T400-Series Technical Note

Syringe Calibration of Tubing Flowsensors

Fluids

PXL, PXN and XL-Series Sensor calibrations should be performed using the actual fluid. A fluid separator diaphragm (latex works well) may be used to keep the syringe clean.

Temperature

Sensors should be calibrated within ± 2C° of the specified fluid temperature since the acoustic velocity of the fluid and tubing properties change with temperature. Constant temperature is maintained through a heat exchanger.

Tubing for PXL- & XL-Series Sterile Tubing Flowsensors

Calibration should be performed on the specific tubing to be used since tubing material and type can change the Probe calibration.

Method

Tubing flow can be calibrated using a syringe with two switch points, with a known volume between the points. This volume is calibrated by weight, by drawing water from a reservoir sitting on a calibrated scale. The reservoir is gravity fed with an overflow hole to maintain constant reservoir height and constant pressure. The switch outputs are then fed to a computer or voltmeter, which calculates the time between the switches. The average volume flow of the syringe (volume flow = volume/time) is then known. At the same time the Flowmeter's pulsatile flow output voltage is fed to the computer (or monitor the flow reading) to average the flow over the above time. The slope of that point is then calculated using the following equation:

$$\text{Slope} = \frac{\text{Measured Flow (of Flowsensor)}}{\text{Real Flow (of Syringe)}}$$

Calibration Routine

A standard calibration routine consists of the following. First a zero flow point is taken. The zero flow reading is subtracted from each Measured Flow point. Data is taken at intervals near the typical flow range and the corresponding slopes are averaged together. The gain adjustment is calculated by the following:

Calibrated Adjustment = 100% Average Slope

Since the PXL, PXN and XL Sensor designs have two transducer pairs, each pair of transducers must be separately calibrated at the factory. This corrects for any slight angle changes between piezoelectric crystals and effects of slight differences in the glue layers. Since the percent difference between the transducer pairs is linear, a new calibration (different tube or fluid) can be made using the calibration adjustment of the flow program. Consult your Flowmeter manual for details on using the menus.

Please contact Transonic Systems Inc.® for more information.

Note: The "average of slopes" line fit is used rather than "linear regression" because the line fit needs to be forced through the zero flow point.