

Analogue position sensor optimising ultrasonic welding systems - Truly vibrant

In order to cope with the requested material diversity in automotive engineering, flexible production systems are needed. Therefore the Lühr Group opts for Turck's analogue magnetic field sensor WIM. Due to direct mounting on the pneumatic cylinder the change over to new materials is possible during on-going production process without manual adjustment.



Position detection, no problem!

Magnet-inductive sensors with analogue output provide a current, voltage or frequency signal which is relative to the piston position. They are suited for simple control tasks.

Today, ultrasonic welding systems are an integral part of interior construction in the automotive industry. They shape the plastic components like instrument panels, centre consoles or door trims as intended by the engineer. The ultrasound is produced with a generator, the mechanical resonance unit, consisting of a converter, amplitude transformer and sonotrode, is mechanically linked to the generator and mounted on a pneumatic cylinder. Mechanically produced vibrations generated by the converter are carried forward under pressure by the sonotrode to the thermoplastic joining parts.

COMPACT

Turck has developed a compact analogue magnetic field sensor WIM40. This sensor can be mounted directly on the T- or dovetail groove of a cylinder and detects gradually each change in movement. The WIM sensor is designed to be quite insensitive to extrinsic magnetic fields. The described application in an ultrasonic welding system of the Lühr Group avoids tedious and time-consuming adjustments of the analogue magnetic field sensor in cases of material changeover.

The ultrasonic energy transmitted into the joining zones creates the molecular and interfacial friction, resulting into warming and melting of the plastic components. The ingress depth of the sonotrode in the plastic material is a measure for the quality of the joining parts, whereupon each material has its own specific optimum value. As long as only one product is assembled, flexibility is not required because the optimum ingress depth remains constant. Especially in the automotive industry various materials of different thickness have to be processed.

Material diversity requires flexibility of systems

As one of the leading manufacturer of ultrasonic welding systems even the Lühr Group has to implement flexibility demands of their customers. Magnetic field sensors were used in the past to adapt the US-ultrasonic welding systems of the Lühr Group to the material change. For each changeover, i.e. from leatherette to plastic, the operator had to change the switch point of the sensor manually in order to attain the optimum values for the currently processed material. This was associated with a production stop and long retrofitting times.

Automatic Material changeover enabled

In order to avoid this situation and to implement a simple, cost-efficient and time saving material changeover a sensor was needed that was able to recognise the ingress depth depending on the applied material. These were the requirements which were presented by the special machine manufacturer to the sensor, fieldbus and interface specialist TURCK. In close cooperation with the customer the Turck developers were able to convert the requirements into a concrete product named "analogue magnetic field sensor-WIM". Owing to the compact housing design, the sensor can be mounted directly on the T- or dovetail groove of pneumatic cylinders.

The WIM sensor provides a standard analogue output signal of 0 to 10 V and 4 to 0.20 mA. An optional frequency output provides a connection for fast counters which are often an integral component of the control system. Therefore an extra counter input must thus be obtained separately. The analogue signal of the sensor enables the setting of various switch-points via control and to assign a certain value of the analogue signal to each material (value A, value B...). Thus the system can be adapted quickly and flexibly during the process to various values in the event of a material changeover.

Exact position determination

The measuring distance of the analogue position sensor is specified with 40 mm, with an average accuracy below 0.1 mm and a repeat accuracy of 0.3 %. Due to the purely analogue measuring principle the actual repeat accuracy is even better with shorter travel distances. The short blind zones of 8 mm only on both sensor ends additionally ensure very precise detection of the limit positions of the pneumatic cylinder. The sensor also provides a measuring range indication, the so-called "in-range function" via an LED display. Hence it is possible to detect if the magnet is located within the measuring range or not.

I/O System at the sensor:

In order to meet the high requirements of the existing Lühr automation systems, Turcks modular I/O fieldbus system BL67 is employed as fieldbus device. This system combines all advantages of advanced IP20 bus terminal systems and transfers these consistently to the rough IP67 environment. For example the BL67 system can be mounted directly in the measuring range of the sensor. If further I/O channels are needed, additional system terminals can be connected easily to the existing Profibus station without any other means. Thus only one Profibus address is needed for this fieldbus station which exactly meets present requirements, makes optimum use of the available space, provides maximum flexibility and is easily taken into operation. Various connectors for the I/O level, the great signal variety plus the separation of connection level (base modules) and electronics complement the range. Due to the independent wiring level, maintenance and service becomes child's play.

The user

Founded in 1919 in Hamburg, the Lühr Group was the only company to offer machinery used for processing all types of plastic and joining techniques on the three sites in Hamburg, Copengrave and Laufen with around 150 employees. The core business of the company ranges from development and construction to machinery for plastic and joining processes, over model, gauge and tool making, to complete small batch productions. Customers are, amongst others, some of the most well known automotive manufacturers and suppliers, as well as aerospace and medical engineering companies.