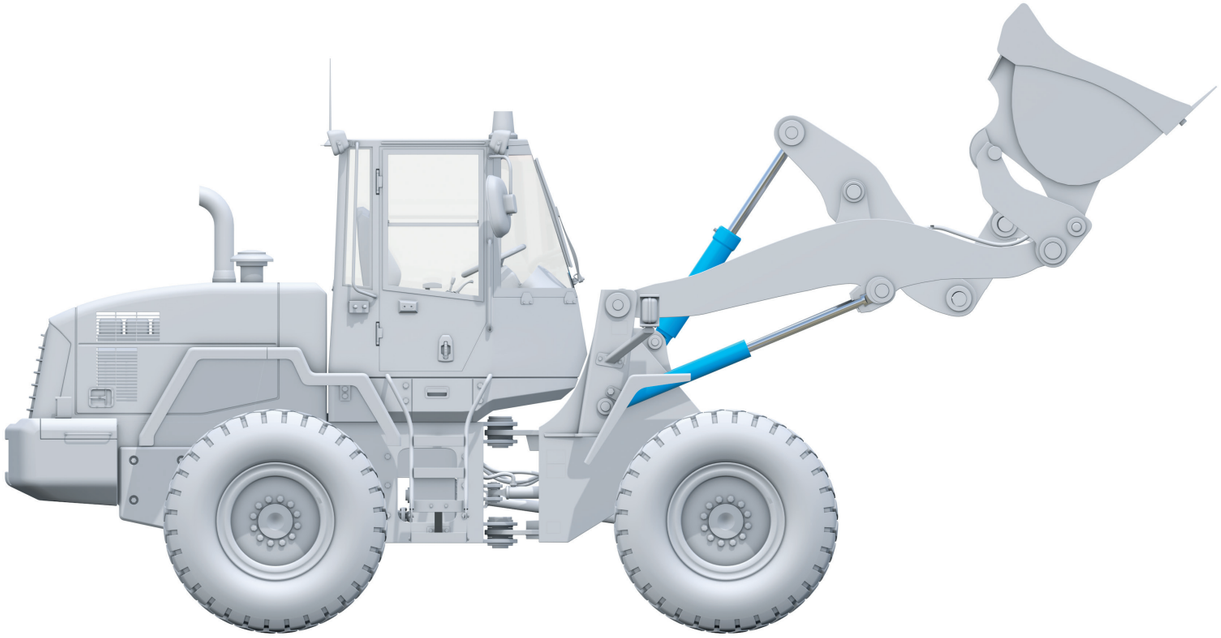
CHRISTIAN FISCHER

WIRED FOR GREATNESS

WIRE-ACTUATED ENCODERS THAT CAN MEASURE THE POSITION OF A VARIETY OF CYLINDERS AND ACCUMULATORS IN A DIVERSE ARRAY OF OFF-HIGHWAY APPLICATIONS ARE A RARE BREED – AND IN DEMAND

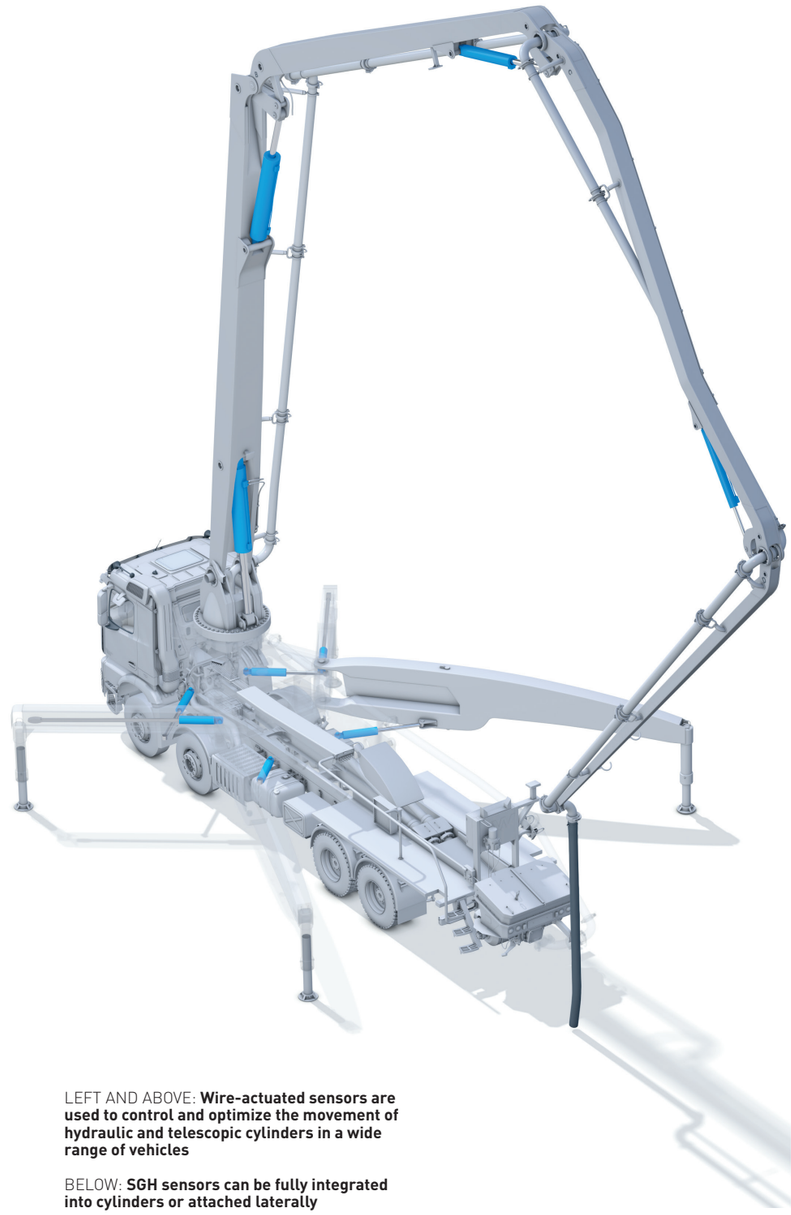


We caught up with Mathias Roth, industry manager for mobile automation at Siko, to find out what distinguishes his company's SGH technology from its competitors.

What is special about SGH technology?
With the wire-actuated encoders of the SGH series, Siko has a worldwide exclusive technology for measuring the position of hydraulic cylinders, telescopic cylinders and piston accumulators. Wire-actuated encoder-based SGH sensors can be fully integrated into cylinders. The advanced, cable-based concept of the SGH sensors provides additional benefits that other products cannot offer. For example, our SGH sensors cover a wide range of applications as well as entire measuring ranges. SGH technology also excels with regard to immunity against shock and vibration. It ensures the absolute best values in this area. The cable-based functional principle also makes SGH sensors the only integrated position sensors in the world that can also be used in telescopic cylinders.

How should we view the development of SGH technology?
Siko benefits 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 0-1m (3.3ft) lengths, our latest generation of wire-actuated encoders, the SGH25 and the SGH50, which measure larger ranges from 0-2.5m (8.2ft) and 0-5m (16.4ft), have been completely developed at Siko.

Wire-actuated encoders are our core competence, so it is not surprising that the entire design of the components is done in-house. In other words, we specify parameters such as the correlation of forces, the spring characteristic curve and the number of revolutions, depending on the product. This makes our SGH sensors extremely robust and durable.



LEFT AND ABOVE: **Wire-actuated sensors are used to control and optimize the movement of hydraulic and telescopic cylinders in a wide range of vehicles**

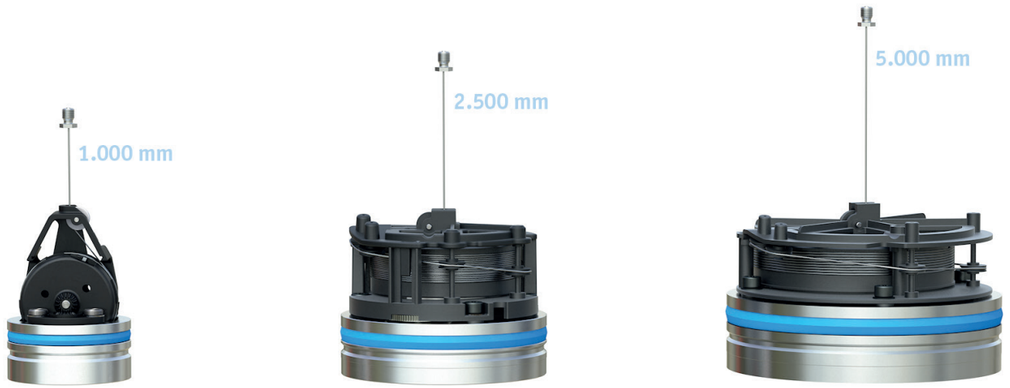
BELOW: **SGH sensors can be fully integrated into cylinders or attached laterally**

Electronically and mechanically, they are designed and tested for the entire service life of the cylinder. The service life thus meets the market's quality requirements – the most important criterion for us.

What challenges were faced in developing the technology?
Sensor solutions intended for hydraulic cylinders must fulfill a central requirement: they should be dependent on the length of a cylinder. To fulfill this requirement, we use an innovative functional principle that achieves a hitherto unknown compactness. SGH stroke measurement technology takes a completely different approach from other measurement systems that use bar-based, inductive or hall-based technology. To record the stroke or movement speed, Siko's SGH systems use flexible cable pull mechanics installed directly in the cylinder.

How exactly does it work?
The cable of the mechanism is fastened in the piston head. When the cylinder extends the cable – which is wound on a cable drum – it is pulled out, turning the drum. This rotation 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 at all times. Electronics, mechanics and sensors are completely installed within the cylinder and therefore 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, influenced or even destroyed. For this reason, the SGH series has protection class IP69K.

What does protection class IP69K mean?
Protection class IP69K guarantees the highest possible protection against external influences that could jeopardize



ABOVE: **The SGH10, SGH25 and SGH50 wire-actuated encoder-based sensors offer solutions for various measuring ranges**

the functioning or the operation of the SGH system. This includes, for example, substances such as water, dirt and dust. The requirements of IP69K are so high that the mechanics and electronics of an SGH 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. All SGH sensors use our KV1H connector systems to achieve these levels of protection.

Key SGH sensor facts

- **Dynamic pressure: 350bar**
- **Peak pressure: 420bar**
- **Proof pressure: 650bar**
- **High flexibility, adjustable to every measuring length**
- **Redundant interfaces available**
- **Safety version can be used up to performance level d**
- **Analog interfaces, CANopen, SAE J1939, CANopen safety**

What about electromagnetic compatibility (EMC)?

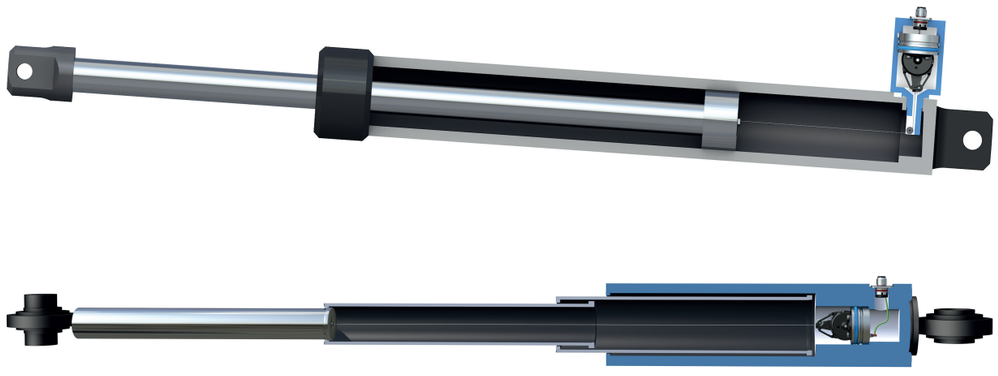
In mobile machines the sensors are supplied via the vehicle's electrical system and therefore, unlike in stationary machines, are subject to external voltage pulses and electromagnetic influences. They must have very high EMC to protect against voltage surges, unexpected discharging and overcharging, which could lead to malfunction and downtime.

What other advantages does SGH technology offer over other measuring systems on the market?

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 if an excavator bucket is set down hard on the ground. This creates a very strong shock wave that moves through the hydraulic cylinder, the piston, the piston rod, and up to the sensor. This can cause serious damage that will ultimately affect the operation of the system. However, with a Siko wire-actuated encoder, the flexible cable fully absorbs this shock, so the sensor operation is not disturbed and there is no downtime of the application.

Which interfaces are offered and what about safety variants?

Our sensors have either the usual analog interfaces, a CANopen interface or an SAE J1939 interface. For safety-critical applications, redundant versions of these interfaces, as well as a CANopen safety interface, are available. These SGH sensor variants can be used in applications up to performance level d (PLd), according to European safety standards.



ABOVE: **The SGH50 – which can measure 0-5m (16.4ft) – in a telescopic installation**

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

The design of the SGH sensors makes them easy – and therefore cheap – to install. SGH sensors do not have a fixed sensor rod, which in conventional systems must be fully inserted into the piston. The cable-based design of the wire-actuated encoder is therefore less expensive because it requires no additional piston drilling. The cable is only mounted on a small thread on the piston.

Furthermore, the logistics and warehousing for SGH sensors is negligible compared with bar-based measuring systems. Imagine being a manufacturer of 5m-long hydraulic cylinders. With a rod-based measuring system, a sensor that is around 5m would have to be transported and stored. In comparison, our SGH50 would not only be quick and easy to ship worldwide, but could also be stored, transported and processed in production with minimal effort. The huge savings for manufacturers of cylinders are obvious. Overall, production time is reduced as substantially as production costs. In this respect, the following rule applies: the amount of savings increases with the measurement length. In addition, SGH sensors are the only technology that can be used worldwide in telescopic cylinders. This gives Siko a unique value proposition. In particular, the latest generation SGH technology, with measuring lengths of up to 2.5m (SGH25) and 5m (SGH50), is in great demand in this area.

Where else are SGH series position sensors used?

Areas of application are generally to be found anywhere 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 the hydraulic and telescopic cylinders of construction machinery, agricultural machinery and forestry machines. Another area of application is in piston accumulators. 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 SGH sensors not only optimize motion sequences, but also the entire development and production process along with servicing, as well as decreasing overall costs. Because of their flexible integration, they offer unprecedented possibilities in cylinder design. For these important reasons, SGH sensors act as so much more than just an equipment option for cylinder stroke detection. **iVT**

Mathias Roth is industry manager, mobile automation at Siko

Christian Fischer is marketing manager at Siko