Air-flow measurement without a dedicated flow-restrictor

Sensirion's experience in over two decades of flow measurement has led to the popularity of its whitepaper "Efficient flow measurement in a By-pass". It presents Sensirion's lessons learned and best practice "design-in" guidelines for a reliable and precise flow measurement. The described method uses a combination of main-pass/by-pass setup and the measured signal is created by a flow restricting element in the flow channel (main-pass). By connecting a microthermal flow sensor (calibrated for differential pressure) in parallel to the restrictor a by-pass is established and the total flow in the main-pass can accurately be determined. The article further discusses the flow vs. differential pressure characteristics of general flow restricting elements and certain design considerations, which allow to get the most benefit out of a microthermal flow sensor, as these feature a high sensitivity and precision even at lowest flows.

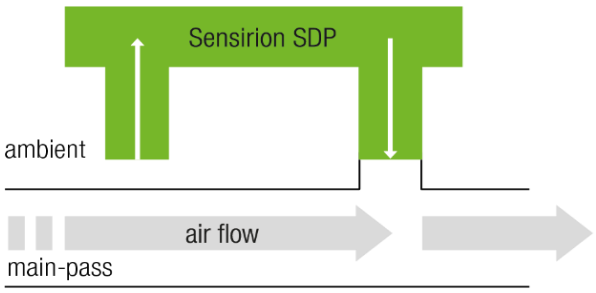

Figure 1: Air flows from the left to right in a flow channel, the main-pass. By measuring the differential pressure between the inside of the flow channel and the ambient, it is possible to determine the amount of air flowing through the flow channel / main-pass

Measuring flow without adding a dedicated flow restrictor

In certain applications it may not be possible or advantageous to add a flow restricting element into the main-pass. In these cases, one could opt for measuring already occurring pressure drops in the main channel or measuring the differential pressure between the main pass and the ambient as shown in Figure 1. In both cases internal structures such as the existing tubing of the flow channel act as the pressure drop element. By conducting a precise flow vs. differential pressure characterization, the sensor readings can be utilized to determine the total main-pass flow.

Sensor requirements

For an accurate conversion from differential pressure to the flow passing through the channel, a precise measurement over the entire dynamic range is required. In first order approximation, a quadratic dependence can be assumed. Therefore, a sensor should be chosen which is already extremely sensitive at lowest flows which corresponds to smallest differential pressure readings.

Microthermal flow sensors calibrated for differential pressure fulfill these requirements and are thus the optimal solution. Sensirion's SDP sensor family features a stable zero point, high resolution, wide dynamic range as well as the precision required for such applications. The SDP sensors are available in different sizes, measurement ranges and have a power consumption which allow operation off a coin cell. Due to the small size the SDP3x is easily integrated into various applications. Consequently, the SDP3x flow sensor is the optimal sensor for demanding wearable respiratory applications.

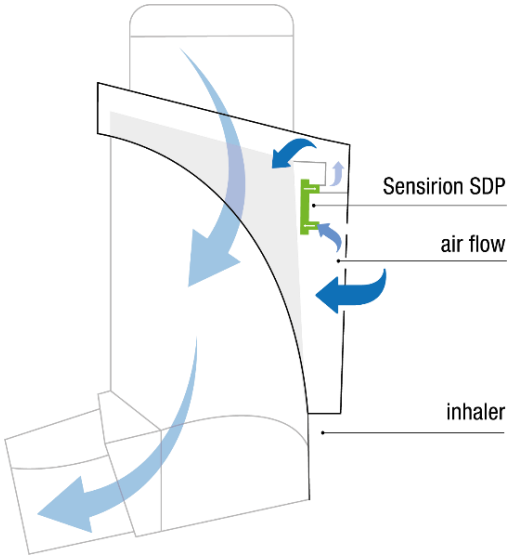

Figure 2: In order to maintain medical approval, inhalers do not allow modifications to the flow path/ inhaler housing. In a smart inhaler clip-on, the SDP3x can be used to measure the pressure difference between the canister and the ambient during inhalation and therewith accurately determine the amount of inhaled flow through the inhaler. *

*Flow measurement in smart inhalers (sensirion.com)

SENSIRION AG, Laubisruetistrasse 50, CH-8712 Staefa ZH, Switzerland
Phone: +41 44 306 40 00, info@sensirion.com, www.sensirion.com