

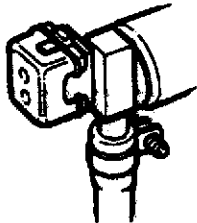





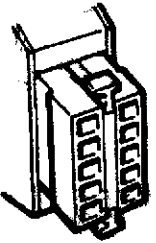


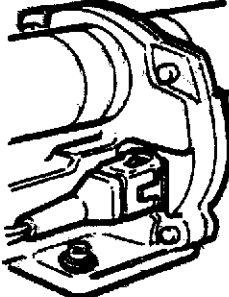
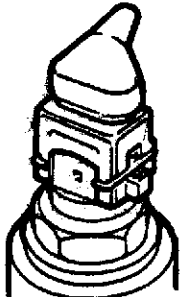

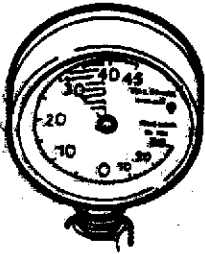

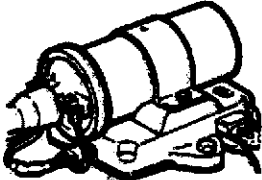
FUEL INJECTION SYSTEM COMPONENTS — RANGE ROVER

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Breather flame trap 2. Vacuum switch 3. Cold start injector 4. Fuel pressure regulator 5. Solenoid operated air valve
(air conditioning versions only) 6. Engine crankcase breather 7. Idle speed adjustment screw 8. Airflow meter 9. Idle air mixture screw 10. Extra air valve 11. Coolant temperature switch | <ul style="list-style-type: none"> 12. Thermostime switch 13. Electronic distributor 14. Throttle potentiometer 15. Air cleaner 16. Constant energy unit <li style="padding-left: 20px;"><i>Inset 'A'</i> 17. Injectors <li style="padding-left: 20px;"><i>Inset 'B'</i> 18. Fuel feed rail 19. Over run fuel shut-off relay 20. Power resistor pack |
|---|---|

CONTINUITY TESTS—Using an AVO meter

The following continuity tests are intended as a guide to identifying where a fault may occur within a circuit; reference should be made to the fuel injection circuit diagram for full circuit information.

Key to Symbols

 <p>Cold Start Injector</p>	 <p>35 - Way Harness Multiplug</p>	 <p>P - Pump Relay M - Main Relay S - Steering Module</p>	 <p>Airflow Meter Harness Plug</p>	 <p>Throttle Switch (potentiometer type)</p>
 <p>Temporary Connection</p>	 <p>Resistor Box</p>	 <p>Injector</p>	 <p>Thermotime Switch</p>	 <p>Extra Air Valve</p>
 <p>Coolant Temp. Sensor</p>	 <p>Ignition</p>	 <p>Pressure Gauge</p>	 <p>Electrical Multiplug</p>	 <p>Constant Energy Unit</p>

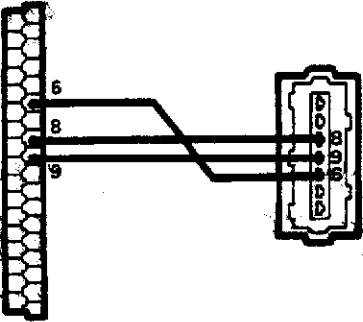
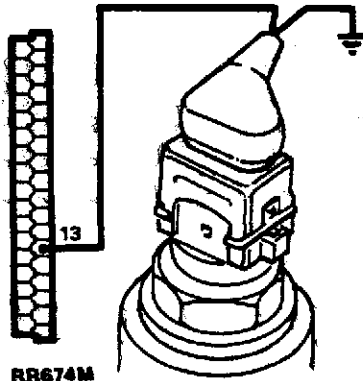
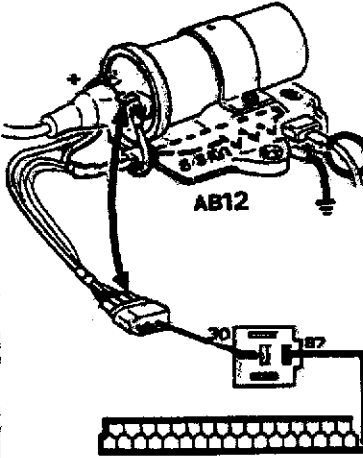
RR 716M

CONTINUITY TEST—Using an AVO meter

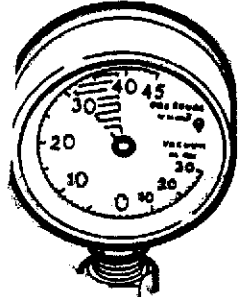
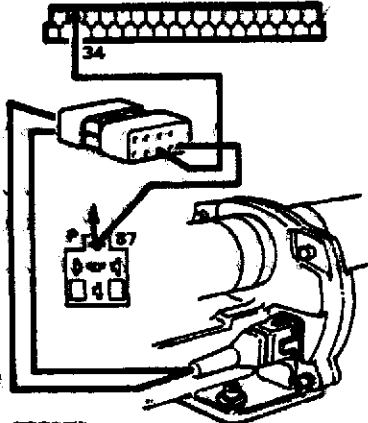
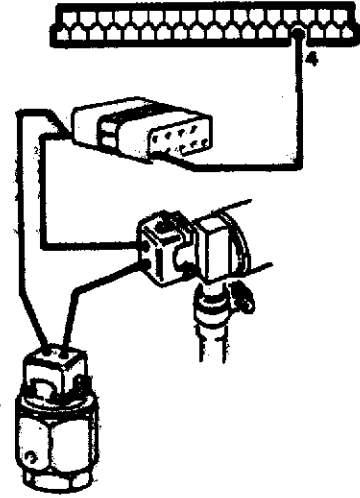
NOTE: All tests are carried out from the electronic control unit (ECU) harness multi-plug unless stated otherwise in the test procedure.

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TEST	CIRCUIT TESTING	EXPECTED RESULTS	POSSIBLE FAULTS AND REMEDIES
<p>1. ECU SUPPLY Disconnect the multi-plug from the ECU. Switch on the ignition. Connect a voltmeter between pin 10 and earth.</p>	<p>RR670M</p>	<p>11-12.5 volts</p>	<p>No reading; check all wiring to main relay, check main relay by substitution. Below 11 volts; check battery. Check circuit for high resistance connection.</p>
<p>2. FUEL PUMP CONTACTS Switch on the ignition and connect a voltmeter between pin 20 and earth. Airflow meter flap closed.</p> <hr/> <p>Operate the flap in the airflow meter.</p>	<p>RR671M</p>	<p>0 volts</p> <hr/> <p>11-12.5 volts</p>	<p>If reading registered, check airflow meter switch action.</p> <hr/> <p>No reading, check wiring from main relay to airflow meter. Check wiring from airflow meter to fuel pump relay. Check pump relay by substitution. Check fuel pump operation by connecting a direct supply to the pump terminals.</p>
<p>3. CRANKING SIGNAL Connect a voltmeter between pin 4 and earth. Crank the engine.</p>	<p>RR672M</p>	<p>8-12 volts</p>	<p>No reading but starter motor operates; check wiring from starter relay to steering module and from steering module to ECU. No reading starter motor does not operate; check starter relay and starter motor. Below 8 volts check battery, check starter motor.</p>

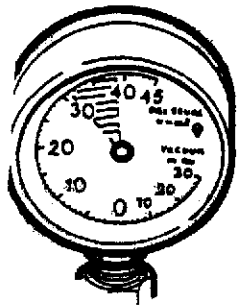
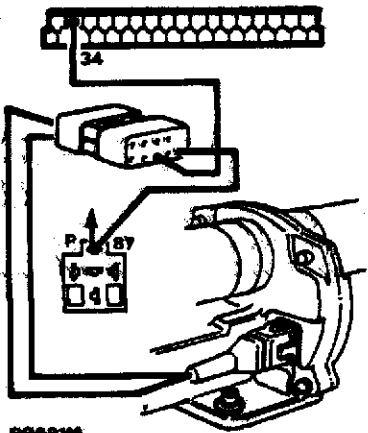
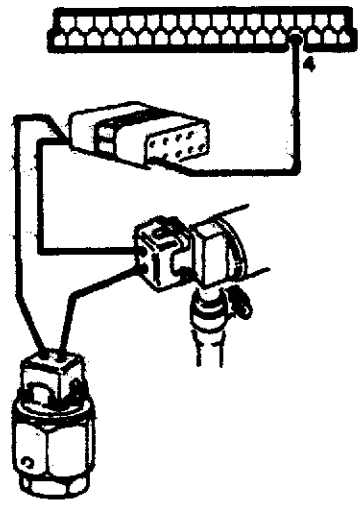
<p>4. AIRFLOW METER Connect ohmmeter between pin 6 and 8.</p> <hr/> <p>Connect ohmmeter between pins 6 and 9.</p> <hr/> <p>Connect ohmmeter between pins 8 and 9.</p>	 <p>RR673M</p>	<p>360 ± 10 Ω</p> <hr/> <p>560 ± 10 Ω</p> <hr/> <p>200 ± 10 Ω</p>	<p>Should readings be different from expected results; check harness continuity between ECU plug and airflow meter plug, i.e. pins 6-6, 8-8, 9-9. Check variable resistor circuit in airflow meter with ohmmeter, check that meter flap is closed before substituting airflow meter.</p>														
<p>5. WATER TEMPERATURE SENSOR Connect ohmmeter between pin 13 and earth.</p>	 <p>RR674M</p>	<table border="0"> <tr> <td>Temp °C</td> <td>K Ω</td> </tr> <tr> <td>-10</td> <td>7.0</td> </tr> <tr> <td>± 1 °C</td> <td>to 11.6</td> </tr> <tr> <td>+20</td> <td>2.1</td> </tr> <tr> <td>± 1 °C</td> <td>to 2.9</td> </tr> <tr> <td>+80</td> <td>0.27</td> </tr> <tr> <td>± 1 °C</td> <td>to 0.39</td> </tr> </table>	Temp °C	K Ω	-10	7.0	± 1 °C	to 11.6	+20	2.1	± 1 °C	to 2.9	+80	0.27	± 1 °C	to 0.39	<p>Incorrect reading; check wiring and electrical plug, renew sensor if readings do not comply with results.</p> <p>NOTE: Connect the AVO measuring leads to the sensor for short periods only, to minimise the effect of self heating due to the measuring current.</p>
Temp °C	K Ω																
-10	7.0																
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<p>6. SPEED SIGNAL (Constant energy ignition) Fit a jump lead between the negative terminal on the ignition coil and pin 1. Connect voltmeter between pin 1 and earth. Crank engine.</p>	 <p>AB12</p> <p>RR675M</p>	<p>6-9 volts fluctuating</p>	<p>No reading; check harness connections between coil and ECU.</p>														

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<p>8. PRESSURISED FUEL RAIL Fit pressure gauge to cold start injector fuel hose. Switch the ignition on and operate the airflow meter spring return switch to energise the fuel pump.</p>	 <p>RR680M</p>	<p>2.4–2.6 kgf/cm² 34–37 lbf/in²</p>	<p>No pressure built up; check fuel pump circuit with voltmeter. If a reading of 12 volts obtained, check fuel pump earth circuit, satisfactory. If earth circuit check pump. Check operation of fuel pump relay and main relay by substitution if pressure reading is zero. Fuel pressure above or below limits; check pipe work and regulator for blockages and falling pressure reading, check pipe work for leaks, check for leaking injectors, pressure regulator and fuel pump non-return valve.</p>
<p>9. EXTRA AIR VALVE Connect ohmmeter between pin 34 and 87 on fuel pump relay.</p>	 <p>RR682M</p>	<p>30–40 Ω</p>	<p>No reading; check wiring and connections between the pump relay, extra air valve and ECU. Check air valve for continuity with an ohmmeter.</p>
<p>10. COLD START INJECTOR Disconnect the thermotime switch. With each of the leads being connected to earth in turn. Connect ohmmeter between pin 4 and earth.</p>	 <p>RR682M</p>	<p>0–5.0 Ω</p>	<p>No reading; check wiring and connections between the ECU cold start injector and thermotime switch. Open circuit; check wiring and connections and cold start injector windings.</p>

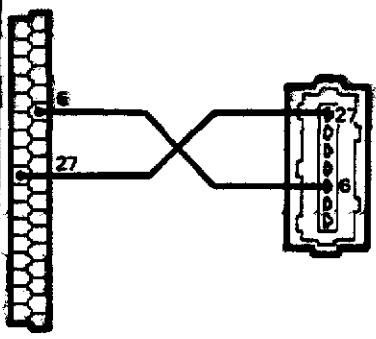
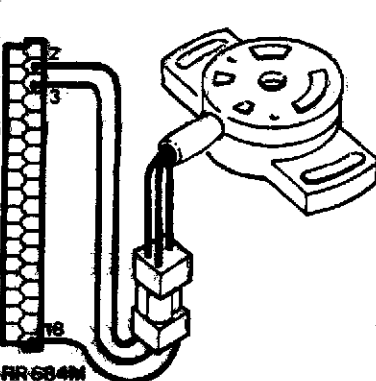
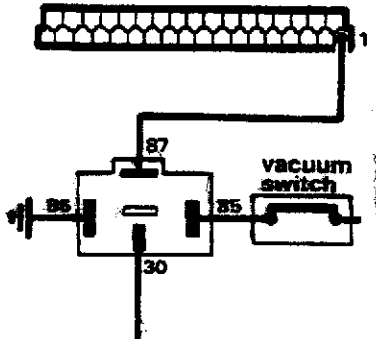
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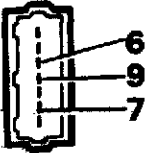
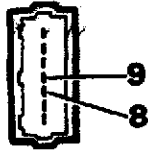
TEST	CIRCUIT TESTING	EXPECTED RESULTS	POSSIBLE FAULTS AND REMEDIES
<p>7. INJECTOR CHECK Numbers 7 and 8 Injector 7 Connect ohmmeter between pin 14 and 87 on main relay.</p> <hr/> <p>Injector 8 Connect ohmmeter between pin 28 and 87 on main relay.</p>		<p>7-10 KΩ</p> <hr/> <p>7-10 KΩ</p>	<p>If reading is below expected results, disconnect each injector in turn to find injector with '00' or low reading; renew injector. If winding resistance of injector is satisfactory, check wiring circuits and resistor pack for open circuit condition.</p>
<p>7A. INJECTOR CHECK Numbers 2 and 4 Injector 2 Connect ohmmeter between pin 31 and 87 on main relay.</p> <hr/> <p>Injector 4 Connect ohmmeter between pin 30 and 87 on main relay.</p>		<p>7-10 KΩ</p> <hr/> <p>7-10 KΩ</p>	<p>See injectors 7 and 8.</p>
<p>7B. INJECTOR CHECK Numbers 3 and 5 Injector 3 Connect ohmmeter between pin 15 and 87 on main relay.</p> <hr/> <p>Injector 5 Connect ohmmeter between pin 29 and 87 on main relay.</p>		<p>7-10 KΩ</p> <hr/> <p>7-10 KΩ</p>	<p>See injectors 7 and 8.</p>
<p>7C. INJECTOR CHECK Numbers 1 and 6 Injector 1 Connect ohmmeter between pin 33 and 87 on main relay.</p> <hr/> <p>Injector 6 Connect ohmmeter between pin 32 and 87 on main relay.</p>		<p>7-10 KΩ</p> <hr/> <p>7-10 KΩ</p>	<p>See injectors 7 and 8.</p>

<p>8. PRESSURISED FUEL RAIL Fit pressure gauge to cold start injector fuel hose. Switch the ignition on and operate the airflow meter spring return switch to energise the fuel pump.</p>	 <p>RR680M</p>	<p>2.4-2.6 kgf/cm² 34-37 lbf/in²</p>	<p>No pressure build up; check fuel pump circuit with voltmeter. If a reading of 12 volts obtained, check fuel pump earth circuit, satisfactory. If earth circuit check pump. Check operation of fuel pump relay and main relay by substitution if pressure reading is zero. Fuel pressure above or below limits; check pipe work and regulator for blockages and falling pressure reading, check pipe work for leaks, check for leaking injectors, pressure regulator and fuel pump non-return valve.</p>
<p>9. EXTRA AIR VALVE Connect ohmmeter between pin 34 and 87 on fuel pump relay.</p>	 <p>RR681M</p>	<p>30-40 Ω</p>	<p>No reading; check wiring and connections between the pump relay, extra air valve and ECU. Check air valve for continuity with an ohmmeter.</p>
<p>10. COLD START INJECTOR Disconnect the thermotime switch. With each of the leads being connected to earth in turn. Connect ohmmeter between pin 4 and earth.</p>	 <p>RR682M</p>	<p>0-5.0 Ω</p>	<p>No reading; check wiring and connections between the ECU cold start injector and thermotime switch. Open circuit; check wiring and connections and cold start injector windings.</p>

Continued

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<p>11. AIR TEMPERATURE SENSOR (Airflow meter) Connect ohmmeter between pin 6 and 27.</p> <p>NOTE: Connect the AVO measuring leads to the sensor for short periods only, to minimise the effect of self heating due to the measuring current.</p>	 <p>RR683M</p>	<table border="1"> <thead> <tr> <th>Temp °C</th> <th>K Ω</th> </tr> </thead> <tbody> <tr> <td>-10</td> <td>8.26</td> </tr> <tr> <td>± 0.5 °C</td> <td>to 10.56</td> </tr> <tr> <td>+20</td> <td>2.28</td> </tr> <tr> <td>± 0.5 °C</td> <td>to 2.72</td> </tr> <tr> <td>+50</td> <td>0.76</td> </tr> <tr> <td>± 0.5</td> <td>to 0.91</td> </tr> </tbody> </table>	Temp °C	K Ω	-10	8.26	± 0.5 °C	to 10.56	+20	2.28	± 0.5 °C	to 2.72	+50	0.76	± 0.5	to 0.91	<p>If reading is infinity; disconnect airflow meter, bridge terminals 6 and 27. If ohmmeter reads zero air temperature, sensor is faulty. If after replacement ohmmeter shows infinity, check wiring and connections to the ECU.</p>
Temp °C	K Ω																
-10	8.26																
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+50	0.76																
± 0.5	to 0.91																
<p>12. THROTTLE POTENTIOMETER CAUTION: Ensure the AVO is set to volts.</p> <p>Reconnect the ECU switch ignition on. Measure voltage between green -VE lead and yellow +VE lead by inserting the meter probes into the rear of the multi plug.</p> <p>With ECU connected insert meter -VE lead to green wire and meter +VE lead to red wire measure voltage.</p> <p>ECU connected and with leads connected as above; open throttle voltage should steadily increase.</p>	 <p>RR684M</p>	<p>4.3 ± 0.2 volts</p> <hr/> <p>0.3-0.36 volts</p> <hr/> <p>Smooth swing within 0.3 to 4.5 volt range</p>	<p>No reading or low reading; check wiring and connections</p> <hr/> <p>If meter reading drops and suddenly picks up through the voltage range—indicates faulty track—renew potentiometer.</p>														
<p>13. OVER-RUN RELAY Disconnect the negative lead from coil to relay. Ignition off, connect ohmmeter between pin 1 and 30 on relay.</p> <p>Ignition on, connect ohmmeter between pin 1 and 30 on relay.</p> <p>Disconnect the vacuum switch and repeat the above test.</p>	 <p>RR685M</p> <p>to coil -VE</p>	<p>Infinity Ω</p> <hr/> <p>0 Ω</p> <hr/> <p>Infinity Ω</p>	<p>Reading other than infinity; check wiring and connections for security. Substitute relay.</p> <hr/> <p>Readings other than zero; check wiring and connections, renew vacuum switch if necessary.</p> <hr/> <p>Readings other than infinity; renew relay.</p>														

<p>14. AIRFLOW METER (Potentiometer) Reconnect the ECU switch ignition on. Peel back rubber boot on plug. Insert +VE meter probe to pin 6 and -VE lead to pin 9</p> <hr/> <p>Connect -VE meter probe to pin 9 and +VE probe to pin 7 measure voltage</p> <hr/> <p>With leads connected as above gradually open air flap. Voltage should decrease.</p>	 <p>RR714M</p>	<p>1.55 ± 0.1 volts</p> <hr/> <p>3.7 ± 0.1 volts</p> <hr/> <p>1.6 ± 0.1 volts</p>	<p>No reading or low reading; check wiring and connections</p> <hr/> <p>Renew airflow meter if results are not within expected results.</p>
<p>15. AIRFLOW METER (Potentiometer) Disconnect the ECU. Switch ignition on. Peel back electrical plug rubber boot. Insert -VE meter probe to pin 9 and +VE probe to pin 8.</p>	 <p>RR715M</p>	<p>4.3 ± 0.2 volts</p>	<p>If actual results do not meet expected results, renew the airflow meter.</p>

After completing the tests with either the 'Epitest' equipment or AVO meter, retest the vehicle to ensure the faults have been rectified.
If faults still persist, check the ECU by substitution.