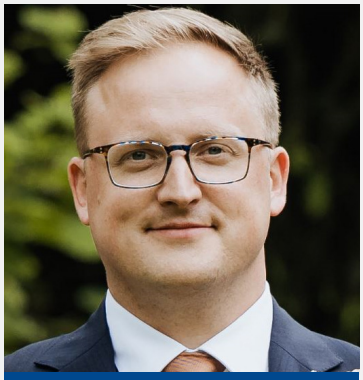
ASK THE EXPERT

Ensuring Reliable Bioreactor Operation with Emerson's Micro Motion™ Hygienic Coriolis Mass Flow Meters



BORIS VANHOVE
Business Development Manager for Life Sciences at Emerson

Bioreactors used in the pharmaceutical and biotech industries require tight control of Critical Process Parameters (CPPs) to ensure target cell growth and target protein production, as well as ensuring the final product is consistent, effective, and safe for patient use (defined as Critical Quality Attributes or CQAs.) One of the most challenging aspects of operation is the accurate measure of fluid flow to the bioreactor with devices that can still be cleaned and sanitized in place between batches.

Boris Vanhove, Business Development Manager for Life Sciences at Emerson, shares his thoughts about bioreactor optimization. With nearly 10 years of combined experience in technical and business development roles, he assists biotech clients in achieving their goals and improving their processes.

What are the main challenges to maintaining the CQAs of a bioreactor application?

In bioprocessing, avoiding contamination is paramount. The bioreactor is set up to allow target cells to grow and produce target proteins in the desired quantities. However, the same conditions ideal for target cells also appeal to other unwanted cells. When cells other than the target ones start growing in the bioreactor, one may have to scrap the entire batch and start costly clean-in-place/sterilize-in-place (CIP/SIP) cycles, which could have been avoided. Rigorous control over what goes into the bioreactor and what physical conditions are needed will help to ensure a qualified product is produced as defined by the CPPs and CQAs. An example of how to achieve this is through accurate mass flow measurement.

What are manufacturers currently doing to measure flow in bioreactors?

To control mass flow accurately, scales and load cells are employed to measure the weight of liquids in the bioreactor. However, for gases, this approach is not feasible. Instead, gas entering and exiting the bioreactor is measured through various mass and volumetric flow technologies. For larger-size bioreactors using load cells can lead to inaccurate mass flow measurements. In current biopharmaceutical manufacturing, this is not yet a limitation, but we can see this happening with the ever-growing capacities of precision fermentation. The bioreactor volumes used for these applications can be as large as 200m³. To ensure precise monitoring of Critical Process Parameters (CPPs), Coriolis meters can be used for their superior accuracy in mass flow measurements.

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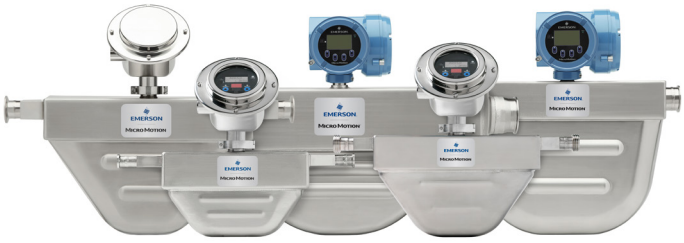
What are the advantages of Coriolis flow and density meters?

Hygienic Coriolis meters are widely recognized for their stability and lack of drift or wear over time. They offer highly accurate flow and density measurements for virtually any process fluid encountered in bioreactors. The "hygienic" in the name refers to the comprehensive hygienic application coverage — this means they are easy to CIP and SIP. Micro Motion Coriolis meters offer dramatic benefits over traditional volumetric measurement technologies, delivering accurate and repeatable process data over a range of flow rates and process conditions. This process data is provided by a single device, giving direct inline measurement of mass flow and density, as well as volume flow and temperature. Since there is no requirement for flow conditioning or straight pipe runs, the installation is simplified and less expensive.



What diagnostics are available to verify performance without stopping production?

As in nearly any industry, remote device diagnostics are an important tool for modern systems. Smart Meter Verification is a unique diagnostic tool patented by Emerson that enhances operational performance and helps customers do more with less. It allows users to troubleshoot, diagnose and gain confidence that their flow meter is operating reliably within the specifications and up to its potential. It offers a convenient check to verify that the meter performance has not shifted.

SMART METER VERIFICATION

This check is done by verifying the stiffness of the flow tubes. Stiffness is directly correlated to a meter's flow and density accuracy. Being able to measure flow tube rigidity allows users to measure causes of a shift in Coriolis meter performance. Smart Meter Verification confirms that the transmitter's hardware and software are working properly. The meter's response to the test is stored in its memory as a signature that can be used as a reference for the meter's life. Such traceability is exactly what is needed for validation purposes of pharmaceutical batch records for regulatory compliance.

What is the future of flow instrumentation in bioreactors?

As mentioned, precision fermentation applications are scaling up bioreactor sizes to new horizons. In biopharmaceuticals, the CQA specifications are too steep for scaling up endlessly. Personalized medicine such as ATMP (Advanced Therapy Medicinal Products) is more prone to scale out instead of up. I expect biofoundries to emerge in fields like precision fermented foods, chemical active pharmaceutical ingredients (APIs), enzymes and nutraceuticals. A biofoundry is a type of bioreactor where costs fall as tank size increases. They allow us to reduce our carbon footprint by minimizing the amount of land needed to manufacture essential products required to sustain our ever-growing population. Standardizing biomanufacturing with scalable technologies will prove invaluable to support the sustainable industries of the future.

Where can I find more information?

Discover more about Micro Motion Coriolis mass flow meters and other bioreactor optimization methods at https://www.emerson.com/en-us/automation/measurement-instrumentation/flow-measurement/coriolis-flow-meters-for-mass-volume-density-measurement.