CAN Newsletter Online

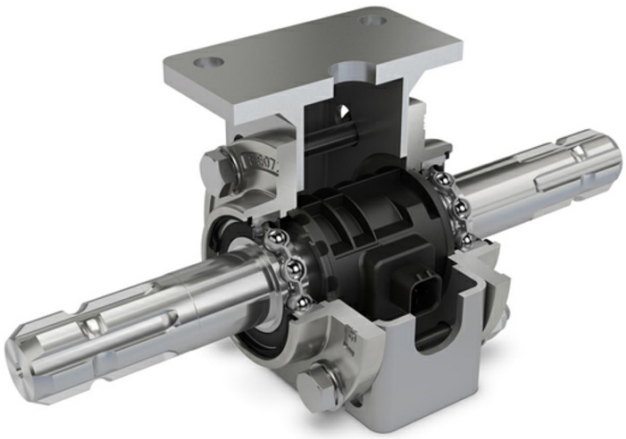
INTEGRATED TORQUE SENSORS

Precision and efficiency in agriculture

Magneto-elastic torque sensor technology allows material stresses occurring in a shaft to be measured directly and converted into a torque signal. Torque measurement modules can transfer their data via Isobus.

SCHAEFFLER OFFERS A MECHATRONIC SOLUTION that allows applications and processes to be monitored and controlled with greater precision, as the torque is recorded right where it is applied. In contrast to conventional torque measurement, disruptive influences in the drive train such as torsion rigidity, temperature effects, and losses can be reduced to a minimum. The contactless sensing means that the measurement takes place with long-term stability. Because the torque measurement is based on changes in the magnetic field and not on evaluating angles of rotation, it is not necessary for the shaft to be weakened. The measuring system therefore causes no loss of rigidity in the drive.

The fertilizer spreaders from Fliegl Agrartechnik rely on torque-controlled push-off of solid manure (Photo: Fliegl)



The fertilizer spreaders from Fliegl Agrartechnik rely on torque-controlled push-off of solid manure (Photo: Fliegl)

Ready-to-fit mechatronic modules

Schaeffler's FAG torque measurement module lets the sensors be adjusted to suit a range of different geometries.
Shaft diameters of up to approximately 100 mm are currently achievable, with a measuring range covering 100 Nm to 20 kNm. The principle on which these sensors work gives them a high degree of linearity and a very low hysteresis; the achievable degree of accuracy ranges around 1 % of the measuring range. In addition to the torque, the sensor modules also allow the speed to be measured and thus the amount of power transferred to be calculated. This means that the load history of the bearing supports and the drive, i.e. the actual load spectrum, can be calculated. As a supplier of bearing and subsystem solutions, Schaeffler is able to offer this torque sensor technology in a range of ready-to-fit modules.
In allowing machines' condition and processes to be precisely monitored by recording the torque, the company provides a prerequisite for interconnected and intelligent processes on the way to Industry 4.0.

Initial applications in agricultural engineering

Torque sensor technology has already found its first applications in the agricultural engineering sector. This comes as no surprise, since agricultural engineering is among the most innovative of all sectors: Independently-driven, electronically-coupled vehicles (electronic towbars), sensor technology for measuring the quality of the ground being crossed, digital field record systems and yield charts, interconnection via Isobus, and control strategies for the targeted use of seeding machines, fertilizer spreaders, and tillage and harvesting machinery are just some of the examples. Today, agricultural engineering has become fully digitalized. While digitalization has made significant improvements to precision as far as control systems are concerned, the electrical, mechanical, and hydraulic actuators must also be able to implement this precision. This is where the new torque sensors offer a lot of potential.

The fertilizer spreaders from Fliegl Agrartechnik rely on torque-controlled push-off of solid manure (Photo: Fliegl)

Torque-controlled fertilizer spreaders

Spreaders of all kinds are designed to spread material as consistently and evenly as possible. Making more economical use of the fertilizer or manure and adjusting it to suit the terrain increases the yield and improves cost-effectiveness. To ensure the highest possible level of spreading precision, the fertilizer spreaders from Fliegl Agrartechnik rely on the torque-controlled push-off of material, e.g. digestate, solid manure, and compost. In addition to lateral and longitudinal distribution, the advantages of this system also include the low level of stress placed on all components, reduced power consumption, and a higher output. The torque measurement module transfers its data to the control system via Isobus. All relevant parameters such as the speed and torque of the take-off shaft, the push-off speed, and the system's hydraulic pressure are recorded using sensors and then processed in the control unit. The quantity of material being spread can be monitored and adjusted from the cabin using an Isobus display.

Competitive advantages with torque sensors

Rauch, an agricultural engineering specialist, already has a history of using innovative torque sensor technology in the drive trains of its fertilizer spreaders. The electronic mass flow control (EMC) metering system utilizes the proportional relationship between the fertilizer flow for each metering slide and the drive torque of the spreader disk. Torque measurement as a central control parameter used to be carried out using oil pressure sensors in the hydraulic motors. However, due to the effect of the temperature on the hydraulics and the bevel gears in the EMC spreader's drive train, the generated torques were subject to variations during the warm-up phase.

The fertilizer spreaders from Fliegl Agrartechnik rely on torque-controlled push-off of solid manure (Photo: Fliegl)

The latest generation of fertilizer spreaders now features torque measurement modules that are integrated directly into the drive hub. These measure the current fertilizer flow rate precisely, directly adjacent to the process and without contact. Even blockages and jams in the metering slides are detected. Costly fertilizer spreading thus becomes even more precise and reliable, and unwanted stresses on the environment during the process are prevented.