

## LH fuel injection system, B202 injection engine

### General

The Bosch LH-Jetronic Luftmassenmesser (Hot-wire sensor) fuel injection system, comprising a mass air flow sensor incorporating a filament (hot-wire sensor), combines the best features of different fuel injection systems with **measurement of the air mass**, i.e. the density of the induction air is taken into account - unlike earlier fuel injection systems.

In the LH-Jetronic system, the **air mass** consumed by the engine is measured, which means that allowance is made for the composition of the air (temperature, pressure and humidity). Measurement of the air mass is performed by the mass air flow sensor with the hot-wire sensor, which measures the air upstream of the inlet manifold.

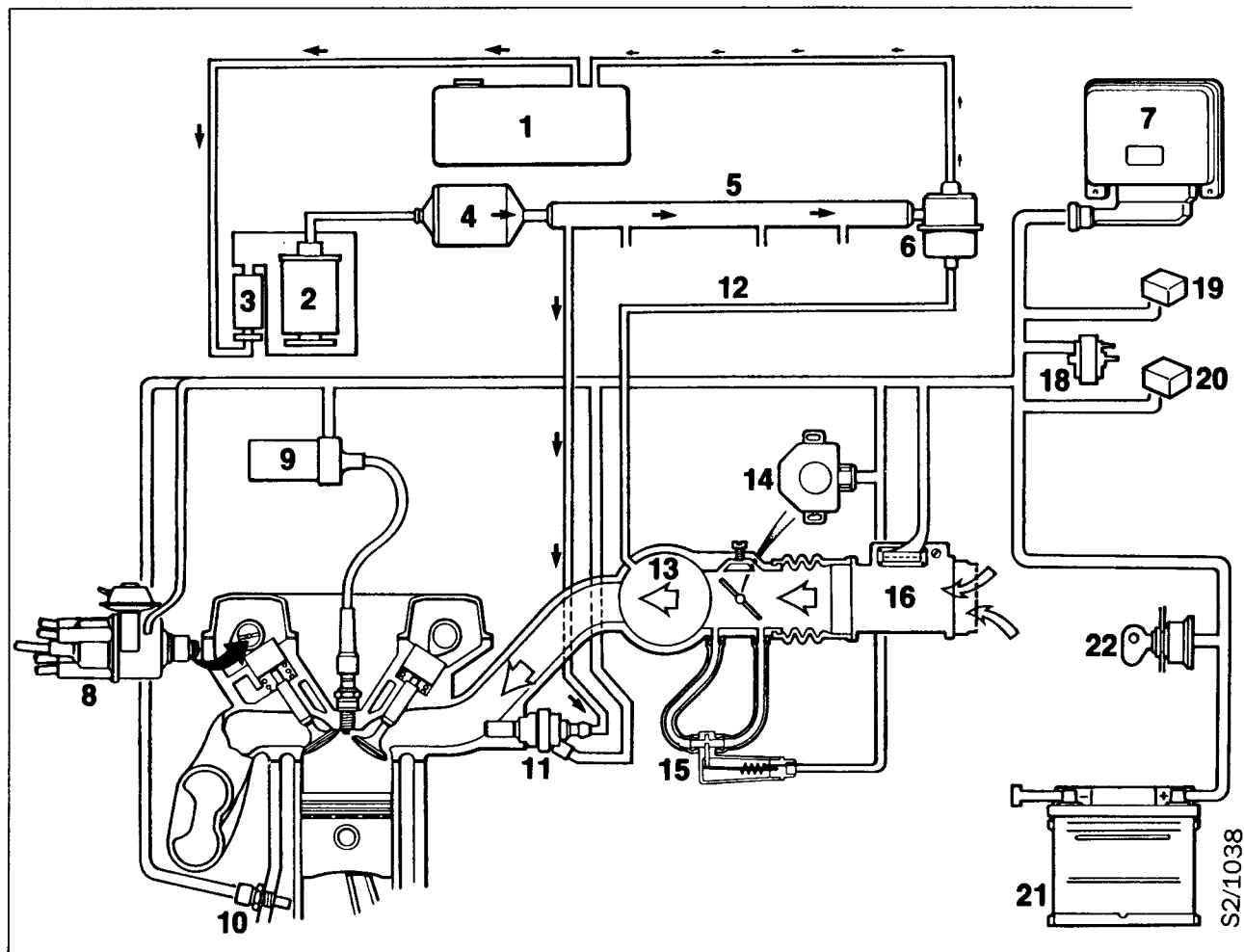
This method provides a more exact measure of the quantity of oxygen supplied to the engine by the air mass, which determines the quantity of fuel required for efficient combustion.

In all previous fuel injection systems, only the air volume (quantity of air) and/or the atmospheric pressure has been taken into account.

The LH system has the following advantages over earlier types of fuel injection:

- Compensation for temperature variations.
- Adjusts the quantity of fuel to the quantity of oxygen at high altitudes.
- Fewer components.
- Lighter.
- Fewer moving parts.
- Wider scope for adapting the quantity of fuel to actual needs (warm-up period/acceleration phase).

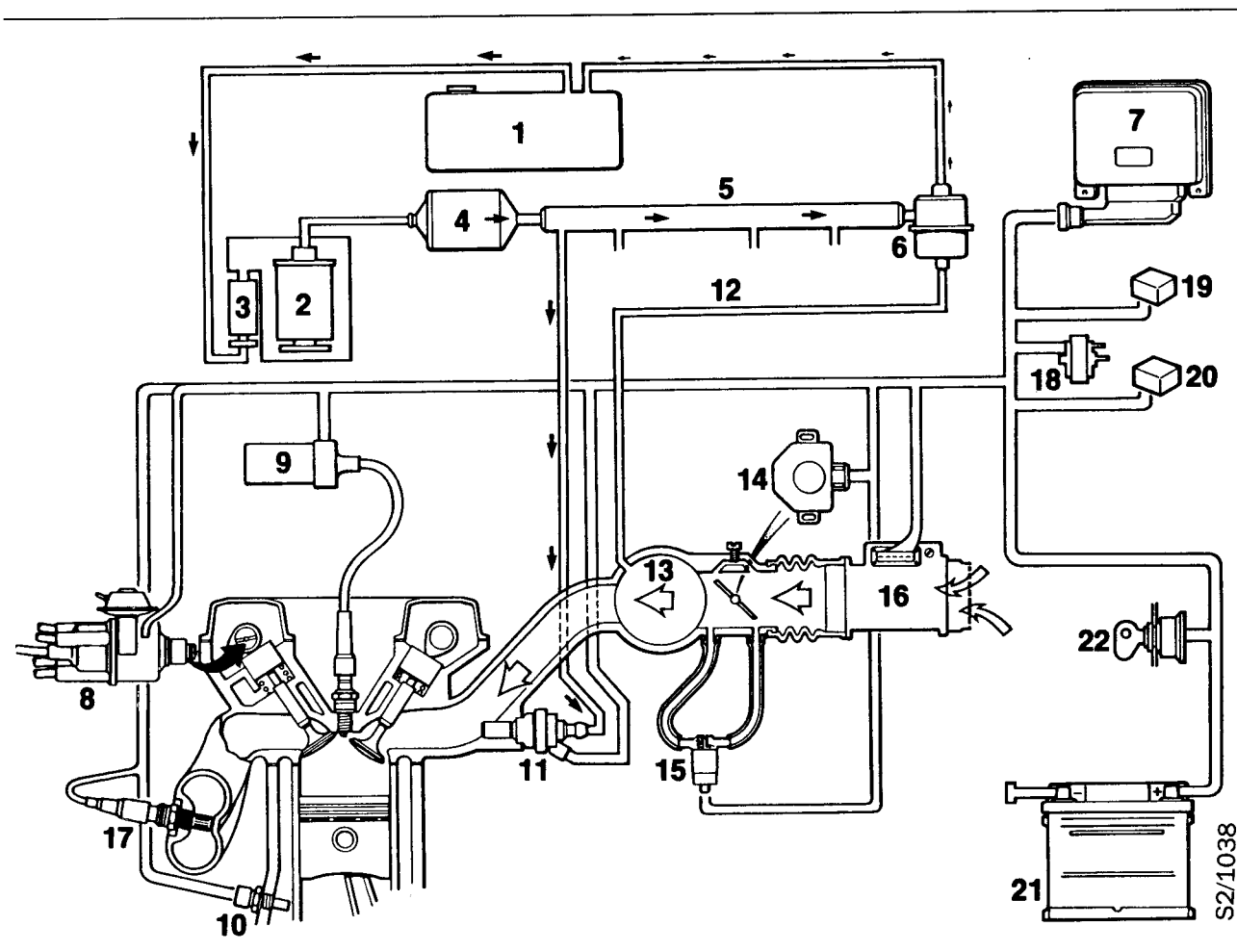
## Fuel injection system, EU (1984-)



Fuel injection system, EU (1984-)

- 1 Fuel tank
- 2 Fuel pump
- 3 Feed pump
- 4 Fuel filter
- 5 Fuel injection manifold
- 6 Fuel pressure regulator
- 7 Control module
- 8 Distributor
- 9 Ignition coil
- 10 Coolant temperature sensor
- 11 Injector
- 12 Vacuum line
- 13 Intake pipe
- 14 Throttle position sensor
- 15 Auxiliary air valve
- 16 Mass air flow sensor
- 17 Pressure switch
- 18 Main relay
- 19 Fuel pump relay
- 20 Battery
- 21 Ignition switch

# Fuel injection system, cars with catalytic converter



*Fuel injection system, cars with catalytic converter*

- 1 Fuel tank
- 2 Fuel pump
- 3 Feed pump
- 4 Fuel filter
- 5 Fuel injection manifold
- 6 Fuel pressure regulator
- 7 Control module
- 8 Distributor
- 9 Ignition coil
- 10 Coolant temperature sensor
- 11 Injector
- 12 Vacuum line
- 13 Intake pipe
- 14 Throttle position sensor
- 15 Auxiliary air valve
- 16 Mass air flow sensor
- 17 Oxygen sensor
- 18 Pressure switch (Turbo only)
- 19 Main relay
- 20 Fuel pump relay
- 21 Battery
- 22 Ignition switch

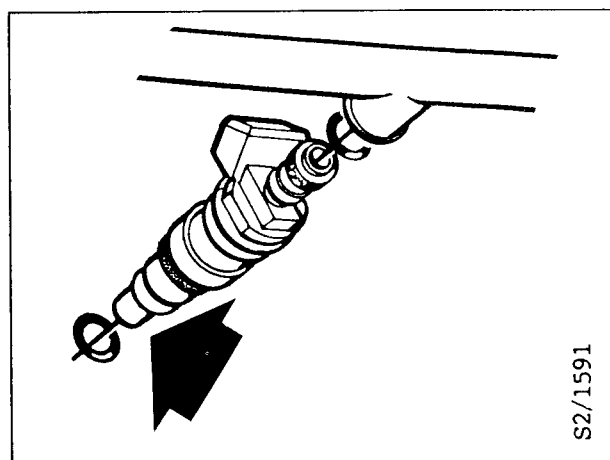
## Principle of operation

The operating principle of the system is as follows. An electric **fuel pump** pumps fuel from **the fuel tank**, building up pressure in the fuel system. The level of the pressure is governed by **the pressure regulator**, which maintains a constant ratio between the fuel pressure and the pressure in the intake pipe. As a result, the quantity of injected fuel is unaffected by variations in the inlet manifold pressure and is influenced only by the amount of time the injector is open.

The fuel is injected by **the injectors** (electrically controlled solenoid valves) fitted in the intake pipe close to the inlet valves and connected by a common **fuel injection manifold**.

The time the injectors remain open is determined by the engine load.

On M1989 and later cars the injectors are fitted with a plastic sleeve. A nozzle of new design improves the long-term characteristics.

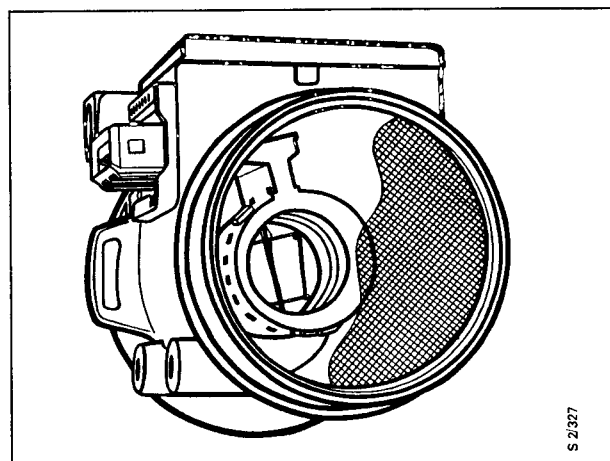


S2/1591

**The mass air flow sensor** consists of an aluminium housing enclosing an air duct. On M1989 and later Saab 900 Turbo models with catalytic converter (LH2.4), the mass air flow sensor housing is made of plastic. Located in the centre of the duct is a tube which houses the platinum filament (hot wire). The temperature of the hot wire is maintained at approx. 100°C (212°F) above the temperature of the inlet air, regardless of the composition of the air or the air flow.

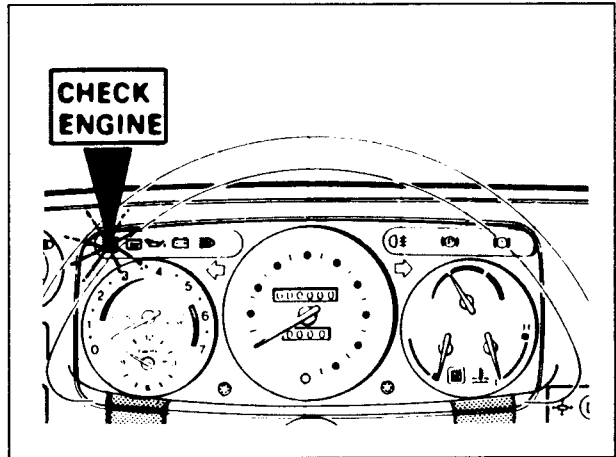
The device for controlling the current required to maintain the hot wire at a constant temperature consists of a bridge circuit and a detector resistor, the voltage variation across which is directly proportional to the magnitude of the inlet air mass.

The electrical components are located in a module on the mass air flow sensor housing. Since the hot wire is sited inside the inlet duct it can become coated with dirt which reduces its sensitivity and affects the results of measurement. To keep the hot wire free from dirt, it is heated to a temperature of about 1000°C (1830°F) for one second. This takes place four seconds after the engine has been switched off.



S 2/327

In the event of a break in the signal from the mass air flow sensor (MAF sensor) caused by a broken hot wire, for instance, an emergency system built into the control module and known as the "Limp- Home" mode will take over, enabling the car to be driven with impaired performance. When the Limp-Home mode is in operation, the CHECK ENGINE lamp on the instrument panel will light up.



The electric signals from the temperature sensor and throttle position sensor (two positions), the ignition pulses from the ignition system and the signal from the mass air flow sensor are all fed into **the control module's** microprocessor which then processes the information and determines the time that the injectors remain open. The hot wire burn-off function is also controlled by the control module's microprocessor.

Other functions stored in the control module include full- load enrichment at different engine speeds, extra acceleration enrichment when the engine is cold, and idling control on cars equipped with IAC.

**The temperature sensor** is of NTC (Negative Temperature Coefficient) type and it sends a continuous engine temperature signal direct to the control module. If there is a break in the signal from the temperature sensor, a signal is simulated by the control module and the system functions on the assumption that engine temperature is +20°C (68°F).

**The throttle position switch** tells the control module whether the throttle butterfly is in the fully open or idling position.

On M1991 and later cars with a B212 engine, the throttle position switch has been replaced by a **throttle position sensor** which continuously and steplessly informs the control module of the current throttle butterfly angle.

**The auxiliary air valve** compensates for losses due to friction when the engine is started from cold by allowing air to bypass the throttle butterfly.

On cars equipped with a catalytic converter, the auxiliary valve has been replaced by an **idle air control (IAC) valve** which also compensates for momentary increases in the load when the engine is idling. On M1991 and later cars with a B212 engine, this valve is of new design, see under "Components".

### LH 2.4 fuel injection system

The LH 2.4 fuel injection system has been introduced on all M1988 and later cars with a B202i engine and on all M1998B and later Turbo cars. This system is a further development of the earlier LH 2.2 fuel injection system. The improvement consists primarily of an expanded memory capacity for the control module, as a result of which the module is fitted with a 35-pin connector.

#### Special LH 2.4 functions:

- Control module with expanded memory
- IAC valve with integral Limp-Home system
- Adaptive (intelligent) idling control system
- Adaptive Lambda system
- Integral deceleration function (fuel shut-off)
- Improved function for shift-up indication
- New CP valve
- Integrated fault-diagnosis system
- Pressure-switch function integrated in control module

M1990 and later cars have additional LH 2.4 functions:

- Wider scope for diagnosis with the integrated fault-diagnosis system
- new control module
- Possibility of carrying out fault diagnosis and fault tracing using an ISAT ( Intelligent **SA** ab **T** ester)

On M1991 and later cars a number of new diagnostic trouble codes, which can be read on an ISAT, have been included in the fault diagnosis system.

### LH 2.4.2 fuel injection system

The LH 2.4.2 fuel injection system was introduced on M1991 cars with all versions of the B212 engine. The most important changes are the wider scope for fault diagnosis made possible by a new control module and the substitution of a throttle position sensor for the throttle position switch.

The IAC valve is also of new design.