Measuring distances by rope

Sensors from yesterday for the applications of tomorrow

"Draw-wire sensors", „rope length gauges", „rope length transmitters", or „string pots" are just some of the names of the widespread forms of displacement measurement sensors, all of which are based on a principle like that of the household tape measure. They are easy to use and still have much of potential, even though they have already been on the market for over 60 years. A summary of the markets and potentials for draw-wire sensors.

A highly flexible steel wire is wound around a drum, as a result of which the actual linear motion is converted into a rotary one. The necessary force is provided by a spring. The turning movement is then converted into an output signal proportional to the displacement, by means of an angle sensor coupled with the drum axis.

In the very simplest case, a multispeed potentiometer is used, which offers a wide range of supply voltages, so keeping manufacturing costs low. This can be easily extended to the still widely-used analog output signals 4...10 mA or 2...10 V by adding current or voltage electronics.

Alternatively, of course, almost every commercially available encoder and therefore the full range of interfaces and buses can be adapted. This ensures a high adaptability to customer needs, particularly for OEM projects.

At first glance, this technology, which is more than 60 years old, appears rather antiquated and hardly of relevance today. However, on closer inspection, it can be seen that nowadays, there are still a number of benefits from draw-wire technology that make it stand out from other forms of measurement.

Thus the draw-wire offers a very good mix of measuring range, accuracy and price.

Besides this, the length always corresponds to the distance from the object because the wire is pulled in again on approach. This means that draw-wire measurement is highly suitable for applications in which telescope-like movements occur - unlike in many other systems. Furthermore, assembly need not be the highest precision, since a slightly diagonal pull hardly will affect measurements. If necessary, it is also possible to redirect the wire with the aid of additional rollers and thus "measure around corners", as it were.

Their suitability for different applications therefore also results from the combination of the individual key features. While the price and the telescopic function are decisive when recording the height of an operating table, it is the long measurement range and the opportunity to output two electrically redundant signals that makes all the difference when it comes to measuring the height of a fork-lift truck.

These variants are gaining in importance, especially due to the revised Machinery Directive and the coming into force of other standards for personal safety (e.g. the SIL). So while a high reliability and a low failure rate can usually be ascribed to mechanical components, these qualities can only be achieved at a reasonable cost with electronic components by using redundant structures. For a draw-wire, this opens up the possibility, mechanically speaking, of constructing a sensor with two sensor elements (e.g. potentiometers) and so cutting the cost of redundancy in comparison to other technologies.

Besides this, a whole series of future applications is being made possible through the change-over from switching systems to continuously measuring ones. This almost always leads to a saving of material and time resources and ultimately to an increase in the efficiency of the final product. For example, when the lifting height of a forklift truck is monitored, the traverse speed is continuously adjusted to the level of the load, so leading to improvements in throughput efficiency.

Since many of these systems have only just been introduced or are still only at the development stage, it can be assumed with a high degree of probability that the growing demand for draw-wire sensors will continue for at least another ten, if not even for a further 20 years.

The draw-wire sensor occupies a special position in the Micro-Epsilon product range. It is a mechanical load-measuring principle where the main role is not played by the high technical performance in terms of resolution or speed. Instead it is a comprehensive package based on technical requirements, durability and price.

Thanks to the correct combination of features, Micro-Epsilon has managed to achieve a very strong market position over the last ten years. A highly modular system has been developed by means of a consistent product policy - both in the catalogue range, as well as in series production. On the one hand, this makes it easier to adapt to customer needs in series products, on the other hand, the costs of logistics and stock are kept at a reasonable proportion of total costs. Micro-Epsilon was able to recognize market trends (higher volume, lower prices, new applications) at an early stage and, unlike most of its competitors, it has backed sensor concepts that are optimized for large numbers (for example, through the use of cast plastic parts for sensor housings).

Consequently, Micro-Epsilon has the largest product portfolio on the market and a very favourable price/performance ratio. Finally, it has been possible to develop a unique selling point, in this case in the form of the "package" most suitable for the customer.

This has been made possible in particular by the production capabilities at Micro-Epsilon Czech Republic. This is because the necessary machine-made parts are present there, as are the resources needed for manual assembly work.

With its disproportionate growth over the last eight years, the wireSENSOR product group now makes a significant contribution to total revenue and to Micro-Epsilon's total added value.

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