



## 6 Fuel injection system - general information

1 An integrated engine management system known as DME (Digital Motor Electronics) is fitted to all models, and the system controls all fuel injection and ignition system functions using a central ECM (Engine Control Module). A Bosch Motronic engine management system is fitted to all models.

2 On most models, the system incorporates a closed-loop catalytic converter and an evaporative emission control system, and complies with the very latest emission control standards. Refer to [Chapter 5B](#) for information on the ignition side of the system; the fuel side of the system operates as follows.

3 The fuel pump (which is immersed in the fuel tank) supplies fuel from the tank to the fuel rail, via a filter. Fuel supply pressure is controlled by the pressure regulator in the fuel rail. When the optimum operating pressure of the fuel system is exceeded, the regulator allows excess fuel to return to the tank.

4 The electrical control system consists of the ECM, along with the following sensors:

- A. Airflow meter - informs the ECM of the quantity of air entering the engine.
- B. Throttle position sensor - informs the ECM of the throttle position, and the rate of throttle opening/closing.
- C. Coolant temperature sensor - informs the ECM of engine temperature.
- D. Crankshaft position sensor - informs the ECM of the crankshaft position and speed of rotation.
- E. Camshaft position sensor - informs the ECM of the intake camshaft position.
- F. Oxygen sensor - informs the ECM of the oxygen content of the exhaust gases (explained in greater detail in [Chapter 6](#)).

5 All the above signals are analyzed by the ECM which selects the fueling response appropriate to those values. The ECM controls the fuel injectors (varying the pulse width - the length of time the injectors are held open - to provide a richer or weaker mixture, as appropriate). The mixture is constantly varied by the ECM, to provide the best setting for cranking, starting (with either a hot or cold engine), warm-up, idle, cruising and acceleration.

6 The ECM also has full control over the engine idle speed, via an auxiliary air valve which bypasses the throttle valve. When the throttle valve is closed, the ECM controls the opening of the valve, which in turn regulates the amount of air entering the manifold, and so controls the idle speed.

7 The ECM also controls the exhaust and evaporative emission control systems, which are described in detail in [Chapter 6](#).

8 The throttle body is coolant heated.

9 These engines are equipped with a Differential Air Intake System (DISA). Variable length intake tracts incorporated in the intake manifold are operated by a butterfly valve according to engine speed and load. This improves engine torque at low and medium engine speeds. The butterfly valve is operated by a vacuum actuator installed under the manifold.

10 If there is an abnormality in any of the readings obtained from the sensors, the ECM enters its back-up mode. In this event, it ignores the abnormal sensor signal and assumes a pre-programmed value which will allow the engine to continue running (albeit at reduced efficiency). If the ECM enters this back-up mode, the relevant fault code will be stored in the ECM memory.

11 If a fault is suspected, the vehicle should be taken to a BMW dealer at the earliest opportunity. A complete test of the engine management system can then be carried out, using a special electronic diagnostic test unit which is simply plugged into the system's diagnostic connector.

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