Engine Management System

Technology Outline

Condensed Version

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ELECTRONIC ENGINE MANAGEMENT SYSTEM (EMS)

The Engine Management System is essentially divided into three sub-systems:

1. FUEL SYSTEM
   Fuel Pump, Fuel Pressure Regulator, Injectors

2. IGNITION SYSTEM
   Distributor, Ignition Module, Ignition Coil

3. EFI COMPONENTS
   ECU, Sensors, Idle Speed Motor, Catalytic Converter and Throttle Body

1. FUEL SYSTEM

Fuel Pump:
The Fuel Pump supplies high-pressure gasoline to the fuel pressure regulator via a fuel filter.

Fuel Shut-off Solenoid:
The fuel shut-off solenoid isolates the high-pressure storage tank from the rest of the fuel system in gaseous fuel applications.

Fuel Pressure Regulator:
The Fuel Pressure Regulator maintains the appropriate fuel pressure in the fuel lines.

Fuel Injectors:
The Injectors deliver a certain amount of fuel based on the fuel pressure and the signal pulse-with.

2. IGNITION SYSTEM

Distributor:
The distributor distributes ignition sparks to the appropriate spark plug.

Ignition Module and Coil:
The Ignition Module receives a 5-Volt square-wave signal from the ECU, which switches the coil on and off at the appropriate time to create high voltage sparks. 1, 2 and 3-channel ignition modules are available.

Multi-coil Distributorless Ignition System:
The ECU can support a distributorless multi-coil ignition system design. The EC66 system can power up to 6 ignition coils for 12 cylinder applications.

3. ECU, SENSORS and CONVERTER

All Sensors work together in supplying the ECU with the information needed to calculate the appropriate amount of fuel and ignition timing needed.

The ECU is equipped with a “Limp-Home” function. This function is pre-set in the ECU and allows the engine to continue to operate with reduced performance, even if a sensor is malfunctioning.

The ECU is equipped with a “Self-Diagnose” (OBD) function.

Manifold Absolute Pressure Sensor (MAP):
The MAP Sensor supplies engine load information based on the vacuum inside the intake manifold. Also is used for altitude compensation, or as a boost sensor in turbocharged engines.

Water (Coolant) Temperature Sensor:
The coolant temperature sensor compensates for cold-start enrichment. The coolant temperature compensation progressively leans-off the fuelling as the engine temperature increases.

Intake Air Temperature Sensor:
Supplies information about the intake air temperature. This information is needed to calculate air density and therefore the fuel amount needed.

Fuel Temperature Sensor:
The fuel temperature sensor is needed for fuel injection quantity compensation on gaseous fuel applications like CNG, LPG and Hydrogen.

Fuel Pressure:
The fuel pressure sensor is needed for fuel injection quantity compensation on gaseous fuel applications like CNG, LPG and Hydrogen.

Throttle Position Sensor (TPS):
The TPS sensor supplies information about throttle valve opening angle and for acceleration enrichment, the TPS supplies information regarding how quick the valve opens and closes. Fuel shut-off when coasting is supported.

Crankshaft Position Sensor (CPS):
The CPS supplies information about RPM, crankshaft position and the number of pulse-signals (number of cylinders) per engine revolution.

Sensor for Cylinder #1 Sync Signal (if used):
Supplies the cylinder #1 reference signal for sequential injection/ignition.

Oxygen Sensor:
Supplies fuel mixture information based on the oxygen content in the exhaust gas. This information is needed for closed-loop operation and allows the ECU to continuously adjust the amount of fuel being injected so optimum air/fuel mixture can be maintained. This function supports Gasoline, CNG and LPG.

Spare Inputs:
Several spare analog input channels are available for additional sensors.

ECU:
The ECU uses Fuel and Ignition Maps to determine the fuel amount and ignition timing requirements of the engine under all engine LOAD and RPM conditions.

The Fuel and Ignition Maps are divided into LOAD and RPM Bands. The engine LOAD is represented by a scale from 7 - 107% and has 16 adjustable load bands. The engine RPM is represented by a scale from 125 to 16,000 RPM and is adjustable every 125 RPM.

The Omnitek ECU uses linear interpolation between the four closest Map Points to the actual engine condition. This assures the most accurate Fuel Injection pulse and Ignition timing.

Outputs:

Injector Outputs:
The EC21 and EC22 have each 2 injector outputs. The EC33 and EC66 have 3 and 6 injector outputs, respectively. The injector drivers are of the Peak-and-Hold type (4A/1A) and can supporting high-performance low-ohm injectors. The minimum impedance (resistance) any output can drive is 1.2 Ohms.

Ignition Output:
The EC21 has 1 ignition output, the EC22 has 2 ignition outputs and the EC33 and EC66 have 3 and 6 ignition outputs, respectively. On a waste-spark system the EC66 can be used on engines of up to 12 Cylinders. Coil-on-plug ignition system designs are supported.

Diagnostic Light and Error Codes:
The ECU is equipped with self-diagnostic (OBD) technology.

Idle Speed Motor:
The idle speed motor increases the engine rpm during the warm-up period and stabilizes the engine RPM at the specified idle speed.

Catalytic Converter:
The catalytic converter reduces the amount of harmful emissions such as CO, HC and NOx.

Throttle Body:
The Throttle Body regulates the amount of air that is supplied to the engine.