CONCENTRATION MODE FLOW RATE CALCULATION

This document describes the formula used to compute the flow rate of a gas when operating the system in Concentration Mode.

X = Subscript which refers to a particular gas port.

F_x = Flow rate for gas port x

F_{total} = Total desired flow rate for output

OGC_x = Output gas concentration for gas port x

CGC_x = Cylinder gas concentration for gas port x

K_x = K factor of cylinder connected to gas port x

K_{ref} = K factor of Mass Flow Controller calibration gas

Flow rate for systems using built-in K factor correction:

$$F_x = F_{total} * \frac{OGC_x}{CGC_x}$$

Flow rate for systems *without* built-in K factor correction, or where external K-factor correction is desired:

$$F_x = F_{total} * \frac{OGC_x}{CGC_x} * \frac{K_{ref}}{K_x}$$

Example: Total Flow Rate desired is 5000 ccm.
Desired output concentration (OGC) is 900 ppm Argon.
Cylinder is 4000 ppm Argon, K factor = 1.31
Flow controllers calibrated in Air (K factor = 1.006)

If system uses built in K-factors

$$F_{argon} = 5000 \text{ ccm} * \frac{900 \text{ ppm}}{4000 \text{ ppm}} = 1125 \text{ ccm}$$

If system does not use built in K-factors

$$F_{argon} = 5000 \text{ ccm} * \frac{900 \text{ ppm}}{4000 \text{ ppm}} * \frac{1.006}{1.31} = 863.93 \text{ ccm}$$

Note: When the K-factor for a gas is greater than 1.0, the true flow rate of the gas will be larger than specified, due to the properties of the gas. The formula above compensates for this phenomenon by reducing the specified flow by the

cylinder k-factor. When this adjusted flow rate is used, the true flow will be correct. The opposite effect happens for gases with k-factor less than 1.0