Sensors for any circumstance

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Modern production processes are becoming increasingly complex and high speed. Low raw material input should contribute to resource and energy conservation. In order to meet the needs of machine building and automation tasks, sensors are becoming smaller and smarter, while also gaining integration capabilities.

A closer look at the non-contact measurement techniques for distance, displacement, position and dimensions shows that all sensors can be divided into two groups based on their physical principle: electromagnetic and optical devices. The electromagnetic sensors, e.g. eddy current or capacitive sensors, detect the distance to the electrically-conductive measurement object based on changes in the electrical field. Eddy current sensors measure the distance via the change in impedance of the sensor coil. However, in the capacitive measuring principle, the sensor and measurement object form the plates of an ideal capacitor. Both principles measure in the submicrometer range. Nevertheless, they differ considerably with respect to the operating environment. While eddy current sensors are ideally suited to harsh industrial environments (e.g. dirt, dust, humidity), capacitive sensors require clean surroundings. These sensors can be applied in electronics production, as well as in the laboratory and clean rooms.

Unlimited scope in design and shape

Cable, sensor size and individual measuring ranges of the standard sensors can be adapted to meet customer-specific applications. Particularly beneficial are sensors with integrated electronics that have a miniature, compact housing or special sensor sizes. The Embedded Coil Technology (ECT) is used for miniaturization in terms of customization. This production technique allows almost unlimited scope in terms of the external design and geometrical shape of the sensors. The entire evaluation electronics is integrable into the sensor. With an eddy current sensor, a two-dimensional coil is embedded in an inorganic material. This material technology improves the sensors in terms of their stability and robustness. The ECT technique also increases their thermal resistance. ECT sensors are suitable for extremely harsh applications such as ultra-high vacuums in semiconductor production.

Unlike electromagnetic techniques, optical metrology uses the effects of optics. Advantages of these techniques are the small measuring point and a relatively large offset distance. Laser triangulation, for example, uses the three-point relationship between the laser diode in the sensor, the target object, and the photo-elements in the sensor. The sensors are offered in a wide range of performance classes to suit a variety of applications. These smart sensors are equipped

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with an integrated controller, enabling the sensor itself to perform evaluation tasks. Even the type of technology can be selected depending on the respective measurement object and the corresponding task. Point sensors measure the distance to standard objects. Sensors that use a short laser line are applied on metallic surfaces and laser scanners with a long laser line can detect multi-dimensional profiles of objects. Furthermore, either a red (all-rounder) or a blue laser diode (applied with red-hot glowing metals and organic objects) can be selected to suit the application. Laser sensors are often used in highly automated production lines, e.g. in automotive manufacturing.

Ethernet as an industrial language

In order to simplify their integration into processes, laser sensors are equipped with a variety of interfaces. As well as analogue outputs, digital interfaces such as Ethernet are also available. The Ethernet protocol uses integrated collision detection of data packets and guarantees complete, faultless transfer of data. This open connectivity protocol enables almost unlimited communication flow within networks independently of the operating system of the terminal device and the hardware. Wiring effort is minimal. The user can address the controller from anywhere via an IP address, and can evaluate the measured data location independently and perform maintenance tasks remotely from anywhere in the world. Operation and configuration take place in a standard web browser, i.e. there is no need to install any additional software. Fast data rates of up to 10 GBit/s are equally impressive. These factors support perfect data transfer and "physical" integration of Ethernet-capable components into the system. The standard components used are mass-produced, making them particularly low cost. Their reasonable price has contributed to the widespread adoption of Ethernet in automation and machine building.

Other optical sensors such as confocal-chromatic measurement systems offer Ethernet/EtherCAT interfaces (real time Ethernet) as well as the analogue outputs. With the confocal chromatic measuring principle, white light is split into different color spectra and focused onto an object through a multi-lens optical system. The sensors produce highly accurate results for distance and displacement measurement, and also for measuring the thickness of transparent multi-layer objects (e.g. flat screens). The user benefits from a tiny measurement spot and nanometer-resolution. In terms of measurement speed, the fastest controller in the world today achieves measurement rates of 10 kHz using an LED light source and 70 kHz using a Xenon light source. This is why confocal sensors are used, for example, in the quality control of high tech production lines of premium electronics manufacturers. Electromagnetic eddy current and capacitive sensors are also equipped with Ethernet interfaces.

Individual sensors and systems

Micro-Epsilon has been a producer of sensors and measurement systems for more than 45 years. Starting as a one-man business, the company has grown into a highly specialized global business. The networked competence centers within the group offer a wide range and depth of development and production expertise, with the flexibility to develop and manufacture tailor-made solutions, providing users with economical and technical advantages over competitor products. The entire solution is delivered from one source, starting from application consulting through to conception and product development, as well as production and after-sales service. Customers benefit from a reliable partnership between manufacturer and user, as well as technical support that is focused on stability and efficiency improvements.

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About

Company name: Micro-Epsilon
Established: 1968
Headquarters: Ortenburg, Germany
Turnover: € 110 m (2013)
Employees: more than 600
Products: sensors, measurement systems

Confocal chromatic sensors are applied in the quality control of electronics productions