

Technical Note No. 003

Effect of Flow Rate on Ozone Measurements: Correction Factors for Slow Flow Applications

Date: 2 August 2006

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Background

Some applications, such as chamber experiments where plants are exposed to ozone, require low sampling flow rates. The small volume of the detection cell used in 2B Tech Ozone Monitors makes our instruments well suited to slow flow applications.

For accurate measurements, the flow rate needs to be sufficient to flush the cell adequately between the Beer-Lambert Law measurements of light intensity I (sample air) and I_0 (ozone scrubbed air). At volumetric flow rates above 600 cc/min, the flow rate used has no significant effect on ozone measurements. As shipped, the Model 202 Ozone Monitor samples air at a volumetric flow rate of typically 800 cc/min. For slow flow applications, the flow rate can be reduced by use of a needle valve inserted in-line just prior to the air pump and a correction factor applied by increasing the slope calibration factor S in the instrument menu. The necessary correction factors are provided here.

Experimental

The sampling flow rate of a freshly calibrated Model 202 Ozone Monitor was varied by use a needle valve inserted in-line just prior to the air pump. A concentration of 300 ppb ozone was generated in a calibration manifold and sampled simultaneously by the 2B Tech standard instrument and by the Model 202 Ozone Monitor. Measurements were recorded as a function of sampling flow rate for both instruments, and a correction factor calculated for the modified Ozone Monitor.

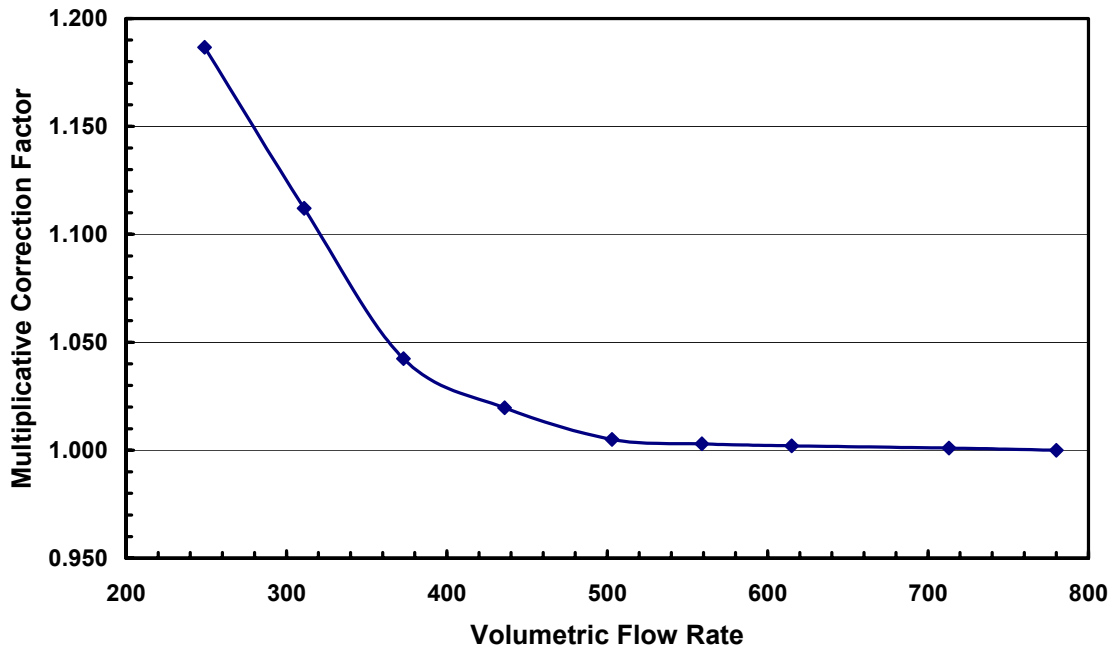
Results

The calibration factors obtained are given in tabular form below and plotted in the following figure.

Flow Rate cc/min, volumetric	Correction Factor*
249	1.187
311	1.112
373	1.042
436	1.020
503	1.005
559	1.003
615	1.002
713	1.001
780	1.000

*To apply the correction factor, multiply the slope (S) calibration factor of your instrument by the correction factor given, and enter the new S value using the instrument menu.

Ozone Correction Factor vs. Volumetric Flow Rate



Conclusions

Without software modifications, the Model 202 Ozone Monitor can be operated down to 300 cc/min with not more than about a 12% correction factor.

By increasing the length of the measurement cycle (e.g., by increasing the time between measurements to 20 s instead of 10 s), it is possible to even further reduce the required flow rate. However, this requires custom software. Please contact us if you would like a custom modification of your instrument for slow flow measurements.

The Model 205 Dual Beam Ozone Monitor requires twice the flow as the Model 202 because of its two detection cells. For this reason, the Model 202 Ozone Monitor is preferred for slow flow applications. To estimate the effect of flow rate on the Model 205, divide the measured volumetric flow rate by 2 and interpolate the required correction factor in the above table and graph.