

## Minimizing Environmental Monitoring Equipment using MEMS Flow Sensor

**Omron provides solution for Magee Scientific's quest for carbon black pollution reduction with the development of new hand-held Aethalometer**

The Aethalometer<sup>®</sup>, manufactured by Magee Scientific of Berkeley, CA, is an instrument that uses optical analysis to determine the mass concentration of "Black Carbon" particles collected from an air stream passing through a filter. In the past, these rack-mounted instruments were large and bulky. They collect data from installations located around the world, but these only give scientists limited, local samplings. To further complete the picture, scientists require a very small portable Aethalometer<sup>®</sup>. Until now, the smallest portable device, Magee's AE42, measured 11" high by 12" deep by 8" wide, weighing approximately 25 lbs. A significant reduction in size required some clever engineering and component sourcing.



Magee Scientific's new portable AE51 Aethalometer in front of their rack-mount AE22 model.

Aethalometers<sup>®</sup> function by measuring the amount of particulate deposited on a fiber filter by a specific amount of air passing through it over a predetermined amount of time. One of the major size reduction obstacles to overcome was finding a small, light weight, highly accurate flow sensor with low power consumption. The engineers from Magee Scientific called on Omron for a solution to their requirements, as Omron had previously provided flow sensors for the AE42. After listening to their requirements Omron recommended their new D6F-P MEMS mass flow sensor.

### **Size & Power Restraints:**

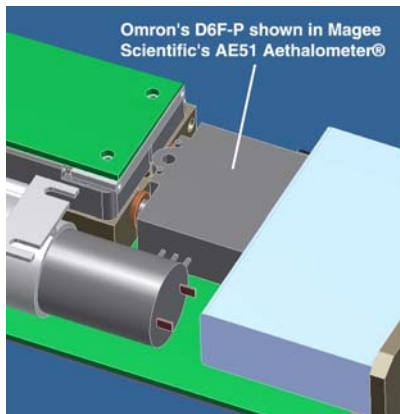
The body of the D6F-P measures just 10mm (0.40”) high by 23.3mm (0.91”) wide by 27.2mm (1.07”) deep, and with a weight of just 8.4 grams, it fell within the size and weight restraints set forth by Magee.



Omron's D6F-P MEMS Flow Sensor

Designed with ease of installation in mind, Omron developed the D6F-P with both the input and output ports on the same side to facilitate the connection of tubing. Magee engineers studied the device and cleverly designed the AE51 with these ports mating

directly to their manifold without the need for tubing. Since the new miniature device was to be battery powered, current consumption was a concern. Drawing just 15mA maximum while operating on 5VDC, the D6F-P once again proved to be a very efficient device.



Engineering sketch of Magee's AE51 internal assembly

### **Accuracy & Repeatability:**

Since the AE51 relies on calculating the exact amount of air for a given time, the flow sensor would have to be very accurate. The D6F-P has a flow range/ pressure range of +1.0SLM (+0.84 in H<sub>2</sub>O), with an accuracy of  $\pm 5\%$  F.S. maximum and  $\pm 2\%$  F.S. typical. This performance would deliver Magee the precise flow readings they required to obtain reliable measurements. Additionally, since the D6F-P's are individually pre-calibrated at the factory for high repeatability, Magee Scientific's finished device calibration time was kept to a minimum.

### **Magee Scientific's Reaction:**

"Omron's D6F-P was instrumental in the development of the AE51. This technology enabled us to meet our goals in developing this micro-product," said Dr. Tony Hansen

President of Magee Scientific. This Aethalometer<sup>®</sup> is so small that it can be strapped on the user's belt, freeing them up to do other work. It can also be tethered to weather balloons allowing for upper atmosphere readings. Another potential application would allow the device to be carried by those whose health might be affected most by inhaling large amounts of black carbon. The AE51 would alert them to areas that have high concentrations of this toxic material.

The D6F-P is one of a complete line of MEMS flow sensors offered by Omron.

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