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Siemens and Newgate Instruments bring a step-change improvement to measurement in the gasfield with the JT400 MVG

Measurement of gas flow at the wellhead with a differential pressure (DP) transmitter is a demanding application in which accuracy, reliability, and ease of installation are of the utmost importance. This is particularly the case at remote well sites, where limited availability of power and access to skilled labor can present difficult challenges that result in increased cost and operational complexity.

For decades, operators and producers have largely had to accept the pain points associated with gas flow measurement as the cost of doing business (i.e., recalibrations after plunger lift operations). This year, Siemens set out to change that by partnering with Newgate Instruments, LLC to deliver a step-change advancement for gas measurement in upstream and midstream applications: the JT400 multivariable transmitter (MVG).

The JT400 MVG is different from other process transmitters in that it was designed specifically for the purpose of measuring gas flow. Its design focuses on performance accuracy and low-power operation, while still making the API-required once-per-second measurements of differential pressure, static pressure, and process temperature. Some of the JT400's notable advantages include:

- The first ultra-low power multivariable transmitter (power consumption less than 4mW)

- Industry-leading DP measure ment accuracy of 0.05% of upper range limit or URL (veri fied by independent 3rd party)
- Best-in-class static pressure reference accuracy of 0.035% of URL
- Even when in over-range condition the sensors remain accurate to 0.1% up to 133% of URL
- Specified static effects on DP zero and span are compensated over temperature, unlike the "reference" conditions for competing products. The temperature effects on zero and span specified is for the entire operating temperature range and not over a small temperature change (such as 28 degrees) as called out on competitors' specifications.

JT400 Features and Benefits

The JT400 MVG possesses a number of unique features and associated benefits that distinguish it from other transmitters on the market. Some of these include:

1. Ultra-low Power Consumption

The JT400 is designed for integration into power-sensitive systems. Its silicon sensor, which is enhanced beyond what normal transmitters use, results in higher impedance. This reduces the current requirement for the sensor and its high sensitivity reduces the voltage requirement, leading to a significant reduction in power.

High impedance has another benefit: virtually zero self-heating. When current is applied to a low impedance sensor the power is dissipated in heat. This causes the sensor to require time to "warm up" in order to get a stable reading. With the JT400 there is no warm up time, which means it can be turned on to obtain a measurement and then turned off as quickly as possible, enabling operators to further conserve power.

Cost Saving Benefit:

With ultra-low power consumption, the JT400 enables operators to use power at the well site for other mission-critical equipment and instrumentation that impacts their bottom line, such as PLC's, RTU's, flow computers, etc.

2. Accuracy / Sensitivity

Single crystal silicon microstructure and high impedance give the JT400 best-in-class accuracy and sensitivity. The combination of elasticity and ion implantation results in a sensor that is perfectly repeatable mechanically with characteristics permanently trapped in the crystal lattice that cannot change unless the sensor is brought to silicon annealing temperatures, which are far beyond the operating temperature of the product. As a result, there is no need to calibrate the JT400 for span or linearity errors since these would be caused by either a damaged instrument or plugged ports, not sensor issues. Quite simply, the calibration tool for the JT400 does not provide linearity correction because it will never be required.

This is in contrast to other sensing technologies based on metal diaphragms or polysilicon, which exhibit changes to their characteristics due to aging, material fatigue or the effects of overpressure. These devices often can continue to operate but must be calibrated for changes in sensitivity (span) and linearity. They can also exhibit changes to characteristics that cannot be calibrated out, such as temperature effects and static pressure effects on DP.

Cost Saving Benefit:

High sensitivity and durability of the JT400 ensures accurate and reliable custody transfer, resulting in increased revenue. Additionally, operators can continue using the same device as pressure in the well drops over time, which allows for standardization of inventory, resulting in lower capital costs.

3. Ability to Withstand Overpressure

Withstanding overpressure situations, including those brought on by plunger lift applications, is one of the most important capabilities a differential pressure transmitter can possess. During plunger lift operations, it is easy to envision how likely it is for a sense line to fail or for a valve to be put into the wrong position, resulting in full-line pressure being applied to either side of the DP sensor. It is important for a sensor to not only recover from such an event but also not have it affect its calibration.

All transmitters currently offered in the gas market have some form of overpressure protection. This is generally done by either stopping the sensing diaphragm movement or by nesting the isolation diaphragm against a machined stop; as the isolation

fluid flows into the space created it forces against an overpressure diaphragm inside the unit. In both cases, the sensing mechanism is affected and zero offsets can result. It also takes time for the diaphragm to "unstick" from its bottoming cradle, causing the unit to remain in overpressure condition even after differential pressure has returned to normal.

The JT400 uses a unique overpressure protection scheme that prevents any component in the measurement system from being stressed, allowing it to return to its normal working state from an overpressure situation. The transmitter will measure accurately as soon as the differential pressure returns to operating range, which improves high-low pressure cycling. Overall, the JT400 can withstand over 100,000 high-low cycles without affecting calibration.

Additionally, the transmitter is designed to continue the characterization beyond the calibrated range. The unit will read accurately (0.1% of reading or better) up to 130% of URL. This is in contrast to most other multivariable transmitters, which are limited to operating within the URL and the lower range limit (LRL). Upon reaching the URL, some sensors will freeze as a response to overpressure. Others will go to zero.

The JT400 MVG, on the other hand, operates through full bi-directional differential pressure and will transition from positive to negative DP without the "oil-canning" exhibited by other MVTs. Bi-directional flow may be measured with a single JT400 unit.

Cost Saving Benefit: Having the capability to self-recover from overpressure situations means less time spent by technicians recalibrating the JT400 in the field. This can generate significant cost savings for well sites in remote areas where access to skilled labor is limited.

4. Ease of Installation/Use

Many pressure transmitters on the market today feature coplanar designs in which isolation diaphragms are welded to the base of the assembly in the same plane as the mounting surface. This not only causes an offset due to mounting stress but it also changes the mechanical properties of the media isolation system, which can affect everything from linearity to thermal effects.

The JT400 differs in that it uses transverse flanges. This mounting scheme effectively isolates the diaphragm from mounting stress. The transverse flange assembly also allows the isolation diaphragms to be larger than a coplanar design, which keeps the spring rate lower, enabling effective measurement of lower pressure.

Another benefit of the JT400 MVG is that it offers drop in compatibility via BSAP, Enron Modbus, and ROC compatible protocols. The device comes standard with Class I Division I, Group C, D, Explosion-proof UL/CUL, as well as intuitive menu operation with live trending in real-time.

Cost Saving Benefit:

The JT400's high level of autonomy drastically reduces the amount of time that a technician has to spend installing and commissioning the device in the field, resulting in significant OPEX reductions over the life of the well.

Changing the Status Quo

Though relatively inexpensive, pressure transmitters are a critical gasfield device that when working improperly can have wide ranging negative consequences both operationally and financially.

Until now, operators and producers have largely had to accept the difficulties that these devices present as the cost of doing business. With the JT400 MVG, Siemens and Newgate Instuments, LLC have changed that by bringing a step-change advancement to gas flow measurement. With ultra-low power performance and industry-leading accuracy, the JT400 is tailored to reducing costs and improving efficiency in upstream and midstream gas production applications.

Siemens Industry, Inc.
Process Industries and Drives
100 Technology Drive
Alpharetta, GA 30005
1-800-365-8766