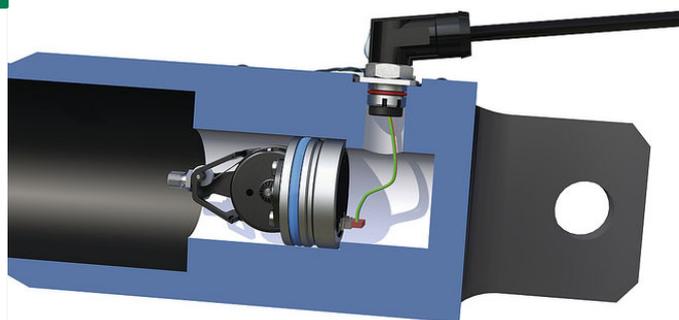


Encoders for hydraulic and telescopic cylinders

Draw-wire sensors based on rotary encoders have some advantages compared to other solutions. Matthias Roth, Siko's Industry Manager Mobile Automation explains them on the example of the SGH series.



(Source: Siko)

Q: In summary: What is special about the SGH series?

A: With these wire-actuated encoders, we are the only metrology specialist to have a worldwide exclusive technique for measuring the position of hydraulic cylinders, telescopic cylinders, or piston accumulators. The wire-actuated encoder-based sensors can be fully integrated into cylinders. The advanced, cable-based concept of the sensors provides additional benefits, which comparable products cannot offer. For example, our sensors cover a very wide range of applications as well as entire measuring ranges. The used techniques also excel with regard to immunity against shock and vibration. It ensures absolute best values in this area. The cable-based functional principle also makes the sensors the only integrated position sensors in the world which can also be used in telescopic cylinders.

Q: How should we view the development of your sensor techniques?

A: We benefit from 30 years of wire-actuated encoder know-how in terms of development, design, and production. Of course, our development, product design, and ultimately the customer also benefit from this knowledge. Like the SGH10, which measures zero-to-one-meter lengths, our latest generation of wire-actuated encoder generators, we have developed by our own the SGH25 and the SGH50 measuring zero to 2,5 meters respectively from zero to five meters. Wire-actuated encoders are therefore our core competence. In this respect, it is not surprising that the entire design of the devices is done in-house. In other words, we specify parameters such as the correlation of forces, the spring characteristic curve or the number of revolutions depending on the respective product. This makes our sensors extremely robust and durable. Both electronically and mechanically, they are designed and

tested for the entire service life of the cylinder. The service life thus meets the quality requirements that have been posed to us by the market. And that is the most important criterion for us.

Q: What challenges were faced during the development?

A: Sensor solutions intended for hydraulic cylinders must fulfill a central requirement: they should not affect the length of a cylinder. In other words, by installing such a sensor, the length of the cylinder should ideally not increase or be minimal. To fulfill this requirement, we use an innovative functional principle that achieves a hitherto unknown compactness. The stroke measurement technique takes a completely different approach than other market-based measurement systems that use bar-based, inductive, or reverberation-based techniques. To record the stroke or movement speed, our sensors use flexible cable pull mechanics installed directly in the cylinder.

Q: How does it work?

A: The cable of the cable mechanism is fastened in the piston head. When the cylinder extends the cable, which is wound on a cable drum, gets pulled out. The drum turns, creating a rotation. This rotational movement is detected by the sensor electronics and converted into a linear position value. This makes it possible to detect the position of the cylinder precisely and completely at all times. Electronics, mechanics, and sensors are completely installed within the cylinder and therefore optimally protected against external environmental influences. This is a clear advantage over cylinder-external sensors, because in this way the entire sensor system cannot be damaged, negatively influenced by environmental influences or even destroyed. For this reason, the sensors are IP69K-rated.

Q: What does a protection class of IP69K mean?

A: IP69K guarantees the highest possible protection against external influences, which could jeopardize the functioning or the operation of the SGH system. This includes, for example, substances such as water, dirt, or dust. The requirements of this protection class are so high that the mechanics and electronics of the wire-actuated encoder must withstand the force of a high-pressure water jet without liquid or other substances being able to penetrate into the interior of the sensor. The sensors therefore ▶

use our KV1H connector systems to achieve these levels of protection.

Q: What is about electromagnetic compatibility (EMC)?

A: This is an important aspect. Because in mobile machines the sensors are supplied via the vehicle electrical system and they, unlike in the case of stationary machines, are subject to significant fluctuations and other external EMC influences, they must have very high electromagnetic compatibility. It protects against voltage surges, unexpected discharging or overcharging, which could be caused by external voltage pulses, to which these machines are exposed. Therefore, these applications require an extremely high degree of EMC, which is one hundred percent legally compliant and protects against malfunction and machine downtime.

Q: Are there other advantages of your sensor techniques as compared to other measuring systems?

A: Another advantage is its immunity to shock and vibration. Very strong impacts and shocks can occur especially in commercial vehicles such as construction or agricultural machinery, for example an excavator bucket which is set down hard on the ground, i.e. actually hits it. As a result, a very strong shock wave is created, which moves through the hydraulic cylinder, the piston, the piston rod, and up to the installed sensor. This can cause serious damage that will ultimately affect the operation of the system. On the other hand, if our wire-actuated encoder is used, the flexible cable fully absorbs this shock, so that the sensor operation is not disturbed and there is no downtime of the application containing the SGH sensor.

Q: Which digital interfaces are offered and what about safety variants?

A: Our sensors come with CANopen or SAE J1939 interfaces. For safety-related applications, redundant sensors with two interfaces or with CANopen Safety (EN 50325-5) interface are available. These sensor variants can be used in applications up to Performance Level d (PLd).

Q: What is about the costs for system integration in cylinders as well as logistics and warehousing?

A: The innovative concept of our sensors leads to an economically very advantageous and therefore even revolutionary situation regarding the integration costs. Our sensors do not have a fixed sensor rod, which in conventional systems must be completely inserted in the piston. The cable-based design of the wire-actuated encoder is therefore less expensive because it requires no additional piston drilling. By contrast, the cable is only mounted on a small thread on the piston. Furthermore, the logistics and warehousing for our sensors is negligible compared to bar-based measuring systems. Imagine being a manufacturer of five-meter-long hydraulic cylinders. In the case of a rod-based measuring system, a sensor that is around five meters long would have to be transported and stored.



*Mathias Roth, Industry Manager Mobile Automation
(Source: Siko)*

In comparison, our SGH50 would not only be quick and easy to ship worldwide, but could also be stored, transported, and processed in the production process with minimal effort. The resulting huge savings for manufacturers of cylinders are obvious. Overall, the production time is reduced as substantially as the production costs. In this respect, the following rule applies: the amount of savings increases with the measurement length. In addition, our sensors are the only ones that can be used in telescopic cylinders. This gives us a real unique value proposition. In particular, the latest products with measuring lengths of up to 2,5 meters (SGH25) and up to five meters (SGH50) is in great demand in this area.

Q: Where else are the position sensors used?

A: Areas of application are generally to be found anywhere where the movements of cylinders have to be controlled and optimized. Of course, there is a particular focus on commercial vehicles. Wire-actuated sensors are integrated in hydraulic and telescopic cylinders of construction machinery, agricultural machinery, and forestry machines. Another area of application is piston accumulator. Again, they excel due to their outstanding compactness. The sensors can be installed in the gas area of the piston accumulator to save space. The general rule is that our sensors not only optimize motion sequences, but also the entire development and production process along with servicing, as well as easing the overall cost situation. Due to the flexible integration, they offer unprecedented possibilities in cylinder design. For these reasons, our sensors are more than merely attractive as an equipment option for cylinder stroke detection. ◀