Feature: Sensors

Optical motion sensors: the touchless alternative

By Christian Fell

Imagine motion sensors that can provide accurate measurement of the displacement and velocity of a moving surface, all without any physical contact with that surface.

That is the idea behind the optical motion sensors from INTACTON, a business unit of the Cologne-based FRABA Group. Based around specialized digital camera technology, these sensors are designed to be mounted a fixed distance from the surface that they monitor. By measuring changes to the optical image that they 'see,' these devices are able to determine exactly how much and in what direction the surface in their field of view is moving.

OPTIPACT and COVIDIS optical motion sensors

INTACTON optical motion sensors are a drop-in alternative to code wheels in manufacturing facilities producing roll products such as paper, fabrics, foil, plastic film or wire. Thanks to their no-touch feature, there are no problems measuring the movement of hot, wet, delicate, sticky or even gooey surfaces, and no chance of surface contamination. Moreover, because they monitor the surface directly, there is no loss of accuracy due to slippage, such as can occur with roller or wheel-based measurement systems.

These devices have also proven themselves to be useful in applications such as control of automated guided vehicles (AGVs). Here, a key advantage of INTACTON optical sensors is that they can deal with a wide variety of floor surfaces, even recognizing special navigational symbols painted on the floor. In this application, optical motion sensors can be significantly more reliable than wheel-mounted rotary encoders since they aren't affected by wheel slippage.

INTACTON produces two main types of optical motion sensors. The OPTIPACT product line uses an image correlation technique to measure displacements of the observed surface. Each device contains a light source and an optical image sensor. As the object moves, an image of the object moves across the face of the optical sensor. 'Snapshots' of these images are recorded at regular short intervals (Δt).

The shift in the image position is determined by an image correlation algorithm. Knowing the shift in the image position and the properties of the optical system (focal length of the lens and distance between the sensor and the monitored surface) it is straightforward to calculate the displacement of the target object (Δx and Δy) and the object's velocity ($\Delta x/\Delta t$ and $\Delta y/\Delta t$).

Most OPTIPACT sensors are equipped with a red LED light source that has the advantage of requiring no special eye protection for staff working near the devices. However, models with a laser light source are available for use with materials such as foil or plastic films that have extremely smooth surfaces.

These devices are compact and relatively inexpensive. They measure motion in two dimensions, which makes them a great choice for many manufacturing processes and for special applications such as AGVs. Accuracy is typically better than 1% of measured displacement while velocities as high as 4 m/s can be reliably monitored.

COVIDIS sensors, which are larger, make use of a sophisticated spatial frequency filtering technology that yields outstanding accuracy – typically within 0.05% of measured results. These devices also have extremely good dynamic response that means that they can detect standstill, changes of direction and accurately track accelerations or decelerations of the object being monitored. They have proven to be extremely useful in production facilities where accurate length measurements contribute to reduce material wastage.

Both OPTIPACT and COVIDIS motion sensors are designed to stand up to the challenge of industrial environments. In both cases, the housings are protected from dust and moisture to IP65 level, although of course the optical paths need to be kept reasonably dust and moisture-free to enable accurate measurements.

Both types of instruments feature RS232 interfaces for connections to control systems along with the standard quadrature pulse interface.

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RFID safety sensors in machine guarding

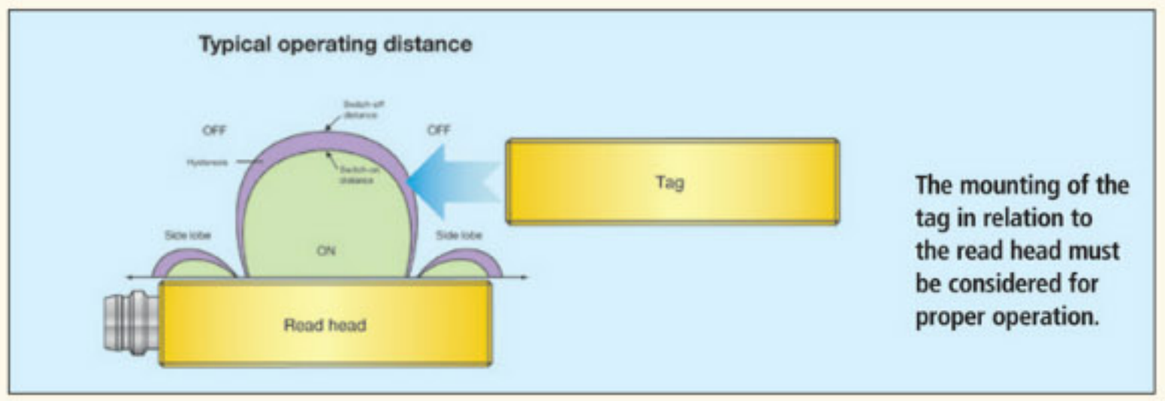
By Tim Cicerchi

Machine safety systems play an important role in factory automation. Machine guarding ensures that the machine is safe for operation. Doors and gates are protected with mechanical safety interlocks, which use a key or tongue to determine if they are open or closed.

Magnetic safety switches are used as well because of their sealed, low-cost design and their ability to be mounted in very wet and dirty environments. Although RFID has been available for 30 years, it hasn't been used in safety systems until recently. A trend in new machine designs now incorporates non-contact RFID safety systems rather than mechanical safety gate switches or magnetic sensors.

RFID safety sensors operate using different principles. This low frequency, 125 kHz system uses three standard RFID components for operation: the tag, which attaches to a movable gate or sliding fixture, the read head, which is mounted so that it will read the tag in the safe position, and the controller, which determines the safe integrity of the entire system.

Tags or transponders are battery free and contain a 32-bit, read-only identifier. Every delivered tag is guaranteed unique.



The mounting of the tag in relation to the read head must be considered for proper operation.

This ensures that when the system is initially setup, a teach procedure will link the tag information to a specific read head. Once that tag is read by a specific read head and the data is verified, the system can be made safe. No other tag/read head combination is allowed once taught.

The read head is a simple ring antenna that communicates with the tag. Read ranges up to 15 mm allow the tag to enter the read field from any direction. This differs from older magnetic safety systems where independent contacts can switch independently when targets move in from the side. Read heads can also be conveniently located up to 30 m from the controller without any degradation of signal strength.

The controller is the brain behind the RFID safety sensor technology. Users can choose to connect one read head or as many as four read heads to control the module. It internally multiplexes the read heads, which allows all read heads to be run in close proximity with one another without mutual interference. The controller also performs the safety evaluation. When the tag moves into position over the read head, the data is evaluated by two microprocessors. If the data is the same, the controller signals the safe state and the machine is ready to run.

The use of non-contact RFID safety sensors is increasing. The sensors reduce machine and wiring costs and are ideal for a wide range of industrial safety applications and RFID safety sensor systems have become a viable option for industrial machine guarding.

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