**ECUs**

**What is an ECU?**

An ECU (Electronic Control Unit) is an embedded system in automotive electronics responsible for controlling a specific function. Each ECU contains a dedicated chip that runs its own software or firmware, and requires power and data connections to operate. An ECU receives input from different parts of the vehicle, depending on its function. The ECU then communicates to actuators to perform an action based on the inputs.

Today's vehicles may contain 100-150 ECUs or more, perform different sets of operations. Control functions range from essentials such as engine and power steering control to comfort such as power windows, seats etc , to security and access such as door locks and keyless entry. And also safety features such as airbags and even basic safety features such as emergency braking.

**Different ECUs in car**

Few basic types of ECUs are Door control unit, Engine control unit, Power steering control unit, Human machine interface, Powertrain control module, Seat control unit, Speed control unit, Telematic control unit, Transmission control unit, Brake control module, Battery management system, Suspension control module and etc.

**Transmission Control Module (TCM)**

Transmission Control Module also called Gearbox control unit is used to control electronic automatic transmissions based on input from various sensors as well as data provided by the engine control unit. It processes the input to calculate how and when to shift the gears in the transmission and generates the signals that drive actuators to accomplish this shifting. TCM is designed to optimize vehicle performance, shift quality and fuel efficiency.

Electronic sensors monitor the gear position selection, vehicle speed, throttle position and number of other parameters.Based on this information, the control module adjusts the current supplied to solenoids in the transmission that control the position of various valves and gears.

The gear position selector switch communicates to the TCM which gear has been selected by the operator.

The crankshaft position sensor provides information to the TCM to determine the existing rotational speed of the engine. This information helps the TCM determine when to change gears.

The throttle position sensor tells the TCM how far the throttle is open which indirectly indicates the engine load. This input is used to determine the best time to change a gear.

The turbine speed sensor determines the speed of the torque converter. The TCM uses this information to find the slippage across the torque converter, which helps it decide when to activate the torque converter lock-up clutch.

The torque converter lock-up clutch increases the efficiency of the transmission by eliminating the hydraulic and pumping losses associated with the torque converter when traveling at steady high speeds.

The transmission fluid temperature sensor is used to ensure that the automatic transmission fluid is at the correct temperature. If the automatic transmission fluid is hot, then the transmission is downshifted.

The brake pedal position sensor helps to ensure that the driver has applied the brake before shifting into park or reverse.

The TCM may also downshift the transmission if the vehicle is going downhill in order to utilize the compression braking of the engine. Inputs from the traction control system instruct the transmission to downshift when one or more tires are losing traction.

