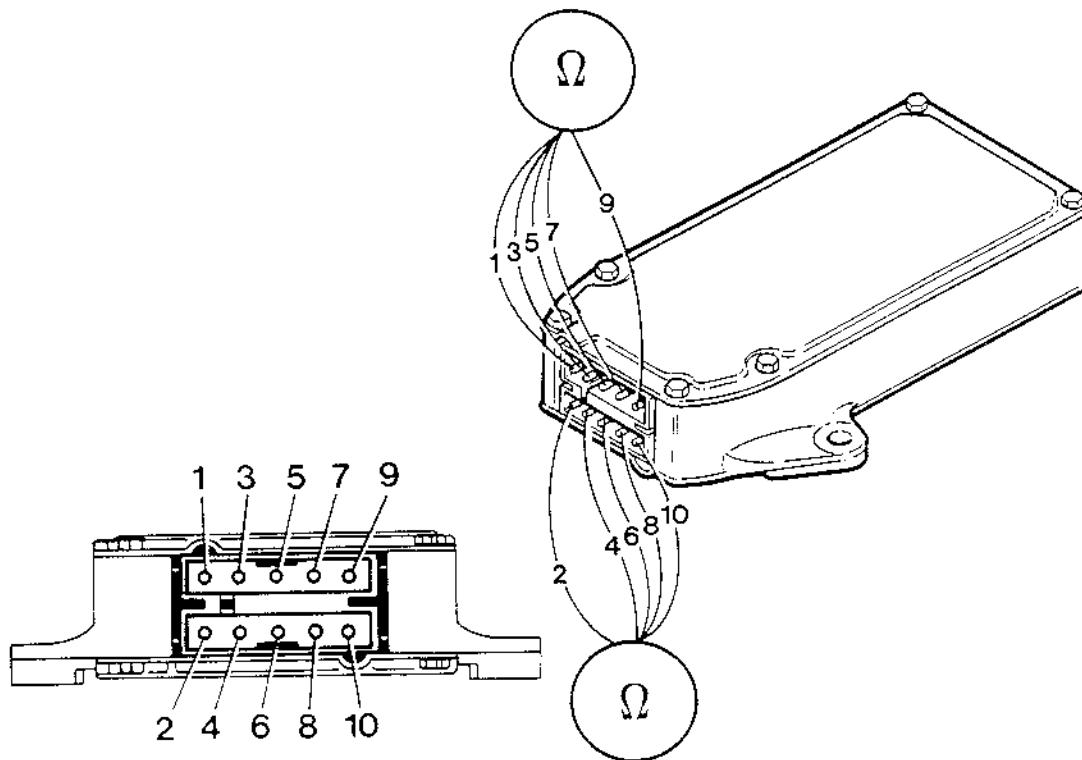
If a faulty injector or resistor is suspected, continue with Test 16.

## TEST16 OHMS

To check resistance of injectors and resistors.

**NOTE:** These checks are made separately - see test 16A and test 16B

### TEST 16A - RESISTOR PACK TEST



Disconnect the harness multiplug from the resistor pack

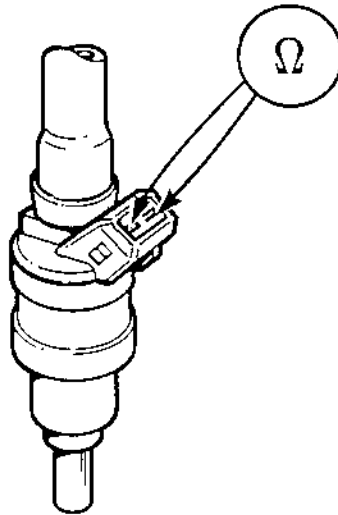
In turn, connect an ohmmeter between terminal 9 and terminals 1,3,5 &7 to check the resistor values for injectors 1,3,5 &7.

Similarly connect the ohmmeter between terminal 2 and terminals 4,6, 8 & 10 to check the resistor values of those injectors.

The values should read 6 ohms  $\pm$  1 ohm.

If any value is incorrect

- renew the complete resistor pack.

**TEST 16B - INJECTOR TEST.**

ECU multiplug disconnected.

Ignition OFF

Disconnect the wiring from each injector, and check its resistance value by connecting the ohmmeter to both terminals.

The resistance value for each injector must be 2.4 ohms @ 20°C  $\pm$  0.5 ohm.  
Renew any injector outside this resistance value.