INJECTION MANAGEMENT

The ECU receives information on rpm (n) and throttle valve opening (alpha) and is then able to identify base pulse constant (ti) within a specific map.

Under various different engine service conditions, injector opening times are optimised by correcting times (in accordance with changing conditions) of: coolant temperature (1), air temperature (2) and signal received from lambda probe (3). Injection is synchronous at all times, i.e. timed to coincide with the moment of ignition.

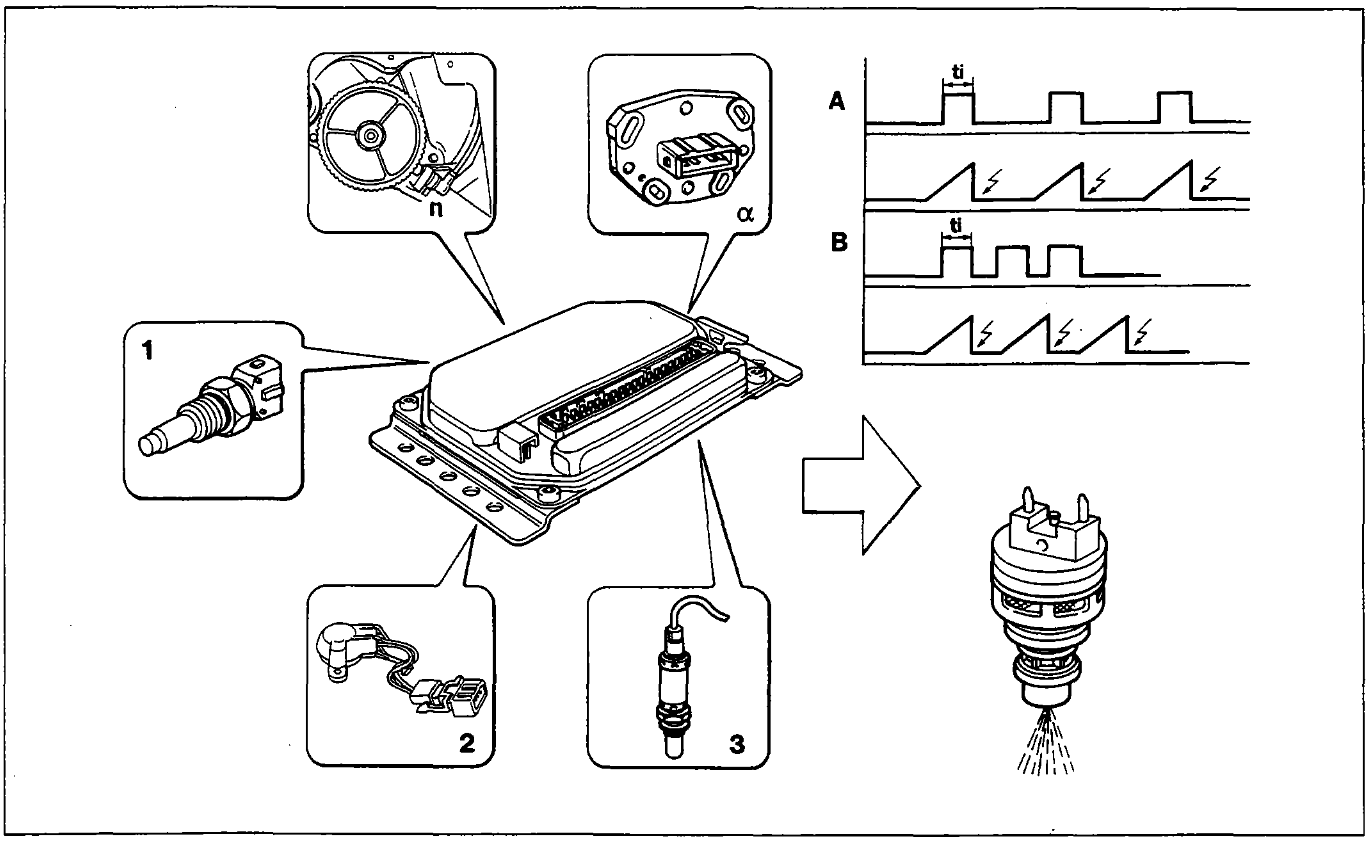
The ECU uses specially selected maps to keep fuel mixture concentration close to stoichiometric levels (14.7 parts air to 1 part petrol).

To maintain this ratio constant, **the ECU uses two different modes for the control of injector opening.**

The first mode is **synchronous operation, where the injector is opened whenever a high tension pulse is sent to the spark plugs** (graph A).

The second control mode is **asynchronous operation, where the ECU controls injector opening regardless of the number of high tension pulses sent to the spark plugs** (graph B).

This occurs because under certain conditions (with base pulse constants too short, ⩾ 1.4 milliseconds) mechcanical inertia characteristics (hysteresis) of the injector do not permit proper opening and closure. For this reason, a specific strategy must be adopted to suit mechanical injector properties.



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Controlling supply to fuel pump

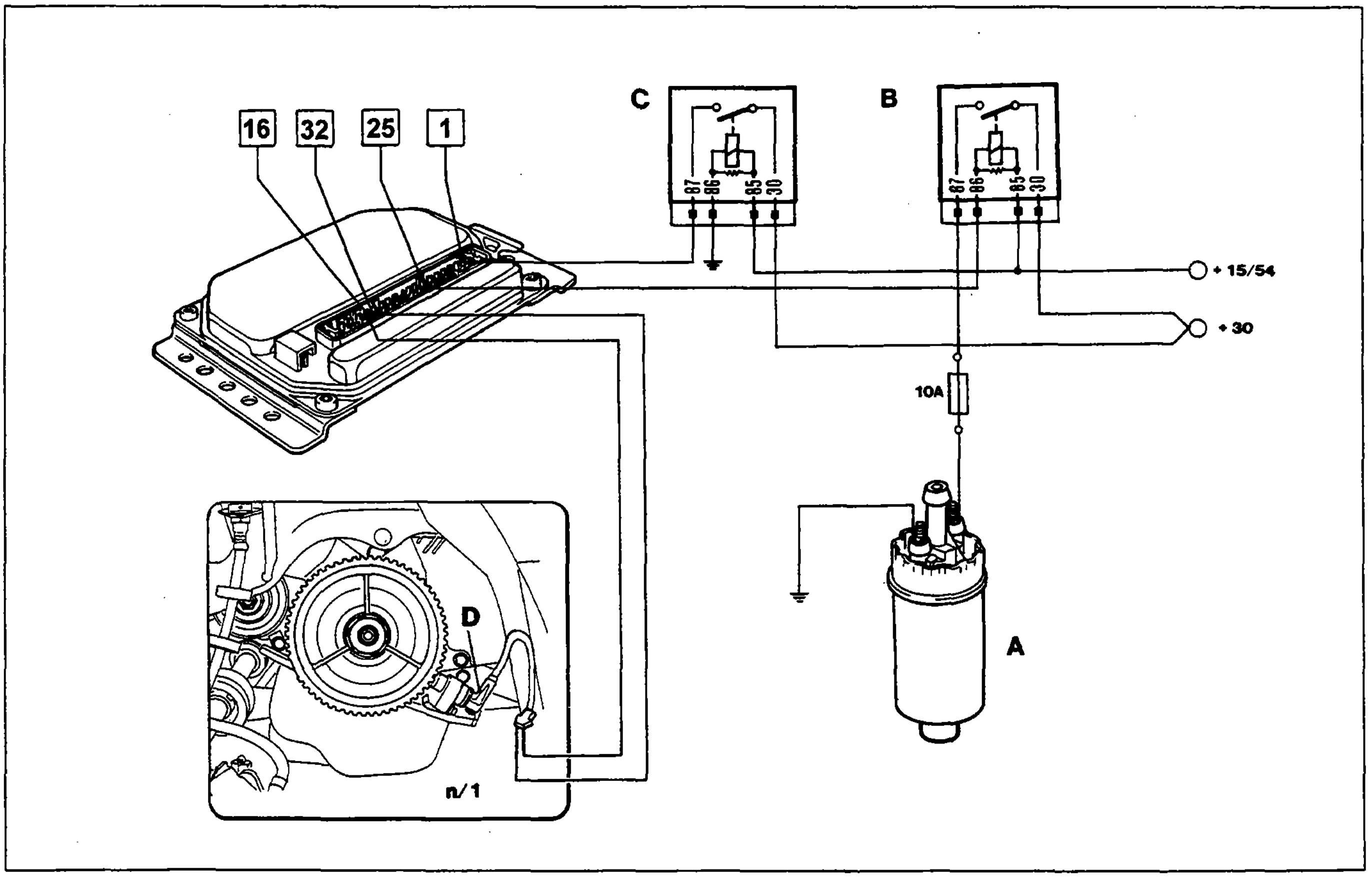
Control of fuel pump (A) is through the ECU which is responsible for turning on pump, by means of relay (B), during start-up and normal engine operation.

With ignition switch in MAR position (15/54), power is supplied simultaneously to pump relay (B) and main relay (C), which closes to provide power to the ECU (terminal 1).

A special circuit in the ECU earths pump relay (B) through terminal (25), which in turn supplies fuel pump (A) with power through a 10 A fuse. The pump puts the fuel system under pressure for about 1 - 2 seconds.

When the engine is started up, an rpm signal from rpm and TDC sensor (D) reaches terminals (16 and 32) of the ECU. After about 1 second, relay (B) is activated and the pump thus stops (for safety reasons) even with the ignition switch in MAR position.
If battery voltage drops below rated level (e.g. during cold starting), the fuel feed pressure tends to drop.

To overcome this drawback, the ECU increases injection time proportionally in accordance with a correction factor to ensure accurate fuel metering at all times.



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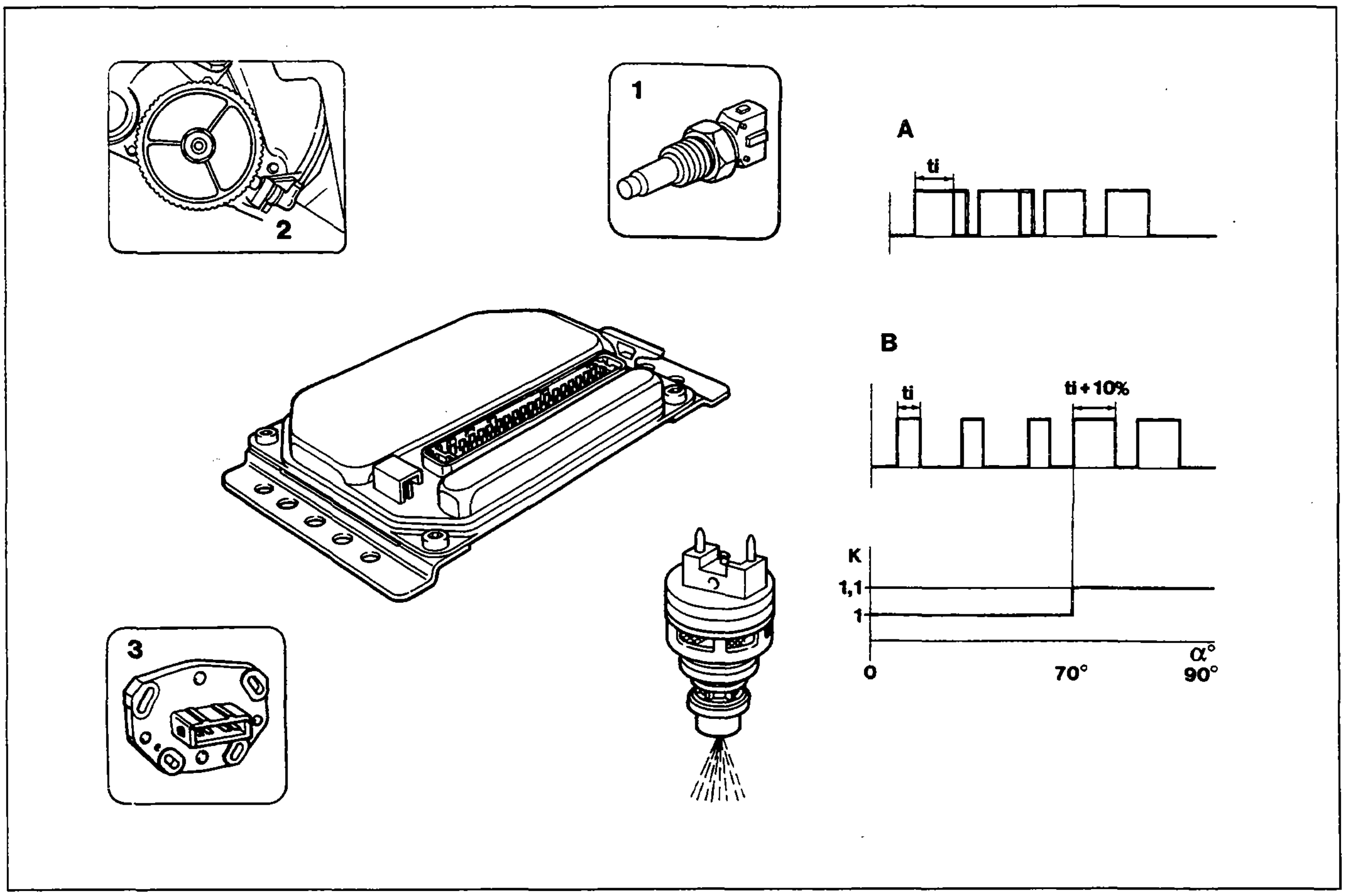
Acceleration and full power

During acceleration, the electronic control unit brings about enrichment of the mixture concentration (graph A) as a function of signals from the coolant temperature sensor (1), rpm sensor (2) and throttle valve angular position sensor (3).

When the engine is working at full power, base pulse constnants (ti) are increased by a factor (K) according to opening angle (α) of throttle valve (3).

When the butterfly valve opening angle exceeds 70° (graph B), fuel power enrichment comes into operation and increases base pulse constant by about 10%.

When rpm exceeds 6000/min, the control unit restricts maximum rpm (suppressing injection pulses by cutting off the fuel supply).



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IGNITION MANAGEMENT

The ignition system is solid-state distribution type. In other words, moving parts are eliminated by doing away with a high tension distributor (case-brush-cap).

Coil (B) is fitted with four high tension outlets connected directly to the spark plugs. Their operation is managed entirely by control unit (A).

The control unit contains (in addition to fuel metering control parameters) a memory map (C) containing a set of optimal advance angles that can be used by the engine according to service conditions: engine load (α) and rpm (n).

The mapped values are obtained experimentally on a bench taking into account power, fuel consumption and polluting emissions.

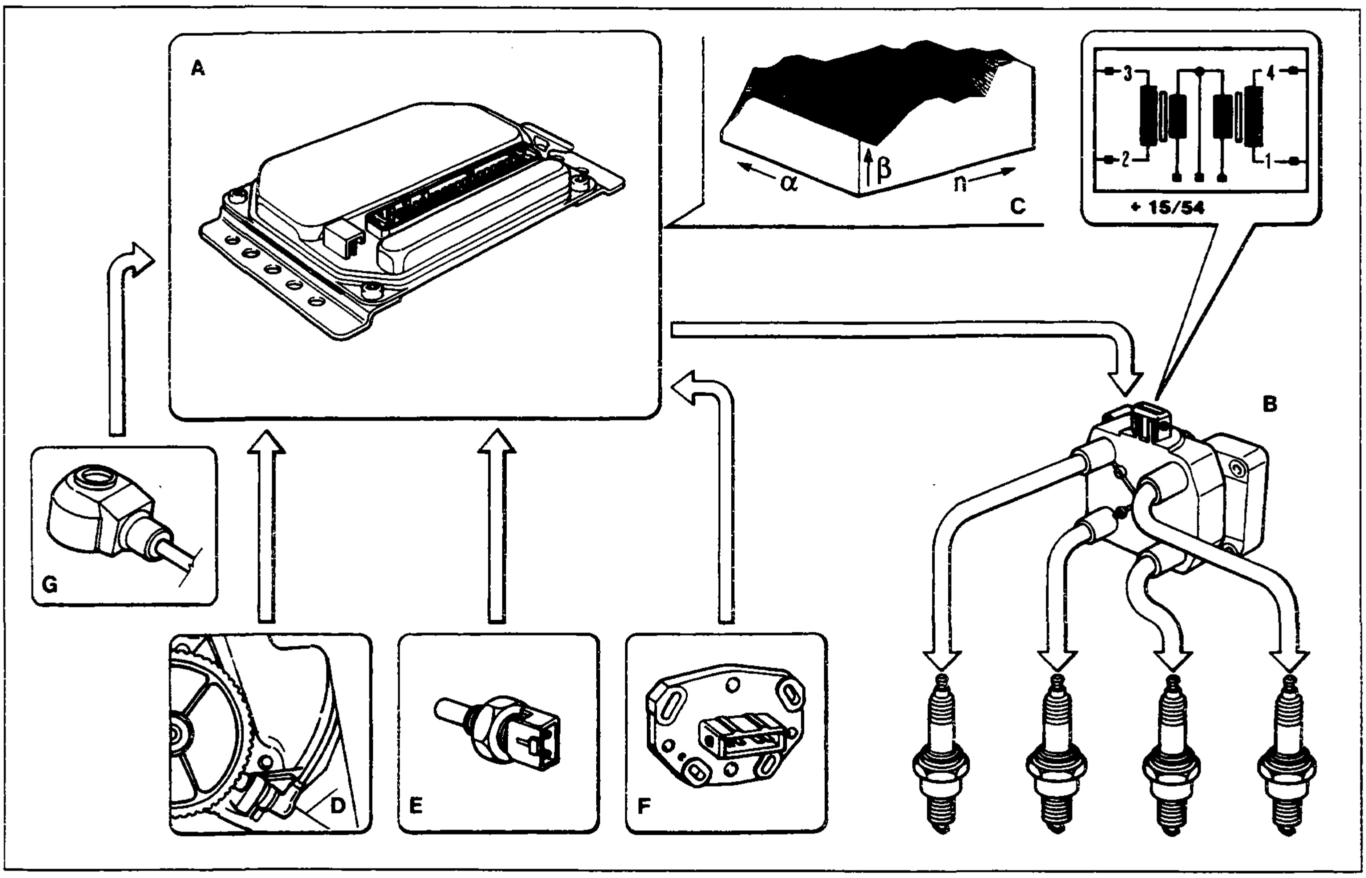
The control unit selects the appropriate advance value according to the memory maps, rpm (D), coolant temperature (E) and engine load (F), knock (G) and governs the ignition unit power module accordingly.

The control unit contains three different base advance angle maps to cater for changing engine service conditions:

- full load, settings mapped according to rpm and engine load.
- partial load, settings again mapped according to rpm and engine load.
- idling, where settings are mapped according to rpm.

The full load and partial load advance angle may also be subject to further corrections on the basis of engine temperature and air temperature. The idle advance angle is corrected only on the basis of engine temperature (non-constant value is about 7°).

The control unit contains an algorithm that computes the advance on the basis of rpm and battery voltage at which current begins to flow into the coil primary winding.



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