

Camshaft and crankshaft applications



ENGINE MANAGEMENT
Camshaft and crankshaft
applications

- Context
- Needs
- Solutions

Context

Today's automobile engines are increasingly managed by electronic control units (ECU) using closed-loop control strategies to optimize engine performance while reducing fuel consumption and emissions.

The ECU can optimize ignition and fuel injection parameters, for instance with variable valve timing (VVT) and variable valve lift (VVL) systems designed to provide more torque at low rpm and more power at high rpm. If the ECU knows the camshaft position before the engine starts to turn, it can also speed up synchronization to reduce engine consumption and emissions during starting.

Another function that drastically cuts fuel consumption and emissions in city driving is the stop/start system that automatically switches the engine off when the vehicle stops at traffic lights or in traffic jams. These and many other engine management functions require sensors to deliver the necessary information to the ECU, in particular concerning the speed, position and direction or rotation of the camshaft and crankshaft.

Electricfil masters all the leading sensor technologies to bring you the right sensing solution for your every need.

Function needs

Electronic control systems that manage today's automobile engines need precise information concerning the camshaft and crankshaft:

- Crankshaft and camshaft position to monitor the position of the pistons in relation to the valves in order to optimize ignition and fuel injection. This is particularly important for engines with variable valve lift (VVL) designed to optimize the air/fuel mixture ratio and temperature, pumping losses, swirl effect and other important parameters.
- Crankshaft speed for engine speed measurement, a key engine management parameter.
- Camshaft position with True Power On (TPO) for fast synchronization and reduced emissions on starting. The True Power On (TPO) function determines the absolute position of the shaft as soon as the sensor is switched on.
- Crankshaft position and direction of rotation for driver assistance functions such as Stop & Start that automatically switches the engine off when the vehicle stops at traffic lights or in traffic jams. Integrated detection of the direction of rotation makes it possible to calculate the position of the

crankshaft when stopped for quick restart and lower load on the starter.

- Camshaft position sensor for closed-loop control of the actuators used to implement variable phasing systems

Sensors needs

The sensors that provide this information must offer:

- High accuracy
- Small size
- Easy integration
- High reliability

Depending on where they are installed, they must also withstand severe environmental conditions:

- High temperatures
- Rapid temperature fluctuations
- Electromagnetic disturbances
- Vibrations
- Corrosive liquids

Electricfil solutions

Electricfil Automotive masters all leading sensor technologies to produce optimum sensing solutions for every need. The solution path is based on more than 25 years of experience in the field.

- **Analysis of customer needs** to select the most suitable sensor type from our proven core technologies (LVDT, Hall, Eddy-Current, GMR, AMR, VR, etc.)
- **Determination of degree of integration** (single sensor, sensor cluster or mechatronic module)
- **Circuit design and ASIC development** if required
- **Selection of electronic components and assembly technology** (e.g. surface mounted devices, discrete components)
- **Package design**, including the selection of materials (PA, PPS, PBT, etc.), assembly process (laser, thermal or vibration welding), potting, overmolding and encapsulation techniques, sizing, etc.
- **Selection of interconnections** (leadframe, flex foil, cable harness, etc.)
- **Magnetic circuit design** (magnet materials, pole piece dimensions, etc.)
- **FMEA, reliability studies, computer simulations, prototyping, initial samples**, etc.

Electricfil sensing solutions for camshaft and crankshaft applications

- > Hall linear/angular position sensor
- > VR speed/position sensor
- > Active speed/position sensor
- > Active speed/position and direction sensor
- > Magnetic ring system
- > Magnetic ring module