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OPERATION OF ELECTRONIC CONTROL MODULE

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In modern cars, mechanical components work in conjunction with electronic ones. Most of the processes occurring in an internal combustion engine are controlled by an electronic engine management system (hereinafter referred to as "ECM"). This system consists of an electronic control unit, sensors, and actuators [1].

Sensors are a kind of sensory organs of the car, they collect information about the processes occurring in the engine and send it to the engine control unit, which is a microcircuit on which the controller with the software is located. The electronic control unit receives information, analyzes it and issues commands to the actuators [1].

Consider the operation of an electronic engine control system using the example of changing the amount of fuel injected. The combustion products of the fuel-air mixture enter the oxygen sensor, which transmits information about the oxygen content in the exhaust gases to the electronic control unit. The control unit compares this value with the nominal value and, depending on the result obtained, sends a signal to the injectors: increase or decrease the amount of fuel injected.

Table 1 – Comparative characteristics of engines with ECM and without

Estimated parameter	Sport Car Engine 1913 (without ECM)	Modern Engine (with ECM)
Engine type	4-cylinder, 4-stroke gasoline	4-cylinder, 4-stroke gasoline
Displacement, sm^3	4441	1984
Max power, hp at a rotation speed, min	82 2800	250 6400
Fuel consumption, l/100 km	30-40	5-7.5
Engine weight, kg	220	132
Max speed, km/h	150	250

The main components of the electronic control unit of the internal combustion engine are processor which performs computational and logical operations, permanent memory which stores the factory settings (and data stored in permanent memory does not change over time) and RAM the function of which is to store temporary information that is overwritten during engine operation [1].

In the early 1970s, the Japanese electronics industry began producing integrated circuits and microcontrollers, which were used to control motors.

The Ford Electronic Engine Control System was put into mass production in 1975. Bosch's first engine control system was the Motronic 1.0, which was introduced in 1979 in the BMW 7 Series E23 (Table 1).

This system was based on the existing Bosch Jetronic fuel injection system, to which ignition system control was added [2].

Self-diagnosis is also a function of the electronic control unit. If a malfunction is detected, a code is generated that contains information about the location and type of malfunction (the first one is a letter: P, B, C, U; the subsequent four characters are numbers). To find out this code, you need to connect diagnostic equipment to the car via the OBD2 connector [1].

The electronic control unit can be reprogrammed, that is, part of the factory software can be changed.

Due to this, it is possible to increase the engine power and change the parameters of environmental regulations.

But you should remember that before the start of production, the car undergoes many tests and improvements, which means that the factory firmware is the most optimal, and making changes can have serious consequences for the car.

References

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