Introduction

Several of the Katronic flowmeters are able to connect to two pairs of sensors simultaneously. This gives the user the opportunity to either measure on two pipes at the same time, or alternatively mount two sets of transducers to the same pipeline.

There are two occasions where this can be of benefit to the client:

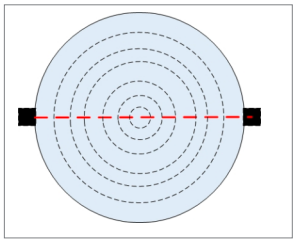
- where there is a possibility that the flow profile may be disturbed owing to bends, or restrictions in the flow,
- when there is a need for improved accuracy.

In Theory

In the case of a measurement location where the flow profile is fully developed and there are no disturbances the theory is straightforward. By taking two measurements it is possible to then average the results in order to obtain a more representative and accurate result.

This is not necessarily the case when there is the potential for disturbed flow. According to theory and our practical experience Katronic would recommend that in these circumstances the averaging function is not used.

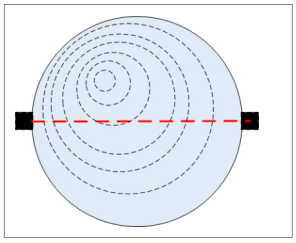
- In normal flow the point of optimum flow velocity should be centrally located within the pipe (Pic. 1).



It should therefore be possible to obtain the correct installation of the flow transducers regardless of where on the pipe that are orientated. As can be seen in Picture 1 the sensor signals always pass through the centre of the velocity profile.

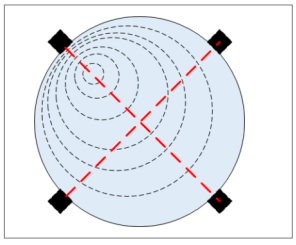
1. Normal flow

- The situation is not the same after a bend or other disturbance source such as a pipe reduction (Pic. 2).



In this case the flow profile has shifted causing the sensors to miss the point of fastest flow. By missing this critical point the flowmeter would measure lower than the expected flow rate. The key point is that in this situation it is not possible for the flowmeter to record more than the expected flow rate, only less.

2. Single disturbed flow



By using two pairs of sensors it is possible for the flowmeter to achieve at least one location where the sensors are closer to the point of maximum flow velocity (Pic. 3). In this instance, while one sensor will show a correct value, the other sensor will continue to under read.

3. Disturbed flow

- Therefore, if the results were averaged although the nett result will be an improvement on a single-channel measurement, what in fact would happen would be that the more accurate flow reading would be made worse. This has been proven in real-world examples.

In Practice

Below is a section of data extracted from measurements done for one of the UK's largest water companies. In this example an ultrasonic flowmeter KATflow 230 was being used on a 919 mm drinking water pipe.

For this installation the only location where the flowmeter could be used was in a chamber located immediately after a 90 degree bend.

Channel 1 Flow l/s	Channel 2 Flow l/s	Average Flow l/s	Max Flow
798.9620	1040.6320	919.7970	1040.6320
928.3410	1041.8950	985.1180	1041.8950
947.4700	1051.7140	999.5920	1051.7140
942.4400	1048.3550	995.3975	1048.3550
953.7190	1057.6120	1005.6655	1057.6120
937.4890	1070.3930	1003.9410	1070.3930
960.0270	1051.2040	1005.6155	1051.2040

4. Measured and calculated flow rates

- As can clearly be seen, the swirling of the water caused by the bend was having a profound impact on the measurements taken by the flowmeter.
- If the average measurement had been taken as correct in this instance then the overall error caused by the averaging calculation would have been in the region of 10 %, when in fact the flowmeter already had the right answer.

Features

All dual-channel flowmeters in the KATflow range provide the user with four options when measuring in this way:

Average	The flow readings are averaged
Maximum	The flowmeter automatically selects the higher flow value available
Difference	The flowmeter subtracts the readings on one channel from the readings on another – used when the sensors are on two different pipelines
Sum	The flowmeter adds both measurements together – used when the sensors are on two different pipelines

5. Math functions

- In order to ensure the best possible resolution the measurements are taken simultaneously with all data being measured, and displayed every second.
- Once the flowmeter has taken the measurement, and performed the required calculation the resulting data can then be stored into the memory of the instrument, or attributed to an output and sent to a third part device.
- When operating in this way, the flowmeter can measure and display flow on both channels, as well as two different calculated values giving the user maximum possible flexibility from their instrument.

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