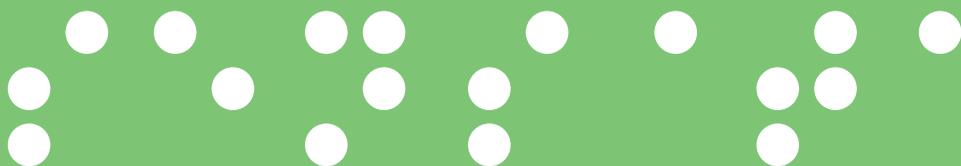


POWERTRAIN SENSORS



Sensata
Technologies

ENGINES

The World Depends on Sensors and Controls



**More than a supplier –
a partner.**

Satisfaction. Much more than just a word for Sensata: it is the objective of every step we take. Our customers and their needs are central to every consideration.

The fast adaptations of customer wishes by direct communication with one of our specialists in the field or in engineering are part of our daily work. Business-to-business processes form the basis for individual optimized solutions. An optimal solution is for us always a cost-effective solution. We never lose sight of costs no matter what we are considering. Does this sound intriguing? Then contact us at www.sensata.com.

Sensata Technologies: about us.

Sensata Technologies provides leaders in the global automotive, appliance, aircraft, industrial, and HVAC markets with sensing and protection solutions. Our mission is to improve safety, efficiency, and environment protection for millions of people every day. Headquartered in Attleboro, Massachusetts, Sensata Technologies has nine technology and manufacturing centers in eight countries, and sales offices throughout the world.

SENSATA ENGINE SENSORS

Advanced Solutions for all Engine Types

Internal-combustion engines.

Internal combustion engines have undergone a major change during the last century: modern types are managed by electronic systems that receive signals from numerous sensors, which, e.g., measure engine speed, manifold pressure or oxygen content. These measurements are converted by transducer technologies into electrical signals, which operate accurately not only over a wide temperature range, but also under harsh environmental conditions, including electromagnetic interferences. They also need to compensate for variations of subcomponents and variations caused by manufacturing processes.

MASS AIR-FLOW SENSORS

Mass Air-flow Sensors measure the air mass in the intake manifold of a combustion engine. This can be a spark-ignited or diesel engine. For spark-ignited engines, it is important to measure the load of the engine demanded by the driver and to provide a signal to the engine controller to determine, together with other sensor inputs, the ignition timing and the fuel required for each individual combustion cycle. For diesel engines, the Mass Air-flow Sensor is used to derive, by means of engine mapping and measurement of fresh air, the exact amount of recirculated exhaust gas. This can then be adjusted to maintain stable combustion without high nitrogen-oxide emissions.

Sensata Technologies uses hotfilm technology. The basis is a bulk micro-machined silicon transducer with high responsiveness to flow dynamics in a layout whereby forward and back flow can be measured. It is fast and no bypass channels are needed. Therefore optimum accuracy for net air mass-flow over the entire engine speed range is provided. Since the transducer element is robust, contamination from dust particles and water droplets through the air filter or soot from the exhaust-gas back-flow dynamics can be avoided by easy measures. Well designed signal conditioning and cost-effective manufacturing and component sourcing result in a highly valued sensor.



OIL-PRESSURE SENSORS

Oil-pressure Sensors measure the pressure of engine oil in combustion engines. For spark-ignited engines, oil pressure is used as an important indication for the operation of systems such as cylinder deactivation or variable valve timing. More advanced systems, where the mechanical-hydraulic oil pump will be complemented with an electric oil pump to cope with pressure extremes, will also use oil-pressure sensor signals.

For diesel engines, which can run very hot due to the regeneration of modern exhaust-gas after-treatment systems and can therefore have a need to assure that oil quality has not deteriorated, the oil pressure can be an important parameter for oil quality.

Sensata Technologies offers its Capacitive Ceramic Pressure Sensor technology. This technology is very robust against higher pressures and against oil and its temperatures. The applications often require very high accuracy at low pressure points, while the operating pressure can be rather high. The technology and packaging provide the cost-effectiveness and high accuracy required by the automotive industry. As a consequence, Sensata Technologies' Oil-pressure Sensors are practically the only sensors used for this application in the entire automotive world.



The diesel sector: market leader in a growing market.

Rising fuel prices are encouraging more and more consumers to look for more fuel-efficient solutions. Modern diesel engines are growing in popularity not only in Europe, but in Asia and North America as well. Experts predict that this growth will increase even more in the future. These modern common-rail diesel engines deliver their comfortable drivability and high fuel economy by the use of many different technologies.

Whether it's the widely adapted common rail or high-flow exhaust-gas recirculation, they have one thing in common: they all have a need for advanced control systems.

COMMON-RAIL PRESSURE SENSORS

To inject the exact amount of fuel for optimum combustion for power at lowest emissions, the fuel pressure inside the rail needs to be monitored closely. A slight variation in fuel quantity can already cause exhaust emissions exceeding the legal limits.

Sensata Technologies is the worldwide market leader in Common-rail Pressure Sensors. We supply a very accurate and robust sensor, with unmatched resistance to vibration. Sensata Technologies has selected a piezo-resistive technology, whereby the strain gauges are glass fused onto a metal membrane, hermetically sealed and resistant to high pressures. The package is designed cost-effective and allows easy adaptation of the hydraulic and electric interfaces such as small and large port fittings and a wide variety of connectors. The sensing element can easily be adapted for different pressures, and signal conditioning can be offered with various diagnostics, and output circuitries, and is even ready for 3.3-volt supply systems.



Sensata Technologies' gasoline solutions: always one step ahead.

Gasoline engines are worldwide the most popular engine types; the main benefits are their cost benefit, combined with specific emission benefits and the high ratio of power delivered to weight. The modern gasoline engine is a high-tech system, with an electronic control unit controlling, for instance, the injection, either direct or indirect, variable valve timing, and electrically regulated pumps.

To allow for the best control in this system, you need sensors that can meet the highest requirements while monitoring all needed system parameters.

*Sensata Technologies is
the worldwide market
leader in Common-rail
Pressure Sensors.*



*Sensata Technologies pressure sensors were on the
first European GDI system, which appeared in 1999.*

ELECTRONIC FUEL-SUPPLY PUMP SENSORS

Modern injection systems use a supply pump that is typically designed to be integrated into the fuel tank. This supply pump provides the fuel at moderate pressure to an engine-mounted high-pressure pump. Whereas the supply pumps provide fuel from the tank at 5-8 bar, the high-pressure pumps can create pressures from 50-2000 bar or higher. Traditionally, these fuel-supply pumps were permanent and electrically driven. Electronic Fuel-supply Pumps (EFP) need to be designed to provide maximum flow even under cold-start conditions. Under various conditions such as low load, low speed conditions, or warm engine conditions, high pressures are not needed, and therefore it was desired to regulate the pump pressure in line with the demand to operate the engine. Sensata Technologies offers its capacitive ceramic technology for these applications. They are suited to withstand these system pressures, and are constructed to withstand all fuel variations over the entire temperature spectrum. Sensata Technologies' EFP sensors have been everyone's preferred choice.



GASOLINE DIRECT INJECTION

Gasoline Direct Injection (GDI) was introduced in the mid-nineties to achieve lower fuel economy compared to the conventional port-injection system. One other benefit is higher power, and this has prompted manufacturers to introduce GDI engines also on larger scales. For the GDI systems, a pressure sensor is needed as a vital input to the engine controller to control the fuel quantity. Gasoline quality can vary widely around the world. It can contain various degrees of sulfur, ethanol content, and other additives. It is therefore important to have a sensor able to work well with all fuels at high pressures and over the typical wide temperature range. Sensata Technologies offers its hermetic metal-membrane technology. The transducer consists of a piezo-resistive strain-gauge bridge, micro-fused to the membrane (MSG). The sensor technology is the same as for the higher-pressure diesel common-rail systems, but scaled down to the gasoline pressures. As with diesel common rail, a variety of hydraulic and electric interfaces is available.





Advanced technology solutions: keep up with the future.

The automotive sector is an innovative sector, always improving existing and developing new technologies. Whether to improve the consumer experience or to reduce emissions, the automotive sector will be on the front line of new technologies. Sensata Technologies shares this drive for innovation and is always working on developing innovative products, so we are ready to support you with the right products to meet all your current and future needs.

Sensata Technologies is the first to mass-produce a Cylinder-pressure Sensor combined with a glow rod.



CYLINDER-PRESSURE SENSORS

One example of an innovative product developed by Sensata Technologies is the Cylinder-pressure Sensor for diesel, with an integrated glow plug, and for gasoline engines. With this sensor, we have combined laboratory sensor performance with durability requirements for the automotive-engine market. This enables control of advanced combustion strategies such as HCCI, which significantly reduces the emission of NO_x and of particles for diesel engines and improves fuel efficiency on gasoline engines. But it doesn't stop there; the possibilities for developing new control and monitoring functions are endless.





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