Temposonics®

Magnetostrictive, Absolute, Non-contact
Linear-Position Sensors

MTS SENSORS

Magnetostrictive Sensors Can Meet Unique Design Challenge in Pipeline Control

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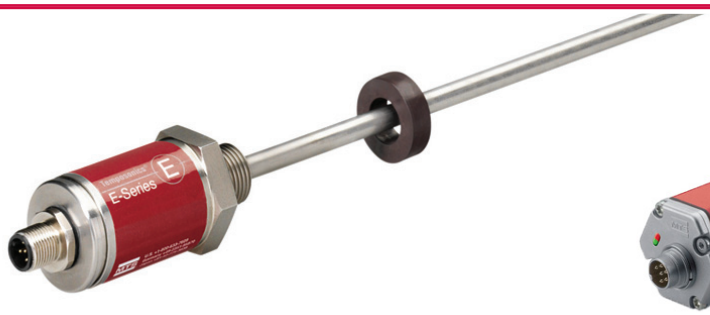

Model EH Rod-style position sensor

Model RH Rod-style position sensor

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THE CHALLENGE FOR PIPELINE CONTROL

When dealing with pipeline transportation of natural gas and other potentially hazardous fluids, operators must rely on extremely reliable measurements and controls to open and close valves. Many of these valves are now controlled by linear hydraulic or pneumatic actuators which can close a critical valve in as fast as three seconds.

The technical issues involved in valve operations are complex and varied depending on the location. A valve operating in a pipeline crossing frozen tundra experiences different stressors than one operating in an urban or tropical environment. Developers need a variety of solutions to meet challenges such as extreme environmental conditions, pressure or temperature. It isn't simply a case of "one size fits all."

As a common example, when a pipeline crosses any body of water, the environmental demands and safety implications of these applications often require advanced solutions. To understand why this was a challenge, it's first important to understand how these systems are typically installed.

Most valves in these situations are operated by closed-system cylinders in which all components are completely sealed from the elements. A gun-drilled piston rod is controlled by a pneumatic or hydraulic cylinder linked to a computer or manual system. A linear sensor within the cylinder allows for precise measurement and control.

Every component in these systems must be designed around not only the valve, but the environment in which the valve operates. It is important for engineers to understand the benefits and limitations of different components as they relate to those design challenges.

Many hydraulic actuators in traditional pipeline valve applications use a Linear Variable Differential Transformer, or LVDT, based sensor. Metal coils fixed to the cylinder housing use an electric current to measure piston rod displacement. These sensors provide the cost point, decent product life and reliability needed in typical valve applications. However, when they must be inserted inside the cylinder, they must be protected from the high pressures involved by either venting the housing or sealing the transducer away from the hydraulics via a flange.

LVDT sensors make sense in some situations. However, when dealing with valves installed in hard to reach areas or where they are exposed to extreme environmental conditions, pressure or other issues, engineers should consider more advanced linear measurement solutions.

As an example, in applications where the displacement range exceeds 20 inches, traditional LVDTs are not considered practical. While these actuators still require gun-drilled piston rods inserted into hermetically sealed cylinders, they do not respond well to the higher pressure points and tend to be less accurate over the longer lengths.

Magnetostrictive sensors enable the longer displacement ranges needed while still offering the benefits required in these applications. Additionally, they can be easily installed inside the hydraulic cylinder and operate efficiently in extreme pressure environments. Originally developed for use in heavy manufacturing applications such as fluid power, factory automation and others, magnetostrictive sensors also provide many direct and secondary advantages in valve control applications. While the setting may differ, many of the challenges remain the same. Specifically, these applications require a high level of accuracy with little to no maintenance.

These sensors work by using the time-based magnetostrictive position sensing principle, developed by MTS Sensors. Within the sensing element, a sonic-strain pulse is induced in a specially designed magnetostrictive waveguide by the momentary interaction of two magnetic fields. One field comes from a moveable permanent magnet that passes along the outside of the sensor. The other field comes from an "interrogation" current pulse applied along the waveguide. The resulting strain pulse travels at sonic speed along the waveguide and is detected at the head of the sensing element. The position of the magnet is determined by measuring the elapsed time between the application of the interrogation pulse and the arrival of the resulting strain pulse with a high-speed counter. The elapsed time measurement is directly pro¬portional to the position of the permanent magnet and is an absolute value.

Because the signal from a magnetostrictive sensor corresponds to absolute position, instead of incremental, it never requires recalibration or re-homing after a power loss. Additionally, since it is completely non-contact, there is no wear and tear, allowing for longer life cycles. These factors make these sensors ideal for enclosed high-pressure environments like those found in valve control systems. The inherent advantages of magnetostrictive sensors allow pipeline valve engineers to address many long standing challenges for remote, harsh environments such as robustness , maintenance costs, and more precise control. By expanding their options, they will be able to provide solutions that improve both the performance and the safety of pipeline valves around the world.

ABOUT MTS SENSORS:

MTS Sensors, a division of MTS Systems Corp., is the global leader in the development and production of magnetostrictive linear-position and liquid-level sensors.

MTS Sensors Division is continually developing new ways to apply Temposonics® magnetostrictive sensing technology to solve critical applications in a variety of markets worldwide. With facilities in the U.S., Germany, Japan, and China, MTS Sensors Division is an ISO 9001 certified supplier committed to providing customers with innovative sensing products that deliver reliable position sensing solutions.

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