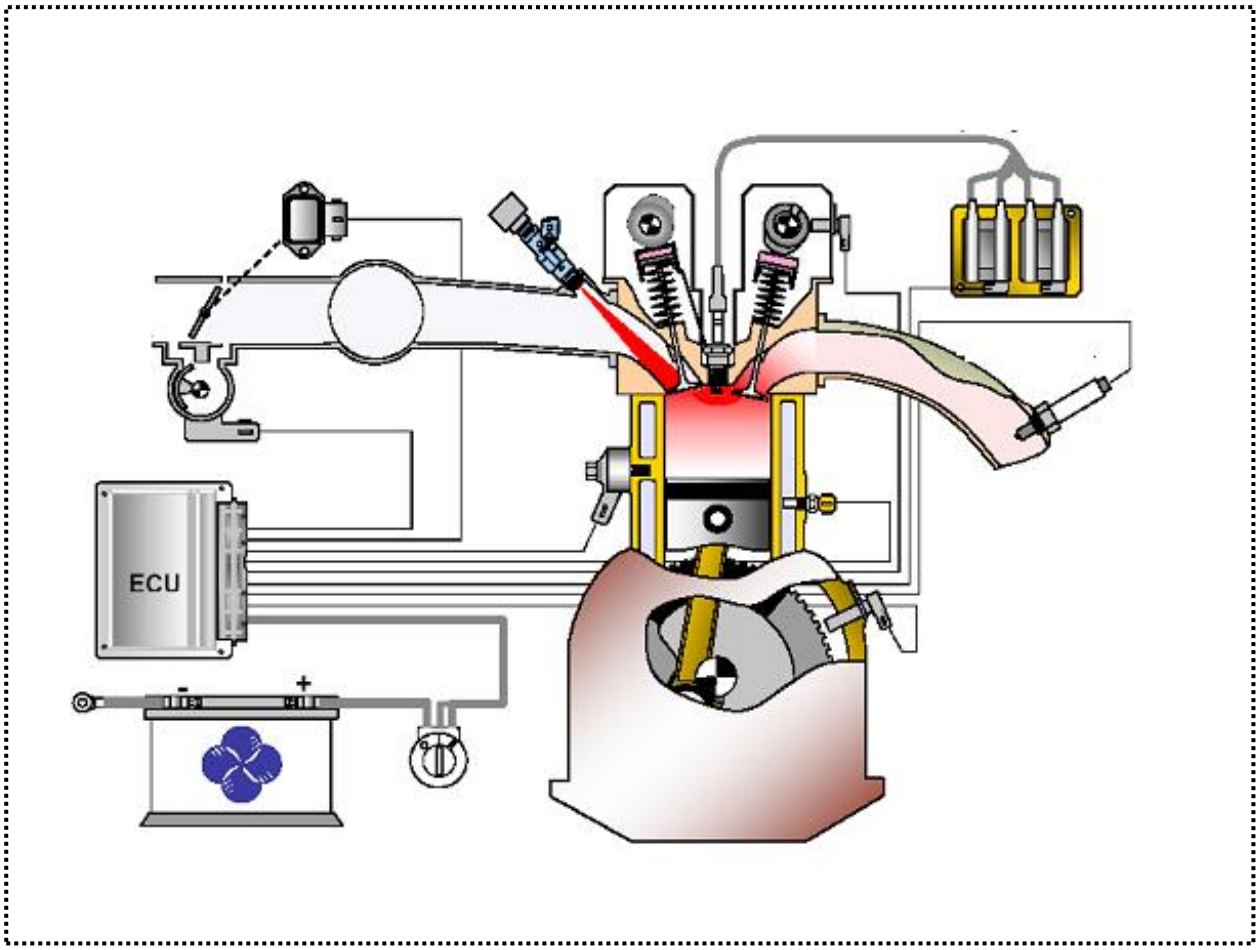
Engine Management Gasoline 1



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Development steps of engine control

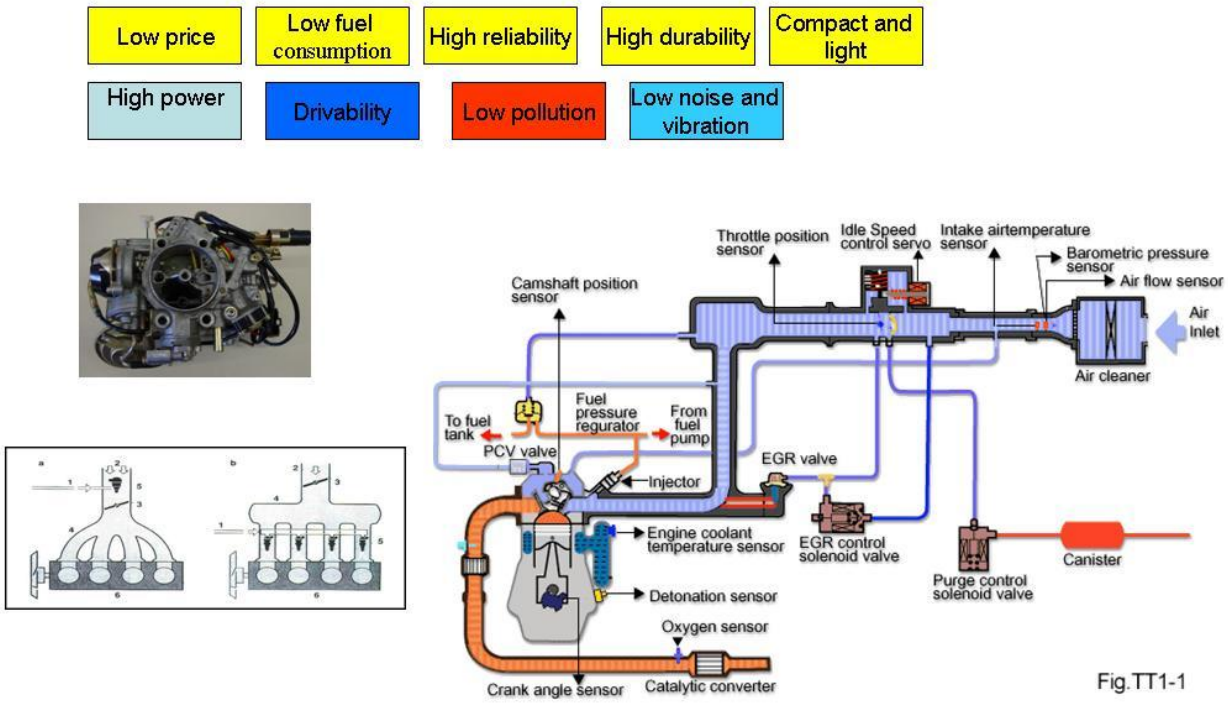
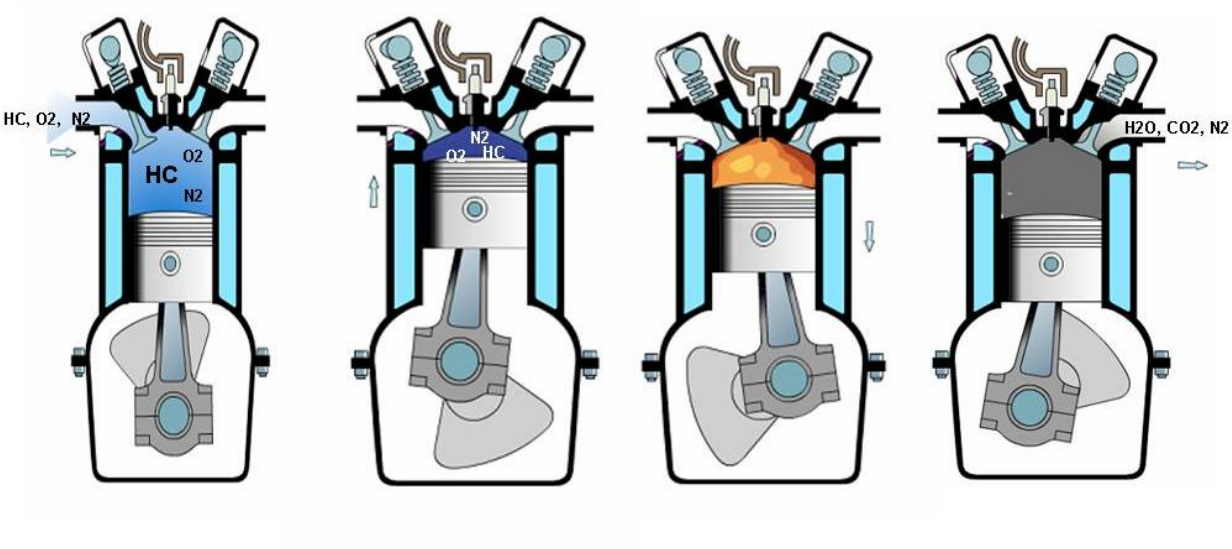


Fig.TT1-1

The requirements for safety, convenience, economy, and environmental protection have increased continuously, which required an improvement of the related technology. Looking at the engine control system in the beginning the control was made by mechanical means, such as the carburetor and the mechanical distributor. With these systems it was very difficult to acquire optimal engine efficiency with simultaneously satisfying emission control regulations. The next development stages were mechanical fuel injection systems such as so called the K- Jetronic from Bosch, followed by the first electronically controlled systems such as the L Jetronic also from Bosch. Some systems applied only one centralized injector, but usually the latest EMS system uses independent injectors, which can be controlled individually. The systems maintain the optimum conditions for fuel and air intake rate as well as ignition timing in order to provide the required torque and power and keeping the emissions low at the same time.

The EMS systems nowadays consist of various sensors detecting the operating conditions of the engine, actuators which are used to influence the operating conditions accordingly, both processed by an electronic device, the control unit. The control unit is processing the data acquired by the sensors in order to determine the best operating conditions and then drives the actuators accordingly. Let’s start with the basic engine operation to understand the control requirements precisely.

Basics about combustion



The gasoline engine is a combustion engine with externally supplied ignition. It has usually a mixture formation system located outside the combustion chamber to form an air-fuel mixture. The injectors are installed in the intake manifold and inject the fuel right in front of the intake valve (port injection), where it mixes with the air. As the piston descends, the mixture is drawn into the combustion chamber. Then it is compressed as the piston moves upward. Next it is ignited by the spark plug to start the combustion. The heat released in the combustion process raises the pressure within the cylinder, so that the piston is pushed down, thereby delivering the engine output. When the piston moves up again the burned gases are pushed out and the process restarts.

Let's have a closer look at the combustion stroke: within a perfect combustion the hydrocarbons in the gasoline react with the oxygen contained in the fuel air mixture to form water vapor (H2O) and carbon dioxide (CO2). Unfortunately the combustion in the engine is not perfect, so that the exhaust gas contains harmful ingredients such as for example HC and CO. Furthermore: under certain engine operating conditions, the nitrogen contained the air also reacts with the oxygen to nitrogen oxides (NOX), which are poisonous (gas). Therefore the amount of NOX and the other harmful components contained in the exhaust gas must be reduced by appropriate counter measures. To reach this many reduction many countermeasures where implemented where the most important one is the three way catalyst, but there are others as well as you will notice during the course.