

# Low-flow gas measurement for research and development in anaerobic digestion and biotechnological processes: improving accuracy, reliability and user experience

## Aim:

CJC Labs Ltd has carried out extensive development on the design and low-cost manufacture of an effective, robust, user-friendly and reliable flowmeter for quantifying low gas flows. Its primary use is to measure biogas and methane production in laboratory studies and commercial testing of anaerobic digestion and other anaerobic biotechnology substrates and processes.

In this project, the company wished to develop a verifiable protocol to assess flowmeter accuracy and reliability. This was in response to requests from end-users indicating the need for a reliable calibration method which could be reported in the scientific literature and used by those working in this field. This protocol and method would also be relevant to users of similar equipment produced by others, or of self-fabricated in-house systems.

## Results:

The results of the work are being incorporated into the advice and support offered to CJC Labs' customers on use of the flowmeters. Useful insights include:

- The scale of potential errors introduced by use of a nominal calibration factor.
- The 'count-to-count' repeatability of the flowmeters.
- The flowrate dependence of the calibration factor.



**Dr Mark Walker, University of Hull**

*"The BIV project with CJC Labs has been interesting and practically valuable. It has provided us with an opportunity to apply scientific expertise to a real-world problem related to instrument accuracy and characterisation, which directly impact on our understanding of biological processes. The partnership has been a great example of how academic/industry collaboration can add value to a commercial offering." – Mark Walker*

Use of a calibration rig developed at UoH also allowed more detailed characterisation of flowmeter behaviour, including 'non-symmetrical' performance and inter-flowmeter variability introduced by small manufacturing and assembly tolerances. This increased understanding is now being used to inform further product development at CJC Labs.

Overall, the work has provided a better understanding of the in-service performance, especially in long-term usage, that can be expected from this type of low-flow water-displacement meter. The results will allow CJC Labs to make recommendations on the frequency and duration of calibration runs and will also provide end-users with a referenceable calibration method backed up by substantial datasets subject to statistical analysis.

*"The BIV project has given CJC Labs the opportunity to make use of specialist knowledge and equipment that would otherwise be out of reach of a small company in a niche area. The planned research paper will allow public dissemination of knowledge essential to users of this type of flow meter and encourage its appropriate and accurate usage." – CJC Labs Ltd.*