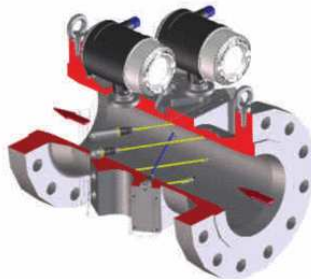


Ultrasonic Meters with Condition Based Maintenance (CBM) - A Fully Automated Approach

Multi-path ultrasonic gas meters that have advanced diagnostic capabilities with two different path layouts in one meter can reduce capital expenditures and save operation groups time and money. One meter incorporates both a fiscal meter and a check meter eliminating the need for two meters to make the same measurement. Additional savings includes eliminating unnecessary preventative maintenance programs as well as costly inspection ports and equipment.



Testing was also conducted using dirty up-stream piping with a clean meter. Under this condition the 4-path meter has slightly under-registered (about -0.1%) when the single-path meter has over-registered by about +0.5%. This result agrees with the outcome of the simulated wall roughness created by sandpaper of different grains.

Application and Conclusion

To implement the CBM technique, the flow computer will totalize the volumes from each meter (fiscal and check meter). At the end of each day (or hour) the volume reported by the fiscal meter is then compared to the volume from the check meter by the flow computer. If the velocity profile in the meter changes, e.g. due to a blocked flow conditioner or pipeline contamination, the check meter will respond differently, and thus the volumes will be different. Depending upon line size and installation conditions, a difference between fiscal and check meter of 1% may be a good alarm

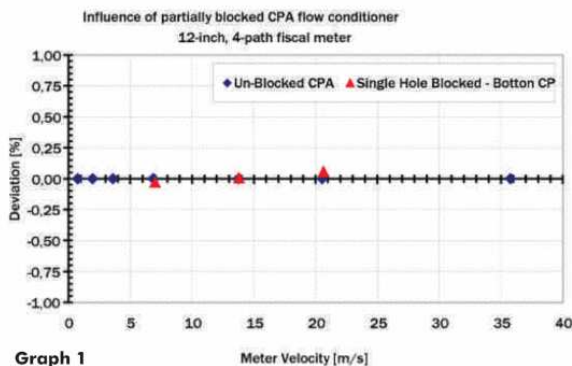
Evaluation

For condition based maintenance (CBM) it is advantageous to have an integrated, automated system that consists of a fiscal and a check meter. The fiscal meter utilizes a traditional and well proven Westinghouse 4-path design that is as insensitive as possible to changes. The check meter with its own electronics uses a simple, single path design that is very sensitive to relevant practical

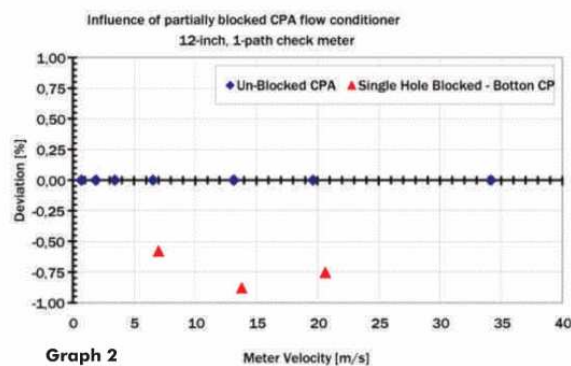
before it has relevance for the fiscal meter reading.

Testing

The SICK MAIHAK FLOWSIC600 CBM concept was tested in various setups to investigate the influence of flow disturbance, wall roughness, pulsations and blocked flow conditioner. These tests were conducted to demonstrate that under conditions that cause



Graph 1




Graph 2

changes, e.g. contamination or upstream flow disturbances. Both are incorporated into the same meter body. This significantly reduces the cost over using two meters and produces a more compact installation.

Using two separate electronics not only provides full redundancy, but also provides integrated additional diagnostics to further help ensure proper operation. Comparing both outputs, it automatically provides not only information about whether something has changed, it also gives an indication long

the single path meter to shift significantly, the 4-path meter would remain accurate.

A CPA flow conditioner was used with one hole blocked for controlled testing at the CEESI Ventura flow calibration facility. Graph 1 shows the affect on the 4-path meter. The meter was not affected by the blockage as depicted by the red diamonds; less than 0.05%. Graph 2 shows the impact on accuracy for the single path meter. The shift on the single path meter exceeds -0.5% and approaches -1.0%.

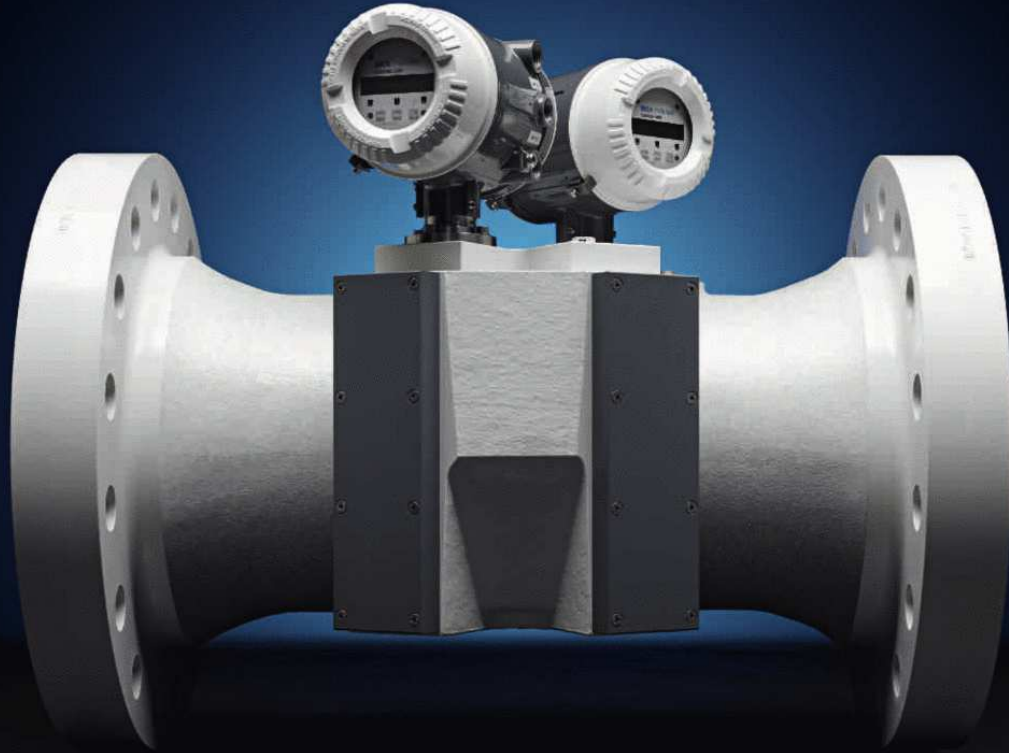
point. Based on controlled tests, a 1% change in the difference generally has less than 0.2% affect on the fiscal, 4-path meter under the same condition. 

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Ultrasonic Gas Flow Meter

For Custody Transfer and Process Applications

FLAWSIC600



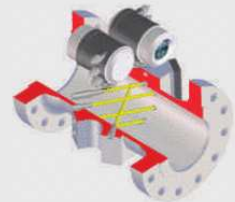
Features (all firsts in the industry):

- Automated alarming of all diagnostics
- New MEPAFLOW CBM software with integrated database
- 2Plex 4+1 CBM design is the only integrated, self-checking redundant meter
- Meter sizes starting at 2" - 4 path meters from 3" to 48"
- Suitable for process gases like N₂, O₂, H₂, CO₂, Cl₂, H₂S, ethylene, etc.
- Virtually insensitive to regulator noise
- Very low power consumption (less than 1 watt) permits solar powering

SICK MAIHAK ultrasonic gas flow meter for custody transfer and process applications. Using high quality materials and leading technology, we provide accurate, stable measurements over a long operational life. FLOW SIC600

Independence
Innovation
Leadership

SICK | MAIHAK
Analyzers and Process Instrumentation



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