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The Use of Magnetostrictive Positioning in Mobile Drilling Rigs Technical Article

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R-Series Model RF Flexible Sensor

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RUGGED SOLUTIONS FOR HARSH ENVIRONMENTS

Mobile drilling equipment, whether it involves water wells or drilling blast holes in open pit mining applications, has to withstand some of the harshest conditions in the modern industrial world. Heat, pressure,

and indefinite periods of use with no downtime – are just a few of the demands required of this equipment. During the design and production of these vehicles, original equipment manufacturers (OEMs) are continually looking for new ways to improve efficiency and eliminate downtime.

Recently, MTS Sensors has been working with several lead manufacturers on machine design advancements that will further that cause. Top drives on mobile drilling rigs rely on position sensors to accurately gauge the depth of the drill bit. To better understand the issue, it is important to understand what the top drive does. The top drive (or rotary head, top head or drill head) turns the pipe with the drill bit at the bottom. As the bit goes deeper, new pipe is added. A sensor tells the operator how deep the drill has traveled.

More accurate measurement means more efficient operations. In addition to more reliable end results - by understanding exactly how deep the bit resides, operators can time stoppages to add new pipe better – and eliminate unnecessary down time. When the new pipe is inserted into the top drive and positioned over the ground pipe, it has to be positioned properly. If it is too low, the upper pipe will collide with the ground pipe and damage the threads. If it is too high, the position of the top drive will have to be adjusted manually, which costs time and money.

For decades, manufacturers of top drives for mobile drilling rigs have been forced to rely on subpar linear measurement technologies to address these issues. This is primarily due to the distances that need to be measured. Most accurate linear positioning technologies aren't designed for applications that long. To compromise, rotary sensors and strings or cables had to be used.

The two most prevalent options have been string pots attached to rotary resistive sensors and string encoders using optical or hall effect rotary sensors. String pots use a measuring cable, spool and spring to measure resistance, which is then translated into linear data. String encoders work in a similar fashion, but use more advanced encoders to translate data.

The downside to using these technologies is that they are notoriously inaccurate or require constant recalibration to ensure continual operations. While they may have been the best possible solution, the technology provides a weak spot in the overall operation of the machine.

Magnetostrictive linear positioning sensors provide a much higher degree of accuracy and better repeatability than either of the rotary methods. Measurements with very high resolution and high stability are possible in sensor elements as long as 50 feet. In tests involving top drives on mobile drilling rigs, we see the potential for significant reductions in down time and greater equipment control than found with rotary sensors.

We are also seeing improvements in durability. Magnetostriction is a non-contact technology, meaning that the magnet used to measure position glides along the element without actually touching. The result is a practically unlimited lifespan without degradation of the output signal, especially compared to springs or cables that can stretch or warp over time. The same feature allows for better operations in environments where vibration and shock are major issues.

Finally, magnetostriction is also an absolute technology, meaning that the position of the magnet in relation to the sensor head never requires calibration, resulting in faster start up times and even less downtime.

There is significant value for the equipment manufacturer as well. Magnetostrictive sensors are more compact and easier to install than rotary technologies. In many cases, they can be embedded directly into the main drill cylinder using a hermetically enclosed support tube. This is the ideal method of installation, as it offers further protection from environmental factors and adds shielding against electromagnetic interference.

In testing with top tier manufacturers, the potential for moving from rotary to magnetostrictive linear positioning in these applications is significant. With access to a truly linear, and more accurate, solution, in longer length applications, manufacturers can reduce costs of operation, improve product productivity and lower their own production costs.

ABOUT THE AUTHOR:

Luka Korzeniowski is the MTS Sensors' North American Technical Marketing Manager for the Mobile Hydraulics industry. He brings more than 19 years of experience in electrical component and construction equipment development. He holds a Bachelor of Science – Physics from Wake Forest University, Winston-Salem, NC.

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