TYCO ELECTRONICS eDIGEST

A series of technology briefs spanning Tyco Electronics' product portfolio

Non-Contact Sensors -- Technology Overview

Over the last several years the automotive industry has increased its focus on advanced control systems. These systems are being implemented for transmissions, engine controls, emissions monitoring, safety applications and more, all of which require highly reliable and accurate position measurement. Tyco Electronics has leveraged its existing capabilities and automotive knowledge and has expanded its product portfolio to include a variety of sensor products, many of which are based in non-contact technology. These sensors can be used to detect position, speed, temperature, air quality (CO^2), and distance.

Tyco Electronics has customer support, design and application engineering, and manufacturing locations in every major global automotive region, enabling us to work closely with customers during the initial design stages of a project to develop the best technical solution with reduced manufacturing complexity. Tyco Electronics has become a global leader in the automotive sensor market with more than 25 million sensors produced since 1997; our sensors also find use in many industrial applications which have similar measurement/sensing needs

Automotive Application Overview

Tyco Electronics has a broad portfolio of high performance non-contacting sensors for under-hood applications, and has incorporated its core technology and experience to develop customized products such as:

- Transmission Position and Speed Sensors
- Clutch Position Sensors (Fig 1)
- Engine Actuator Sensors --Throttle, EGR, Turbo Charger (Fig. 2)
- Engine Position and Speed Sensors
- EPAS Steering Position –, Torque- and Motor Sensors

Figure 1 -- Clutch position sensor

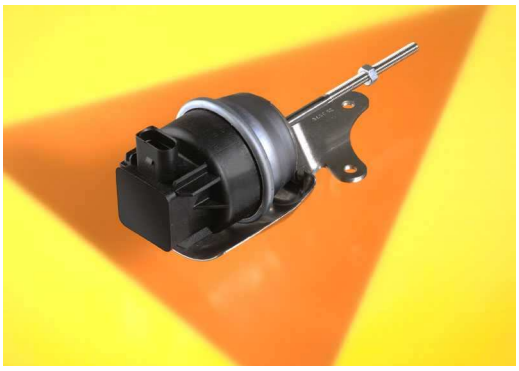

Figure 2 -- Engine actuator sensor

Elsewhere throughout the vehicle, non-contacting technology offers higher reliability, improved durability and basic levels of error detection for critical control and safety applications such as:

- Seat Track Position Sensors
- Brake Light Switches
- Convertible Top
- Seat Belt Buckle
- Door Latches

Technology Overview

Besides specific measurement requirements, application conditions determine the choice of the appropriate sensor technology. Because of their ability to withstand harsh environments and abrasive conditions, non-contact magnetic sensors should be used for the most critical functions inside the engine compartment. For rotational speed and position detection, to compensate for position tolerances and position drifts of the mechanical connection without degraded performance, magnetic sensors with a large control tolerance field are used.

In addition to Hall-effect semiconductor solutions, Tyco Electronics offers reliable sensor systems with anisotropic magneto-resistive (AMR), and permanent magnet linear contact-less displacement (PLCD) sensor technology. AMR semiconductor and magneto-inductive PLCD sensors are both characterized as particularly durable magnetic sensor technologies. Both utilize magnetic field saturation and are highly flexible with respect to packaging and integration. Key to a successful application is choosing the right sensor technology; in combination with the design of an economic magnet circuit concept.

A thorough evaluation of the environmental capability of the selected materials and technologies is also important. The final selection must be evaluated for performance against the application requirements and suitability for cost effective and quality controlled manufacturing processes.

As an example, under-hood sensor applications present particularly challenging temperature-load profiles, high vibration strains and resistance to chemical liquids requirements that are critical to the robustness and sealing of the respective sensor housing technology. Tyco Electronics' sensor housings are made of temperature-resistant plastic materials and the architecture is defined by the application space conditions, connector preferences, or the cable entry requirements. For applications that require hermetic and oil-tight sealing, the sensor housings are potted, free of blow holes and sealed with laser-welded housing covers to guarantee protection of the enclosed electronics (Fig 3). If required, sensor assemblies can also be directly overmolded with plastic material in a transfer mold procedure. This overmolding process results in an especially compact and vibration-resistant final package (Fig. 4).

Figure 3 – Sealed sensor

Figure 4 – Overmolded assembly

As stated previously, the interconnection technology is also very important. For electrical interconnections, Tyco Electronics uses stamped lead frames, high-temperature printed circuit boards and cable clusters. For reliable non-solder contacts, welding technology such as Resistance, McGregor and laser welding are preferred. Interconnects to printed circuit sensor boards can be made by lead free soldering or Tyco Electronics' Action-Pin technique.

In the future, the demand will increase for multi-functional sensor modules. For the integration of several sensor functions into one cluster, the product reliability requirements are achieved through the use of proven core technologies, standard sub-modules in the form of multi-type universal components and by reduction of interfaces. Tyco Electronics offers core competence in developing, designing and producing highly integrated sensor modules in house.

For additional technical information, contact your local Tyco Electronics Sales Engineer, or visit http://www.tycoelectronics.com