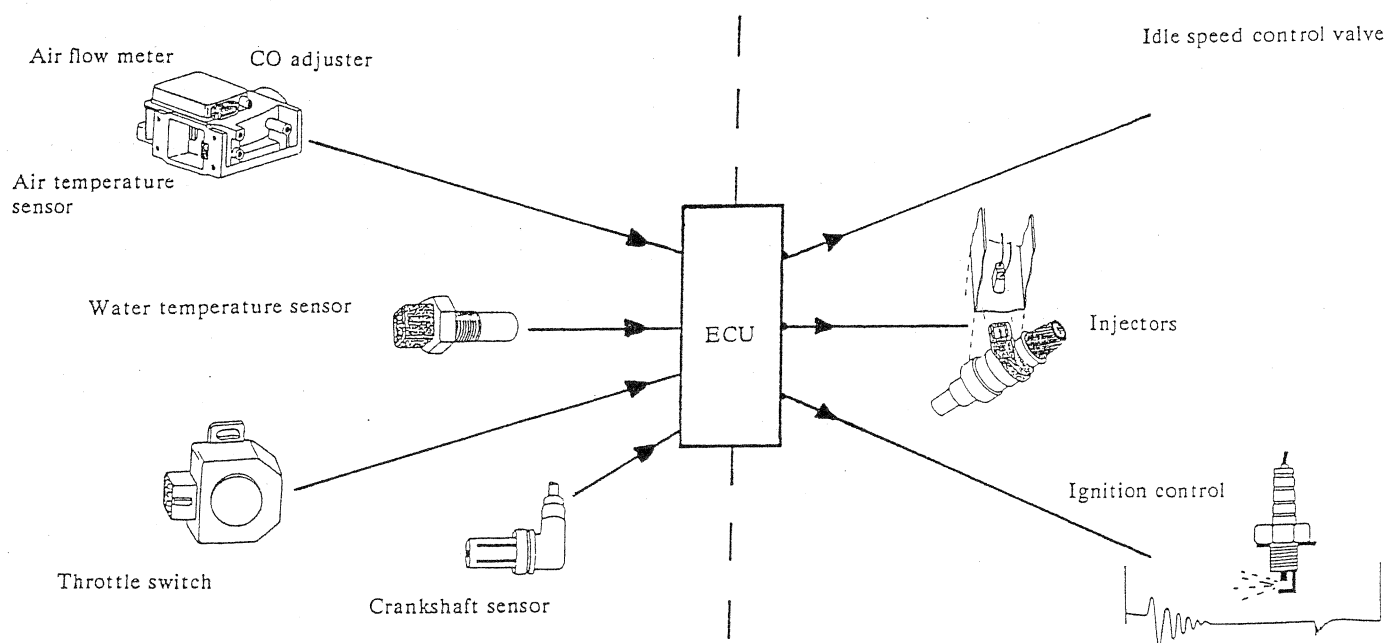


# Vauxhall 2.0 Litre Motronic Injection/Ignition

## System Features

The Vauxhall 2.0 litre engine, introduced for the 1987 model year, was equipped with a Bosch Motronic 4.1 engine management system. Although the vehicle body etc was changed for the 1989 model year, the engine and management system remained basically the same. There was however a change to the management system around the early part of 1990, the Motronic system fitted is now referred to as version 1.5. The most noticeable difference between the 4.1 and the 1.5 is the change from a throttle position switch to a throttle position sensor ie. a variable resistor or potentiometer is used which enables all throttle positions and movement to be identified. Bosch have produced a number of Motronic systems, all of which are essentially an injection system and ignition system controlled by one ECU. Later versions, such as the 4.1 and 1.5 fitted to the Vauxhall 2.0 engine, also control the idle speed control valve as well. The injection side of the system relies on the same principles as those used on the Bosch LE system. The ignition side of the system shares the sensors of the injection system so that accurate timing can be provided by the ECU. The sensors also serve the idle control valve system so that the correct idle speed can be maintained.

The sensors on the Motronic system operate on a supply of approximately 5 volts as opposed to the battery voltage supply of the LE system and for this reason, test specifications will differ in a number of areas. The ignition system operates on the variable dwell angle principle to ensure that the dwell period is correct irrespective of engine speed and supply voltage or current flow through the primary circuit. A current limiting hump is not visible when observing the primary or secondary waveforms however, variations in current flow are accommodated by changes in the actual dwell angle, it. if the current flow is reduced, an increase will occur in the dwell angle.



SYSTEM LAYOUT

## Sensors

The sensors used for the Motronic 4.1 and 1.5 systems are virtually the same as for Bosch LE.

Air flow meter (flap/vane type) incorporating the air temperature sensor. Measures the air flow into the engine and the intake air temperature. The information is used to establish an indication of load enabling mixture and timing corrections to be made.

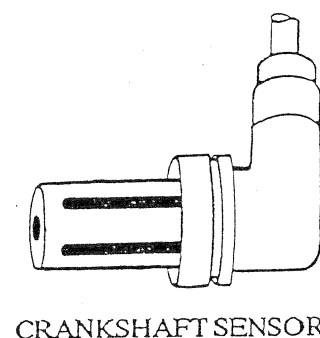
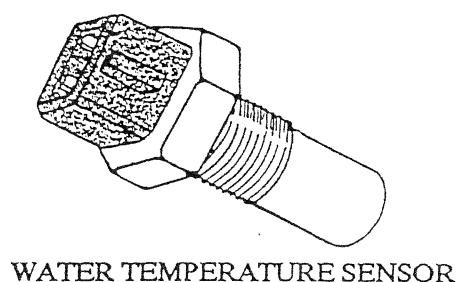
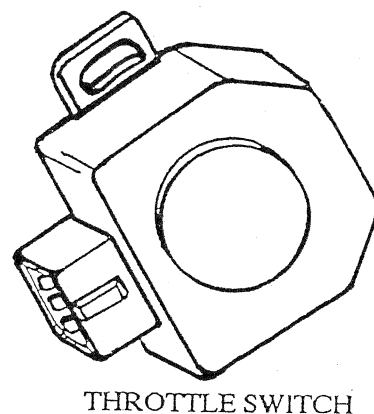
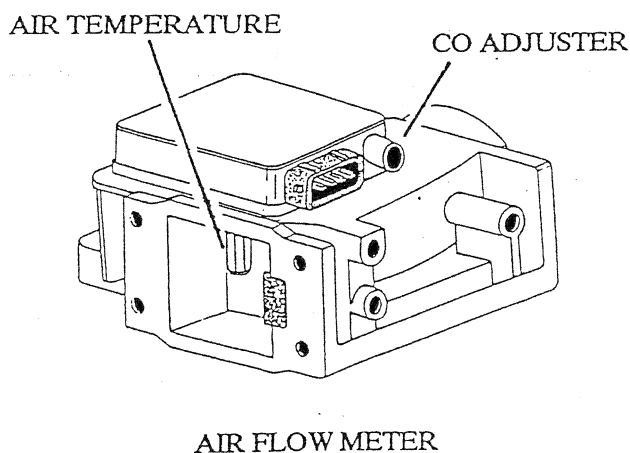
Water temperature sensor. Measures coolant temperature. Indicates engine temperature for fuelling and timing corrections, also enables idle speed control to be adjusted for cold running (fast idle).

Throttle switch (4.1). Indicates idle and high load positions of the throttle. Enables fuelling to be corrected as well as a basic reference for idle so that the idle speed control or injection cut off can be implemented.

Throttle position sensor (1.5). Indicates all throttle positions and throttle movement. As for the throttle switch but with greater accuracy, this enables a better indication of load to be provided for fuelling and ignition purposes.

Crankshaft sensor. Provides a basic reference to crankshaft position as well as engine speed. The reference is used for ignition timing purposes and for providing a triggering reference to the injection system. Accurate crankshaft speed signal also for timing purposes.

CO adjuster. Although not normally regarded as a sensor, the CO adjustment on this application of the Motronic system is achieved by adjustment of a variable resistor or potentiometer. The output voltage from the adjuster is therefore noted by the ECU which then alters the injection signal accordingly to enrich or weaken the mixture. Note that the electrical CO adjuster is located on the air flow meter (Not fitted on vehicles with a catalytic converter).



## Self Diagnosis

The Motronic 4.1 and 1.5 systems are able to provide a fairly reasonable level of self diagnosis. In order to make use of this facility however it is necessary to use a fault code reader which is programmed to function with this system.

Should a fault occur in the engine management system which results in out of range values being passed to the ECU, the engine indicator on the dash board will illuminate with the engine running. In most cases, should a sensor circuit develop a fault, the ECU will supply a basic running program for timing and fuelling which will enable the vehicle to be driven although the engine running may be poor.

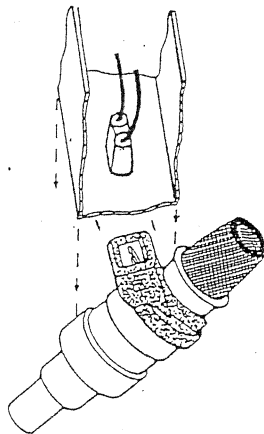
A subsequent bulletin will deal with a number of systems with this facility. Note however that if a fault code is obtained, it usually only indicates an area in which the fault has occurred and basic checks will still be required. Also note that if a sensor or sensor circuit fails but the signal to the ECU is still within the operating range, the fault code will indicate that all is well although the engine may run badly.

## Injection Duration

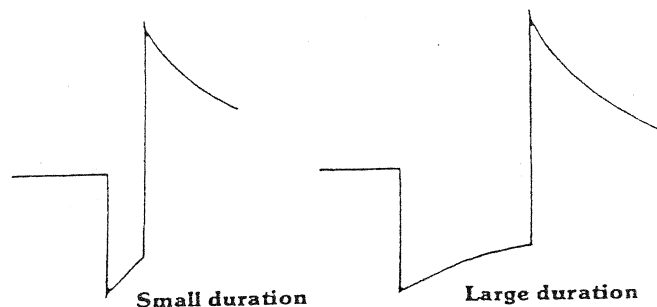
If possible, it is an advantage to establish an injection signal duration value in order to perform a quick diagnosis. Ideally an oscilloscope with a millisecond scale for checking the injection duration should be used but an accurate dwell reading (digital readout) in conjunction with the oscilloscope will suffice for most of the tests.

On this system, it is necessary to remove the plastic cover from the long box which encloses the injector connections. A thin probe will have to be attached to the test lead in order to make contact with the correct injector terminal. Note that the injectors have two terminals and the left hand terminal should provide the expected readings and waveform.

The injector connection terminals are located in the plastic box which sits on top of the injectors. The lid of the box must be lifted to gain access to the terminals.



**FUEL INJECTOR**



**INJECTION WAVEFORM**

## Cold running

With the test lead connected to the injector terminal, start the engine and check the injection duration. The duration may initially be very large due to after start enrichment but it will quickly reduce to a normal level for a cold engine.

Typical injection duration values on a cold engine (approximately 20 deg C coolant temp) after 10 seconds running.

| milliseconds | degrees | (approx)<br>% |                                                |
|--------------|---------|---------------|------------------------------------------------|
| 3-3.5        | 5-6     | 5.5-6.5       | <i>Degrees and % will vary with idle speed</i> |

Values will be larger for a colder engine and lower for a warmer engine.

If the duration is too large or too small, check the coolant temperature sensor and the air flow meter for a sticking flap. Also note that minor changes can occur to the duration values if the throttle switch/sensor is incorrectly set or faulty.

## Hot running

Perform the same test as detailed for a cold engine but note that the duration values should be less.

Typical injection duration values on a hot engine (approximately 80 deg C coolant temp) after 10 seconds running.

| milliseconds | degrees | (approx)<br>% |
|--------------|---------|---------------|
| 2.5          | 3.5     | 4.0           |

Values will be larger for a colder engine and lower for a warmer engine.

If the duration is too large or too small, check the coolant temperature sensor and the air flow meter for a sticking flap. Also note that minor changes can occur to the duration values if the throttle switch/sensor is incorrectly set or faulty.

## Cranking test

If the engine does not start, carry out an injection duration check during cranking. It is possible however, if there is no ignition, that some items of test equipment may not be able to provide a stable waveform due to the lack of an ignition trigger or reference.

If the injection or engine management system is faulty, preventing the engine from even attempting to start, it is likely that a major fault exists in which case there is unlikely to be any injection signal at all. If one of the sensors is faulty (except the crankshaft sensor) it is likely that the engine will attempt to start enabling an injection duration to be checked or at least established.

Typical injection duration values on a hot engine (approximately 80 deg C coolant temp) during cranking.

| milliseconds | degrees | %  |                                                    |
|--------------|---------|----|----------------------------------------------------|
| 2.5+         | 2+      | 2+ | <i>Degrees and % will vary with cranking speed</i> |

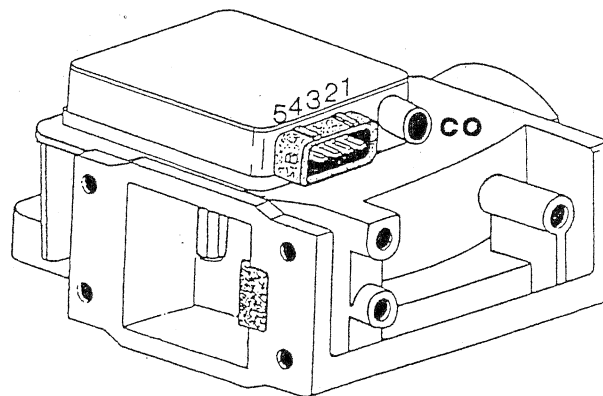
Values will be larger for a colder engine and lower for a warmer engine.

If the duration is too large or too small, check the coolant temperature sensor and the air flow meter for a sticking flap. Also note that minor changes can occur to the duration values if the throttle switch/sensor is incorrectly set or faulty.

If there is no injection duration or waveform at all, it is likely that either the crankshaft sensor or circuit is at fault or there is an ECU failure. If the crankshaft sensor is faulty, there will be no ignition and this is also possible if part of the ECU has failed. Refer to crankshaft sensor and ECU checks.°

## AIR FLOW METER, CO ADJUSTER AND AIR TEMPERATURE SENSOR

The air flow meter operates in the same way as the type fitted to the LE system but it operates on a 5 volt supply. By peeling back the rubber cover on the air flow meter plug, it is possible to gain access to the air flow meter terminals while the management system is functioning.



### AIR FLOW METER AND TERMINALS

- (1) Check for approximately 5 volts with the ignition switched on or the engine running at terminal 3 of the plug. If there is no voltage, check the wiring back to the ECU terminal 9.
- (2) Check with the ignition on for Zero volts on the earth circuit at terminal 4 and if voltage exists, it is likely that the wire is not connected to the ECU terminal 6. In all cases, ensure that the plug terminal makes a good contact to the air flow meter.

- (3) Check with the ignition on for approximately 2.5 to 3 volts at terminal 5. This is the air temperature voltage which may vary slightly with differences in the air temperature. If there is no voltage, check for a good connection to terminal 22 of the ECU. If the voltage is approximately 5 volts, carry out resistance checks on the air flow meter as detailed below. Also recheck the air flow meter earth connection.
- (4) Check with the ignition on at terminal 2 for a reading of approximately 0.2 to 0.3 volts (if available use an oscilloscope with low voltage waveform facility). Start the engine and allow the engine to idle. On a warm engine (normal idle speed), the voltage should increase to approximately 0.75 to 1 volt and on a cold engine (fast idle) the voltage is likely to be around 1 volt or more. Slowly increase the engine speed and note that the voltage should increase at the same time as the speed increases. Also quickly snap the throttle open and check that the voltage rises quickly.

If there is no voltage, carry out resistance checks on the air flow meter. If the voltage readings do not increase to approximately the expected values, check for free movement of the air flow meter sensing flap and also carry out resistance checks. If the voltage readings are slow to increase, this normally indicates a sticking flap but note that digital volt meters and digitised oscilloscopes may provide a slight delay in the changes of voltage readings.

Snap open the throttle and check that the voltage increases. The exact value will depend on how hard and quickly the throttle is opened but expect at least 3 volts and possibly as high as 4.5 volts. If there is no increase, or if the increase is very low or slow, suspect the air flow meter and carry out the resistance checks below.

- (5) Check with the ignition on at terminal 1 for approximately 2.5 to 3 volts. This is the voltage level affected by the position of the CO adjuster. If the voltage is greater than 4.5 or is too low, this will result in fault being detected by the ECU which will illuminate the dash board light.

The CO adjuster should be set so that the voltage is approximately 2.5 but it is sometimes necessary to set the value at around 2.8 to 3 volts to achieve reasonable idle performance. Note that the blanking plug will have to be removed from the adjuster and the adjusting screw should not be subjected to any pressure. The screw also requires a large amount of movement to achieve any noticeable alteration to the setting. The blanking plug should be replaced or renewed after adjustment.

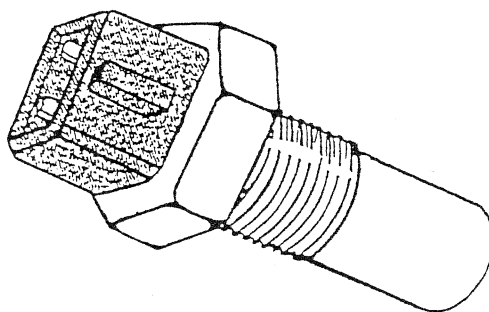
- (6) If any of the above checks produce incorrect voltage readings which may indicate an air flow meter fault, a number of resistance checks can be carried out to assist in proving the fault.

Disconnect the plug from the air flow meter and connect an ohm meter between terminals 2 and 3 of the air flow meter. This measurement should alter as the air flow meter flap opens. The resistance with the flap in the closed position will be very low (typically around 400 ohms) and it will increase as the flap is opened. Note however the resistance value will increase and decrease as the flap is progressively opened, a maximum value as high as 2,500 ohms may occur. If a fault exists in the resistive track, it is likely that an open circuit reading will occur at some stage during the movement of the flap. If this occurs or if the resistance is too far out of specification, the air flow meter should be changed.

- (7) Check the resistance between air flow meter terminals 1 and 3, this is the resistance across the CO adjuster potentiometer. The resistance should progressively increase or decrease as the CO adjuster is turned. The maximum and minimum values are between zero and approximately 550 ohms but a typical reading is around 250 ohms. If the resistance reading is short or open circuit at any stage (except for the zero ohms at one end of the adjuster travel), it will be necessary to renew the whole assembly.
- (8) Check the resistance between the air flow meter terminals 5 and 4, this is the resistance across the air temperature sensor. The reading will vary with the temperature but at 0 deg C the resistance will be approximately 6,000 ohms the value can decrease to lower than 1,500 ohms if the air temperature is high. If the resistance is incorrect or does not alter with changes in air temperature, the whole assembly should be changed but note that a faulty sensor will normally be indicated by an open or short circuit reading.
- Note that to change the temperature, warm air can be blown over the sensor (do not use a naked flame) or a freezer spray could be used to reduce the temperature of the sensor.
- (9) Check the resistance between terminal 3 and 4, this checks the continuity between the input and earth connection of the resistive track and internal circuits. A reading of around 300 ohms to just under 600 ohms is expected. If an open or short circuit reading is obtained or if the reading is too far out of specification, the air flow meter should be replaced.
- (10) Check with the ignition switched on and the plug disconnected from the air flow meter for approximately 5 volts on terminal 3 and 5 of the connector plug. Terminal 3 is the supply for the air flow meter and CO adjuster, terminal 5 is the feed for the air temperature sensor. If either of the two readings are incorrect, check the wiring to the ECU noting that terminal 3 on the air flow meter connects to ECU terminal 9 and air flow meter terminal 5 connects to ECU terminal 22. If the wiring is good, check the ECU.

## WATER TEMPERATURE SENSOR

The water temperature sensor functions by altering its resistance with changes in coolant temperature. The sensor resistance will be high with cold temperatures and low with hot temperatures. The changes in resistance alters the voltage between the sensor and the ECU. On the Vauxhall engine, the sensor is located on the cylinder head just behind the alternator.



WATER TEMPERATURE SENSOR

- (1) Roll back the rubber protection cover on the sensor plug and check the voltage on the two terminals of the sensor. One terminal is the earth connection which should have a zero volt reading. The second terminal voltage will depend on temperature but note that on a hot engine the voltage will be low (approximately 0.7 volts) and when the engine is cold, the voltage will be higher (as high as 4 volts but this will still depend on exact temperature).
- (2) If the voltage does not alter as the engine warms up from cold or if the reading appears to be incorrect at any temperature, disconnect the plug from the sensor and check for a supply of approximately 5 volts to the plug with the ignition on. Also check for continuity to earth on the second terminal and correct as necessary. If the voltage is not available, check the wiring back to terminal 13 of the ECU and if OK, check the ECU.
- (3) If the wiring and voltages are good, check the resistance across the terminals of the sensor and compare against the chart below for various water temperatures. Note that it may be more convenient to remove the sensor and place it in water of various temperatures to establish a change in the sensors resistance. If the readings are incorrect or do not alter, replace the sensor.

| Temp (Deg C) | Typical resistance (Ohms) |
|--------------|---------------------------|
| 10           | 5,000                     |
| 20           | 2,000                     |
| 80           | 275 to 350                |

- (4) It is possible to carry out a simulation test by substituting a variable resistor at the sensor connector plug. For this system a resistance range of zero to 10,000 ohms will be suitable. With the resistor connected and the engine running (set the resistance to suit the engine temperature for starting), the resistance can be adjusted which should then cause the mixture to go rich (higher resistance) and weak (lower resistance). The change should also be detected by observing the injection waveform or duration which should increase for rich mixture and decrease for weak mixture.

When simulating, as a cold value is selected on the variable resistor, the idle speed control valve should also be affected which should result in an increase in the idle speed.

Note that the ECU will respond to a very low resistance or a very high resistance by illuminating the engine warning light, this indicates that the sensor values are out of tolerance. When adjusting the variable resistor therefore, note that it is possible reduce the resistance to a level below an accepted value which will illuminate the warning light.

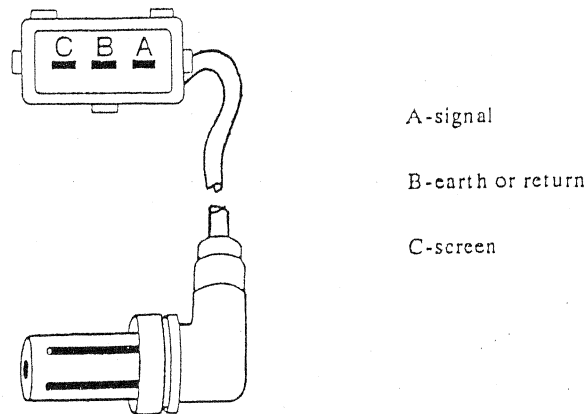
- (5) If there is no change in mixture or injection duration during the simulation test, check the connection to earth for one of the sensor wires and to ECU terminal 13 for the remaining wire. If the wiring is OK, suspect the ECU.

## CRANKSHAFT SENSOR

The crankshaft sensor is located adjacent to the front engine mount on the Vauxhall 2.0 engine. It indicates the speed and position of the crankshaft for timing and fuelling correction. The sensor is

connected to the ECU by 2 wires but a third wire is used as a protective screen. Access to the wiring can be gained via a connector plug which is located near to the top of the timing belt cover at the front of the engine.

The sensor should normally only require testing if the engine is difficult to start or will not start. There is a remote possibility however that misfires or poor running could be caused by a sensor related fault.



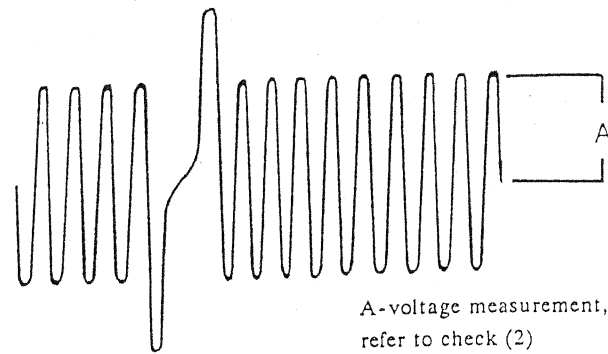
### CRANKSHAFT SENSOR AND CONNECTOR PLUG TERMINALS

- (1) Roll back the protective cover on the connector plug which will expose the 3 wires or terminals. Connect an oscilloscope or AC volt meter test lead to each of the 3 wires in turn and crank or run the engine. A zero volt reading or no waveform should be obtained from 2 of the wires, these are the earth connection through the ECU and the screen wire. The third wire should provide a waveform or an AC volt reading.
- (2) The waveform should be similar to the illustration and note that there is a series of pulses, with an occasional pulse which serves as a master reference. The voltage of the series of pulses will depend on engine speed but typically at cranking speed, expect approximately 2.5 volts or more as indicated on the illustration.

If an AC volt meter is used, the voltage reading is generally slightly below the voltage indicated on the waveform and a typical value of around 1.5 volts or more is acceptable at cranking speed.

Note that if the engine is running, some test equipment may slightly affect the running of the engine when connected to the sensor and in extreme cases cause the engine to stop. Increasing the rpm before connecting the test lead usually enables the checks to be performed. Also note that as the speed is increased, the voltage produced by the sensor increases.

- (3) If there is no voltage reading or waveform, disconnect the 2 halves of the connector plug and check the resistance of the crankshaft sensor. Connect an ohm meter probe to one of the end wires of the plug leading to the sensor and the other probe to the remaining wires in turn. A reading should be obtained between 2 of the wires of approximately 600 ohms but note that a faulty sensor is normally indicated by an open or short circuit reading.



### CRANKSHAFT SENSOR WAVEFORM

- (4) If there appears to be a fault at the sensor, check the wiring from the plug to the sensor and if good, renew the sensor. If the sensor appears to be OK, check the wiring to the ECU from the other half of the sensor plug. Terminals 25 and 23 are the sensor connections, and the screen is connected to terminal 5 and to earth.
- (5) Although unlikely to occur, check that the sensor is not being affected by a build up of metal. It will be necessary to remove the sensor from the engine to check for this problem.

### THROTTLE SWITCH

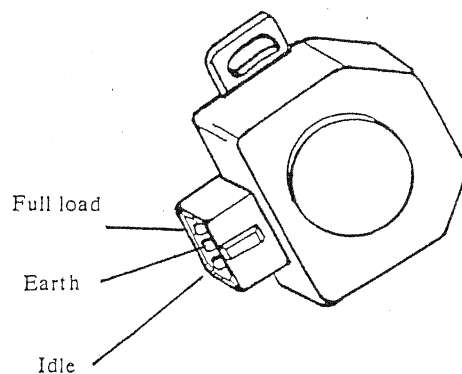
The throttle switch indicates 3 effective throttle positions to the ECU ie, idle, full load and part load. Idle and full load indications are provided by 2 sets of contacts which close either at idle or when the throttle is approaching the full load position. The part load position exists when neither of the contacts are closed. Because the system operates with approximately a 5 volt supply to the sensors, unlike many other Bosch systems, the voltage to the throttle switch is also 5 volts. On this system in fact, each of the contacts form part of an earth circuit from the ECU and therefore there is 5 volts available to each of the contacts. When a set of contacts close, the circuit is completed through to earth and the voltage is then zero on that part of the circuit. This is similar in principle to checking the voltage at the negative side of an ignition coil with the points open, and then closed.

- (1) Disconnect the plug from the throttle switch and with the ignition switched on, check for approximately 5 volts at each of the outside terminals of the plug. If there is no voltage, check the wiring through to the ECU terminals 2 and 3. Check that the centre terminal of the plug has a good connection through to earth.

- (2) With the plug still disconnected, Use an ohm meter to check for continuity between the centre terminal of the switch and one of the outside terminals when the throttle is closed. If there is no continuity at either of the terminals, it will be necessary to adjust the switch until the idle contacts close which should then result in continuity between the centre terminal and one of the outside terminals.

Having established which of the terminals is for idle, check from the centre terminal to the remaining outside terminal and open the throttle. The contacts should close as the throttle is approaching the fully open position which will be indicated by continuity or zero ohms on the meter.

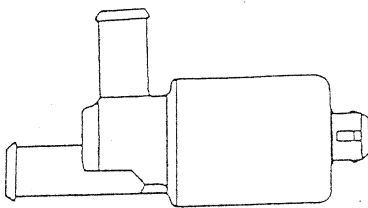
If in either case the contacts do not appear to close or if there is a resistance across the contacts of more than 7 or 8 ohms, the switch should be replaced.



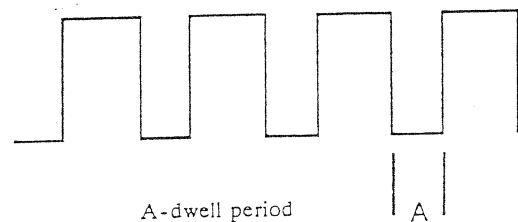
**THROTTLE SWITCH**

### **IDLE SPEED CONTROL VALVE**

NB. The valve is spring loaded to the closed position if there is an electrical failure but, in this situation, the valve will still provide a slightly fast idle.



**IDLE SPEED CONTROL VALVE**



**IDLE SPEED CONTROL WAVEFORM**

- (1) With the engine idling at normal temperature, switch on the headlights, heated rear window and heater fan. The engine speed may momentarily drop but should then quickly be restored to its normal speed. If the speed is not maintained, carry out checks as outlined below.
- (2) Connect a dwell meter or oscilloscope to the 2 terminals in turn of the idle speed control valve. Gain access to the terminals by peeling back the protection cover on the plug. One of the terminals will provide a dwell reading or waveform and the other terminal should not indicate anything other than battery voltage.
- (3) The dwell reading will typically be around 40 degrees (approximately 44%) with no load applied. Apply electrical load as in check (1) and note that the dwell reading should increase to approximately 44 degrees or more, this is indicated on the waveform by an increase in pulse width.
- (4) If there is no reading or waveform, ensure that there is a battery voltage supply to the valve on one of the wires. The voltage supply is from the main relay terminal 87. If the supply is good, check the resistance across the 2 terminals of the valve (plug disconnected) and expect a reading of approximately 8 ohms. If the reading is incorrect, replace the valve.

Also check the wiring from the signal wire back to the ECU terminal 33. If the checks do not prove a fault, suspect the ECU.

- (5) If a waveform or dwell reading is available but it is excessively large or small, it is likely that the valve is seized or inoperative which will force the ECU to provide an excessive large or small dwell value in an attempt to restore the idle speed. If this is the case, check the valve for sticking and excessive build up of dirt.
- (6) By carrying out the simulation test as detailed for the water temperature sensor, it is possible to establish whether the valve responds to a cold engine signal. As a cold engine value is selected via the variable resistor, the valve should open and provide a fast idle, also note that the dwell value should increase.

## WIRING CHECKS

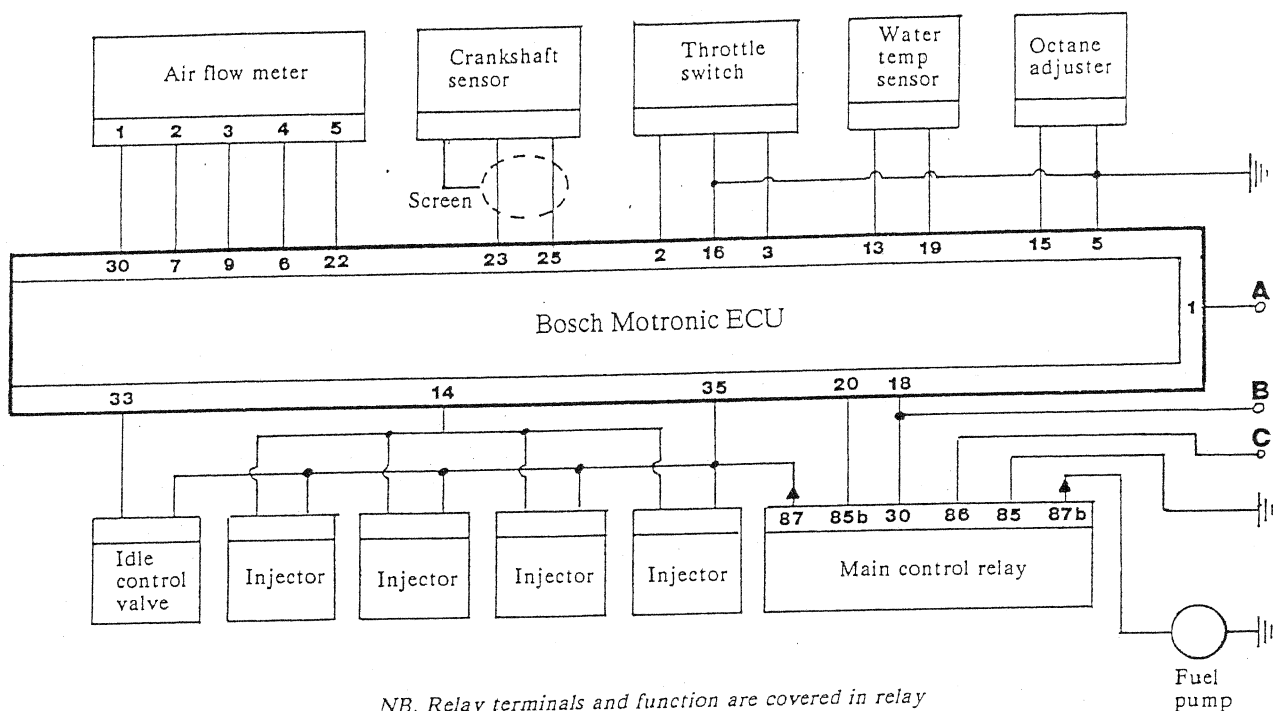
The wiring diagram should be referred to for carrying out continuity checks on the circuits. Always disconnect the multi plug from the ECU and any other relevant connector plugs when carrying out resistance or continuity tests. If any voltage checks are carried out, note that supply voltages from the relays are at battery voltage and supply voltages from the ECU to the sensors are approximately 5 volts. Also ensure that the ECU earth connections are good.

NB. Due to the complexity of the wiring for the Motronic system, the diagram below has been simplified to enable basic continuity checks to be established between components and the relevant ECU terminals. The earth connections shown on the wiring diagram indicate that a wire or terminal is connected to an earth point. The connections may not necessarily join together exactly as illustrated on the diagram.

A-To terminal 1 of the ignition coil (ECU switches coil circuit on and off)

B-Direct supply from battery positive terminal

C-Live from ignition switch in 'run' and 'crank' positions.



NB. Relay terminals and function are covered in relay checks

### SCHEMATIC WIRING DIAGRAM

## VAUXHALL ENGINES FITTED WITH BOSCH MOTRONIC 1.5

The main bulletin covers the Bosch Motronic 4.1 ignition/injection system as used on the Vauxhall 2.0 litre engines. During late 1989, a revised version of the system was introduced and is referred to as the Motronic 1.5. Other versions have also been introduced (onto some models) which have more substantial differences compared to the original system and will therefore require a more in-depth bulletin.

The 1.5 system is in principle the same as the 4.1 version but there are a few notable changes. The throttle switch of the old version is replaced with a throttle position sensor which is a variable resistance type (potentiometer). The switch was only able to indicate idle, full load or part load but the variable resistance type can provide information on all throttle positions and the rate of change of throttle movement.

Less obvious is the change in the injector wiring on the 4 cylinder engines where the injectors are now connected to the ECU in two groups of two. On the older system they were all connected to the ECU at one terminal.

The ECU now has a 55 terminal connector plug compared with the older type 35 terminal plug. This allows additional components to be wired to the ECU. It is quite likely that when encountering vehicles produced from around 1991 onwards, it may be equipped with a catalytic converter, Lambda (oxygen) sensor and a fuel tank vent valve.

### THROTTLE POSITION SENSOR

The throttle position sensor is a variable resistor with three connections to the ECU. One connection is the 5 volt supply to the start of the resistance track, the second terminal is the earth connection at the other end of the track and the remaining connection is the signal connection. The signal connection also has 5 volts available to it from the ECU and when it is disconnected from the sensor this terminal on the plug will provide a reading of 5 volts. Note that the 5 volts is not a power supply, the signal wire is part of an earth circuit from the ECU and when it is disconnected from the sensor, there is no path to earth therefore the available voltage is measured.

However, if the wire was connected to earth, the circuit would be earthed and the reading would be zero volts. On this particular application, to reach earth the current flow must pass through the resistor track in the sensor. Depending on the resistance of the track, a portion of the voltage will pass through to earth and the remainder will still be measured at the terminal. The exact resistance will vary depending on the position of the throttle and this results in a changing voltage at the terminal as the throttle is opened and closed.

- (1) Disconnect the plug from the throttle position sensor and with the ignition on check for approximately 5 volts at terminal 1 and 3, a minimum value of 4.9 volts is acceptable.

If there is no voltage, check the wiring back to the ECU plug terminals. Sensor terminal 1 connects to ECU terminal 26, sensor terminal 3 connects to ECU terminal 53.

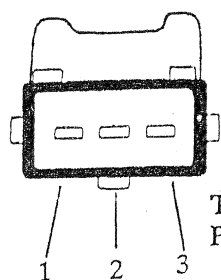
Also repeat the checks using plug terminal 2 as the connection for the earth probe of the test equipment, the readings should be the same although a very slightly lower reading may occur. If there is now no reading or it is less than 4.9 volts, check the wiring between terminal 2 and the ECU terminal 12. If there is still no reading refer to the wiring diagram, check the ECU earth connections and if good suspect the ECU.

- (2) Reconnect the sensor plug and check the voltage at terminal 2 by accessing the back of the connector plug. Note that the voltage should increase as the throttle is opened. The voltage at the idle position should be between 0.12 and 1.22 volts. This reading should not alter unless the sensor is faulty or the throttle butterfly set screw has been adjusted incorrectly. Note that the set screw should not be altered to achieve a change in the idle speed.

At full throttle, the voltage at terminal 2 should be around 3.90 to 4.95 volts. If the voltage does not change or it does not increase progressively, it indicates a sensor fault.

- (3) A resistance check can be carried out between terminals 1 and 2 of the throttle sensor with the plug disconnected, typical values are around 2 K ohms.

Check between 1 and 3 or 2 and 3, the resistance should increase or decrease as the throttle is opened. If there is an open circuit or the change is not progressive or, it is fluctuating, renew the sensor.



THROTTLE POSITION SENSOR  
PLUG TERMINALS

There are a number of other terminals on the ECU that may be used depending on the application and specifications, the following are some of the terminals that may be used and any variations that might exist.

6-----LCD instuments, 4WD and auto box

9-----Speedo/mileage frequency sensor

20-----Is not connected on cars with  
catalytic converters

21-----Auto box

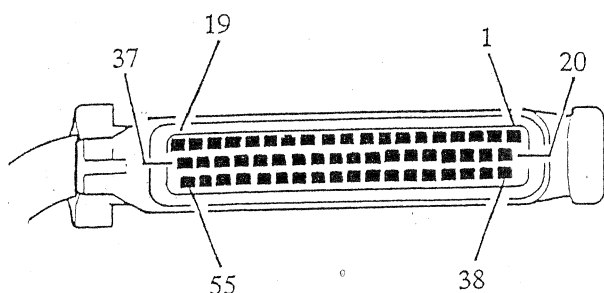
22-----Instuments

34 & 51---Auto box

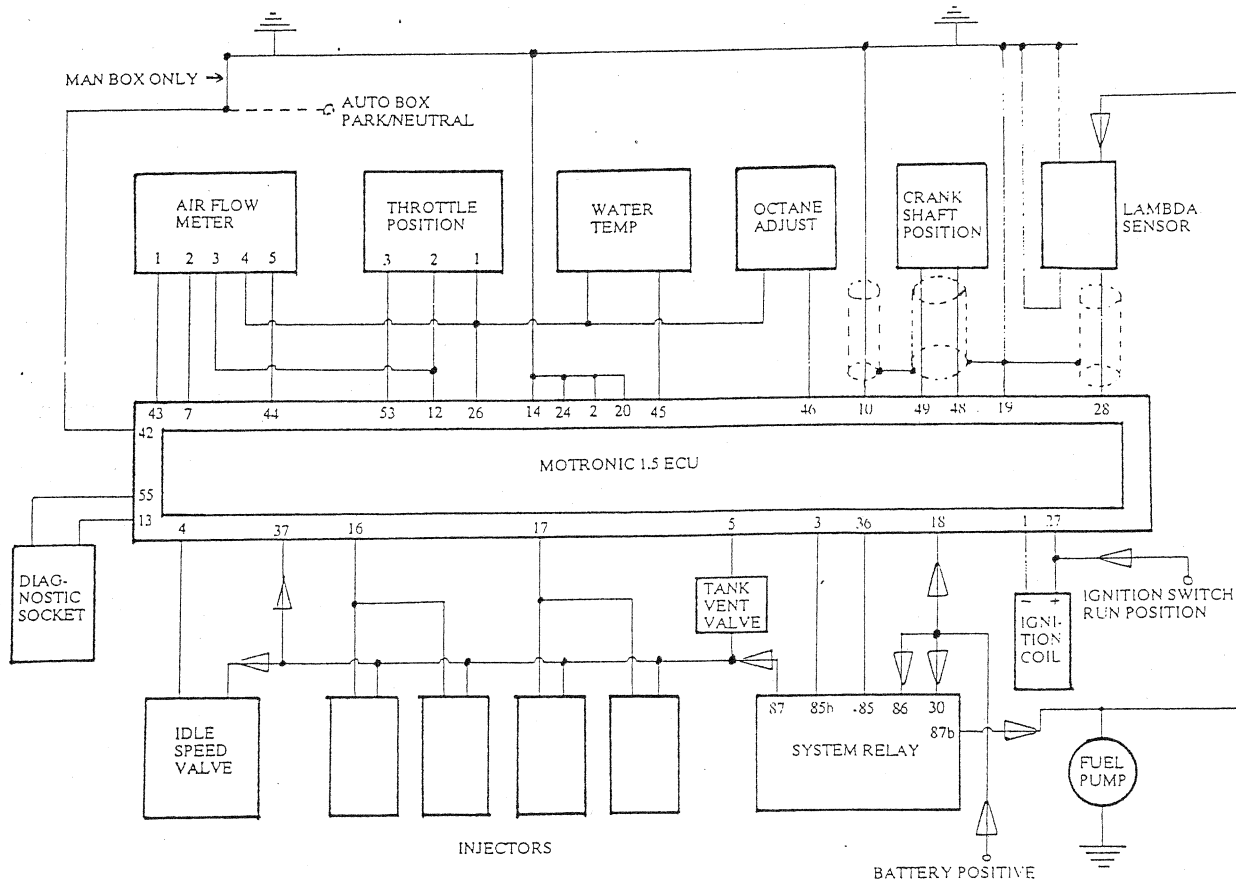
40 & 41---Air conditioning

47-----4WD

The fuel tank canister vent valve is not usually fitted unless the vehicle is fitted with catalytic converter and Lambda sensor emission devices.



ECU PLUG TERMINALS



MOTRONIC WIRING (1.5 version only)

### MOTRONIC 1.5 ECU PIN IDENTIFICATION

1. Negative side of coil.
2. Earth.
3. Control circuit for fuel pump (from relay pin 85B)
4. Pulsed side of Rotary Idle Valve.
5. Pulsed side of Tank Vent Valve.
6. 4WD ECU - A/T ECU - Fuel Tell-Tale lamp.
7. Load signal output from air-low meter.
8. -
9. Speedo, mileage frequency sensor.
10. Earth.
11. -
12. 5V supply to air-flow meter & Throttle potentiometer.
13. Diagnostic socket supply.
14. Earth.
15. -
16. Pulsed side of injectors. (Bank of Two).
17. Pulsed side of injectors. (Bank of Two).
18. Permanent live - keep alive memory.
19. Earth.
20. <sup>NOT</sup> Earth. (For vehicles fitted with 'Catalyser'.)
21. Earth. (For vehicles fitted with 'A/T'.)
22. Engine tell-tale warning light.
23. -
24. Earth.
25. -
26. Earth <sup>VIA ECU</sup>
27. Ignition feed.
28. Output from Lambda sensor.
29. -
30. -
31. -
32. Output to on-board computer.
33. -
34. A/T ECU.
35. -
36. Control circuit for supply to auxiliaries and ECU (from relay pin 85).
37. Supply to ECU & to on-board computer.

- 38. -
- 39. -
- 40. A/C
- 41. A/C.
- 42. Earth for manual transmission only.
- 43. Output from CO potentiometer - Not fitted with Catalyser.
- 44. Output from NTC 1.
- 45. Output from NTC 2.
- 46. Octane plug input.
- 47. Earth for vehicles fitted with 4WD.
- 48. Output from crankshaft sensor.
- 49. Output from crankshaft sensor.
- 50. -
- 51. A/T ECU.
- 52. -
- 53. Output from throttle potentiometer.
- 54. -
- 55. Earth for diagnostic socket.

