

New Systems for Various Applications

Robust Linear Position Sensors with Long Life Time

Gefran has launched a new product series: the high-precision and robust magnetostrictive position sensors of the Hyperwave series. The linear position transducers operate contactless, are characterized by their high EMC noise immunity and are insensitive to vibrations and shock. To meet the requirements of diverse applications, the linear position sensors are available in three different versions.

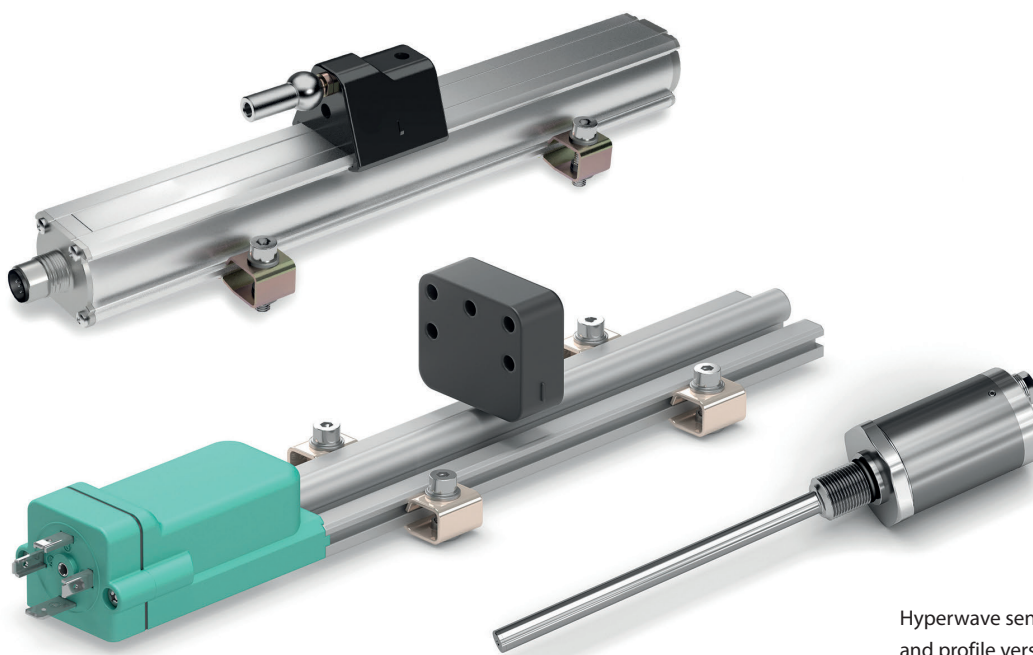
For nearly 50 years Gefran, a global supplier of solutions and components for automation, drive technology and sensors with headquarter in Italy, has been developing position sensors to measure the positions of moving machine elements. These sensors are based either on potentiometers or magnetostrictive technology.

"Potentiometers consist essentially of the wiper track and wiper", explains Kai Weigand (Fig. 1), product manager for sensors at Gefran. "They are typically used in plastic injection molding, pneumatic

applications and presses, and are easy to install." The resolution of the output signal is infinite with this technology. Potentiometers, which operate at low voltages, are available in numerous versions and are relatively inexpensive. However, they are also susceptible to wear, which makes them high-maintenance components. In addition, installation in cylinders is possible only to a limited extent. The measuring accuracy of these sensors can also change over the life time.

An alternative is the magnetostrictive position sensor. Their non-contact

operation means the sensors are not susceptible to wear, which makes them maintenance free. Their working life is nearly endless, and they feature consistently high precision of 0.01 %. The resolution of the output signal is up to 0.5 µm. "Magnetostrictive position sensors can be used in hydraulic cylinders without any problems", says Weigand. "Its casings with a high IP rating make the sensors very resistant to contamination and high pressure." The sensor properties are also suitable for hydraulically driven axes. Other advantages of the magneto-



Hyperwave sensors are available in rod and profile versions for measuring ranges of different lengths, and with different interfaces. © Gefran

strictive measuring principle include parallel measurement by two or more position cursors. The use of an absolute position measurement also eliminates the need for a reference run during commissioning of the system. Due to their positive properties, magnetostrictive sensors are gradually replacing potentiometers.

Less Noise and More Precision

Gefran is taking the development of magnetostrictive position sensors a step further by equipping newer models with Hyperwave technology (**Fig. 2**). "A modified configuration of the receiver coil mechanically masks the longitudinal component of the wave, so that the measurement includes only the desired torsional signal component", Weigand explains. The signal-to-noise ratio is therefore 15 times better than in previous models. "One advantage of this is that the signal is much more resistant to vibrations and shock. It also guarantees high EMC noise immunity, as well as consistently precise and continuous operation."

The position measurement is achieved by the interaction of two magnetic fields: the first field is generated by a current pulse along the entire sensor. This interacts with the second field, from a position magnet, also known as cursor, attached to the axis of movement.



Fig. 1. Product manager Kai Weigand: "Potentiometers are typically used in injection molding, pneumatic applications and presses."

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Profile or Rod Design for Different Requirements

Gefran offers the new position sensors in profile and rod versions (**Title figure**). The profile version is designed for universal use and can be attached with brackets directly on the structure to be measured. The cursor can be used freely or guided.

The rod-type position sensors, which are made of stainless steel AISI 316L, are ideal for installation in hydraulic cylinders with operating pressures up to 350 bar, where they measure the piston position in real time. They can also be used as a

level sensor thanks to a cursor which floats. Both versions feature an analog signal or digital interfaces such as SSI or I/O-Link for Industry 4.0 applications and communicate via CANopen, Profibus and Profinet protocols. A large selection of analog outputs enables direct measurement of displacement and velocity, as well as inverse measurement with high precision and repeatability and a very low non-linearity error.

Diverse Plastic Processing Applications

Hyperwave sensors are available for a broad temperature spectrum from -30°C to $+90^{\circ}\text{C}$ and are very reliable even at extreme temperatures. The sensors also feature a waterproof case with IP67 rating. These properties make non-contact magnetostrictive position sensors suitable for use even in demanding environments.

Both Hyperwave versions are available in three variants:

- "General" with a measuring range of up to 1500 mm,
- "Plus" up to 2500 mm and
- "Advanced" up to 4000 mm.

Typical applications for the Advanced variant include measuring the movement of tools in injection molding machines (**Fig. 3**). "In injection molding the most important factors are precision, repeatability and, of course, shock and vibration resistance", says Weigand. Measuring the position of the tool »

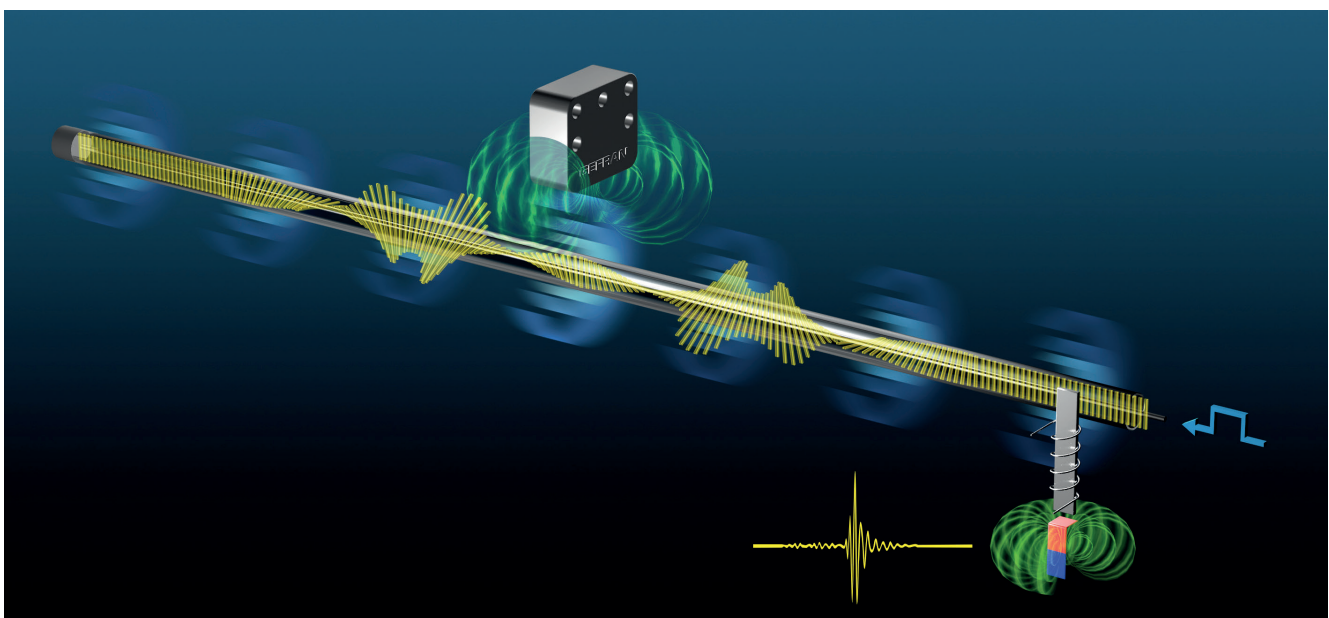


Fig. 2. A modified configuration of the receiver coil (bottom right) allows Hyperwave sensors to mechanically mask the longitudinal wave component, so that the measurement includes only the desired torsional component. © Gefran

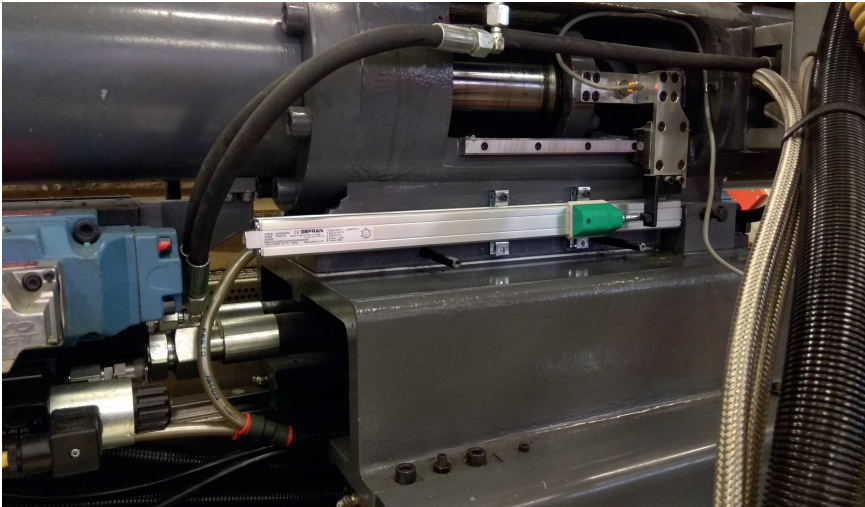


Fig. 3. The new magnetostriuctive profile sensors can be mounted directly on the structure to be measured, such as an injection molding machine as shown here. © Gefran

ensures well-coordinated machine motions to prevent collisions, for example with gripping robots. Especially in injection molding processes, reactions within a period of milliseconds are often necessary", Weigand continues. The production and removal of injection molded parts must be exactly timed. Other advantages of the Hyperwave technology are a low signal-to-noise ratio, i.e. the high resolution, and flexibility in the length of the measuring ranges of up to four meters.

The position sensors of the Advanced series are also suitable for synchronization – such as in the control of cylinders in metal, plastic or rubber presses with measurements in the micrometer range. In this application, four cylinders are used to close the press. Exact synchronization of components is

important for preventing jamming or uneven pressing within the machine. Each cylinder must therefore have its own servo control and position measurement system, to achieve synchronization of the position within 10 µm.

The position sensors of the Plus series are suitable for position measurement in applications that do not require an especially high resolution, but high vibration and shock resistance – such as in winding applications – or that have an expanded operating temperature range, such as screen changers in machines for recycling plastics (**Fig. 4**). "Contaminations are removed from the liquid plastic by pressing it through a metal

screen", explains Weigand. "Screen changers use pressure measurements to detect when the screen needs to be changed." The old screen is then removed and a new one inserted by means of a hydraulic motion.

Other applications rely primarily on the efficiency, robustness and durability of magnetostrictive position sensors. Examples are dosing applications, or jockey control in coil and winding technology. This is where the non-wearing sensors of the General series are used.

Expansion into New Markets

The development of Hyperwave technology is supported by continuous investments in research and development, as well as close cooperation with well-known universities. "Our customers profit from in-house production of the sensor elements used in our position sensors, which ensures measurements of very high precision as well as high flexibility with respect to installation and adaptation to other systems", says Weigand in conclusion.

Their high precision, robustness and compact design will allow use of the new linear position sensors in other industries and applications in the future: Potential application scenarios, for example, would be sawmills in the woodworking industry, roll gap measurement in rolling mills in the metalworking industry, and vulcanization in the tire industry. ■

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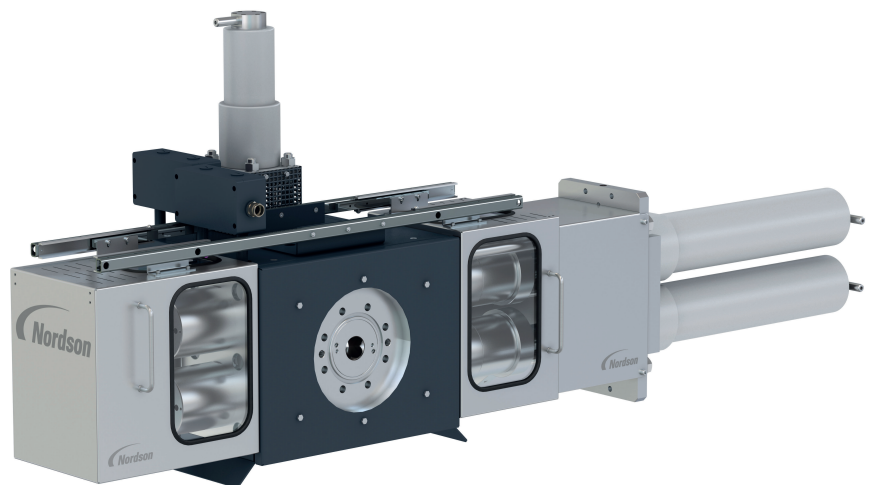


Fig. 4. The position sensors of the Plus series are suitable for applications with an expanded operating temperature range, such as screen changers used in machines for recycling plastics. © Nordson