Flow Sensor Comparison

Sensor performance test on flexible tubes in realistic environment

Application Note

SONOTEC

Company Althea, one of the leading North American contract manufacturers specializing in cGMP manufacturing, analytical development, aseptic filling and protein delivery technologies was looking to evaluate flow systems for multiple applications throughout their facilities. One of the main issues was to replace scales for volume measurement by flow sensors. For that reason, three competing flow sensor set-ups were tested for their measuring performance and suitability for the customers' specific application needs.

Test Set-Up

SENSOR	SONOFLOW® CO.55/160 V2.0 Competitor X | Competitor Y
TUBING	RM-2708, 0.5" ID, 0.75" OD
PUMP	Watson Marlow 620S pump, ALT-34345
DATA LOGGER	Omega Data Logger, OM-CP-QUADPROCESS-25MA
FEEDING	100 L plastic carboy
CONSTRAINTS	Water at room temperature

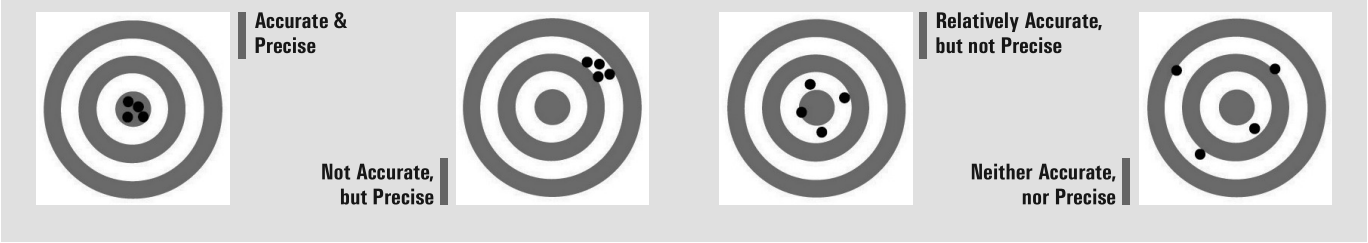
Sensor Specifications

	SONOTEC® Ultrasonic clamp-on sensor	**COMPETITOR X** Disposable turbine sensor	**COMPETITOR Y** Ultrasonic clamp-on sensor
ACCURACY	+/- 2 %	+/- 5 %	+/- 3 %
PRECISION	+/- 0.5 %	≤ 1 %	+/- 20 ml / min (max)
RESOLUTION	0.001 ml / min	1 ml / min	2 ml / min

Accuracy & Precision

Accuracy describes the error between the real and the measured value. It is an indication about how close you can get to the correct value. Reversely, precision describes the random spread of measured values around the average measured values. It finally defines how consistent you can get the results. The standard deviation (STDEV) of a measuring sequence stands for a measure of precision.

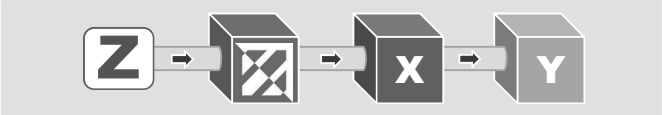
Precision is by far the most critical determinant for any measuring device and the basis for an accurate measurement. A precise flow sensor can be calibrated to become an accurate one; the reverse case is not possible. Resolution indicates the smallest detectable change in flow that a sensor can measure.



Sensor Set-up & Test Arrangement

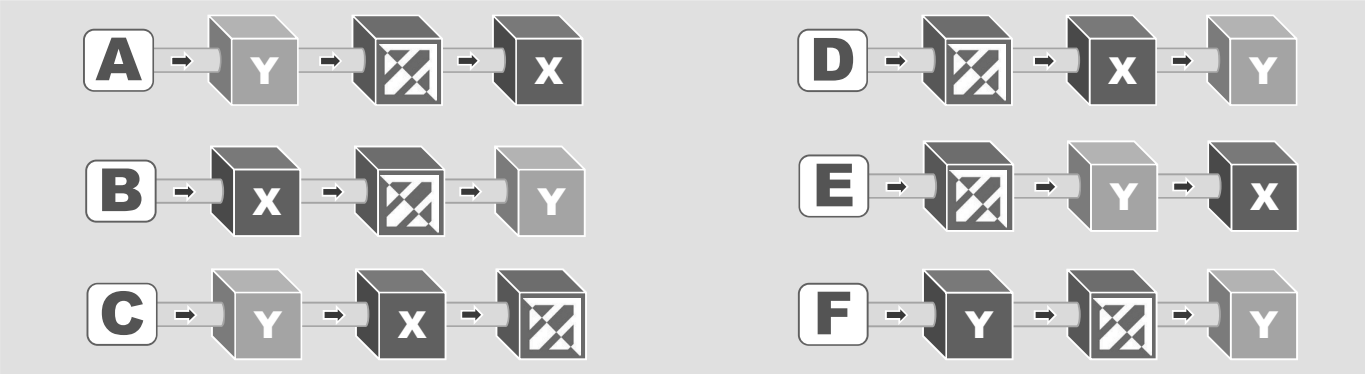
Test set-ups A / B / C / D / E / F represent a 60 minutes run each, the sensors have been re-clamped from test to test.

Set-up Z was the only 180 minutes run performed.



Minimization of Systemic Measurement Errors

The sensor set-up was chosen to minimize systemic measurement errors while comparing the sensors to each other. All test conditions were kept as stable as possible by using the same sensor and application set-up in steady ambient conditions such as temperature and air pressure. All sensors have been calibrated to the applied test set-up to finally refer to the pump output at 3.5 L / min.



Measuring Results Pump output 3.5 L / min, 60 / 180 minutes runs

	STDEV L / min			AVERAGE FLOW RATE L / min			ACCURACY		
SETTING		X	Y		X	Y		X	Y
A	0.0388	0.1630	0.1433	3.47	3.69	3.43	-0.86 %	5.43 %	-2.00 %
B	0.0288	0.1670	0.1415	3.48	3.65	3.43	-0.57 %	4.29 %	-2.00 %
C	0.0524	0.1692	0.1482	3.48	3.85	3.37	-0.57 %	10.00 %	-3.71 %
D	0.0492	0.1639	0.1380	3.47	3.64	3.59	-0.86 %	4.00 %	2.57 %
E	0.0382	0.1810	0.1324	3.44	3.24	3.35	-1.71 %	-7.43 %	-4.29 %
F	0.0362	0.1684	0.1459	3.45	3.17	3.51	-1.43 %	-9.43 %	0.29 %
Z	0.0260	0.1467	0.1357	3.38	3.08	3.49	-3.43 %	-12.00 %	-0.29 %

Interpretation of the Results

Summarizing all six 60 minutes runs and the 180 minutes run, the average STDEV of the SONOFLOW® CO.55 V2.0 sensor of 0.0406 L / min indicates the highest precision of all three tested sensors. This number represents an average precision of 1.16 % of the SONOTEC® device, compared to 4.04 % (Sensor X) and 4.82 % (Sensor Y).

As the precision specifies the repeatability of the sensor describing how consistent results could be reached; accuracy in turn, defines the error between the real and the measured value. Accuracy, indeed, is finally an issue of a high precision and an optimum calibration of the sensor.

With reaching the best values of the STDEV during each run, the SONOFLOW® CO.55 V2.0 shows the best precision of all competing sensor set-ups. This outstanding performance makes sure to also reach consistently high accuracies, ranking the SONOFLOW® CO.55 V2.0 top in five of seven of the simulations realized. This could be even topped by an improved calibration to the test environment.

The high resolution of the SONOFLOW® CO.55 V2.0 is one of the key reasons reaching these exceptional results.

SONOFLOW® CO.55 V2.0 stands out for high precision and best accuracy.

SALES & SUPPORT

SONOTEC US Inc.
190 Blydenburgh Rd
Suite 8, 2nd floor
Islandia, New York 11749, USA

phone +1 631 / 415 4758
e-mail sales@sonotecusa.com
web www.sonotecusa.com

SONOTEC

Certified according to ISO 9001 & EN ISO 13485