

THERMAL MASS FLOW METERS PROVIDE NEW FEATURES FOR AERATION FLOW AND DIGESTER GAS APPLICATIONS

AERATION FLOW AND DIGESTER GAS

For years, Thermal Mass Flow Meters have been employed at Waste Water Treatment Plants to oxygenate the aeration basins to assist in the process of breaking down municipal waste, or to monitor Digester Gas to help achieve an overall system balance. However, only recently, have there been significant breakthroughs in the technology, to allow on site calibration validation; to permit greater flexibility and ease in installation; and to provide strategies where one meter can act as a spare for dozens of differing installations.

PRINCIPLE OF THERMAL MASS FLOW METERS

A Thermal Mass Flow Meter is based on the principle of conductive and convective heat transfer, and essentially picks up the movement of gas as the molecules of gas cool off the heated sensor. As such, they are extremely accurate devices (typically 1%) and have extraordinary low-end sensitivity – they can detect even the slightest flow of the gas. They are temperature compensated, have negligible pressure drop, are resistant to contamination, and the more modern devices can tolerate wide gas temperature fluctuations. They use reference grade platinum RTD windings as the sensors, and therefore the measurements are extremely stable over time. Typical Thermal Mass Flow Meters have at least a 100 to 1 turndown, so a very wide range of measurement is available.

CONFIGURATIONS AND INSTALLATION

Most importantly, they are easy to install. Most manufacturers provide 1/2" or 3/4" diameter probes that are easy to insert into existing pipes from 2" to 24" (or for small pipes, in-line styles with NPT fittings are available). Merely tap a hole, weld a half coupling, and insert using a manufacturer provided isolation valve assembly, or even a simple compression fitting. Most manufacturers provide guidelines as to how far into the pipe to locate the sensor, and some manufacturers offer a variety of strategies, even if the flow profile is not ideal – a condition typical of the drop lines in an aeration basin (the flow profile depends on a number of factors, the most important of which is the length of unobstructed straight run prior to the flow meter). Thermal Mass Flow Meters are available with integral or remote enclosures that are powered from either 24 VDC or 115 VAC.

READOUTS AND OUTPUTS

Specifically, the Flow Meter will report Gas Mass Flow rate in SCFM, SCFH, LBS/H or other convenient measurement units (without requiring external temperature or pressure devices to do so), and the devices will also totalize the ongoing gas consumption (SCF or LBS). The flow rate is reported over 4-20 ma outputs, as well as on a display (LCD or LED depending on the manufacturer), and can also be accessed on a laptop. Some manufacturers provide the ability for the totalizers to be reset externally by a simple contact closure, or by utilizing menuing systems accessed by a keypad or via RS232 and a laptop. In some models relays are available that can be configured as pulsed outputs, and a remote counter can then be used as an independent method of reporting consumption.

NEW FEATURES OF THERMAL MASS FLOW METERS

- ✓ A recent advancement (by one of the manufacturers) is to offer (as a standard feature) remote enclosures that contain all the electronics (as well as a display of flow rate, temperature and total), eliminating the need for any electronics at the sensor location. In this type of configuration, the sensor has a convenient weather proof and explosion proof junction box for the 6-conductor cable, but no electronics - a major advantage in very hot or cold climates where electronic components may be degraded or be susceptible to failure. The robust NEMA 4X remote electronics enclosure can be mounted up to 2000 feet away, and thus can be mounted indoors, or at least in a cabinet, where the ambient temperature is not severe. Neither

the cable length, nor cable temperature effect the meter's accuracy, since the circuitry in the remote enclosure has lead-length compensation, thus maintaining the original factory calibration, regardless of cable length.

- ✓ Another recent advancement is the ability to calibrate for up to four different gas mixes, and these calibrations can be stored as separate ranges, or channels. This feature is particularly useful for cogeneration facilities where many different gas mixtures need to be measured: Digester Gas, Natural Gas, Landfill Gas or a Mix of these gases to run the engines. In fact, a multiple channel insertion meter can serve as a spare for all these different applications: Simply select the appropriate calibration channel, enter the pipe area in a menu item, and set the desired full scale. Or perhaps the multiple channel meter can be also serve as a spare for the Waste Gas or Air Flow Meters for the aeration basins.
- ✓ Also, recently introduced, is the ability for these ranges to be selectable in the field by a Touch Display Screen Keypad, laptop, or even remotely selectable with contact closures. With a Touch Display Keypad, the cover does not have to be opened to activate the menuing system!
- ✓ Finally, one of the manufacturers offers a routine to check the calibration of the meter by utilizing "zero flow" as a test point, and comparing it to the original factory calibration which is furnished upon shipment. This routine also verifies if the sensor is clean, as well as assuring that the meter is still in calibration. Thus, it is no longer necessary to send meters back for expensive recalibrations!
- ✓ In extreme situations, where moisture is present (although it is best to eliminate excess moisture with traps, dryers and filters), splash guards are available with some manufacturers to minimize the effect of moisture on the flow sensor.
- ✓ Finally, new strategies for temperature compensation have become available, where there is no effect at all from the extremes of seasonal temperature variations – the flow meter holds its accuracy regardless of the temperature of the gas being monitored.

In summary, Thermal Mass Flow Meters now offer many new features to benefit the operators of Waste Water Treatment Plants, including the ability to periodically validate calibration, and having provisions for more easily installing the meters. And there are numerous applications at the WWTP where the technology applies: They measure direct Mass Flow of Air Flow to oxygenate the aeration basins; they measure Digester Gas, Waste Gas or Bio Gas, Mixed Gas and Natural Gas; and also can be used to monitor Oxygen flow for odorizer systems. However, they do not require separate temperature or pressure devices, are extremely accurate, and are very cost effective. Furthermore, their extreme low-end sensitivity (velocities as low as 10 SFPM), negligible pressure drop, high accuracy, long term stability and ease of installation, are important features that improve overall efficiencies at the plant.

The Author:

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