APPLYING K-FACTORS TO MICROMANOMETERS WITH FLOW CALCULATION

APPLICATION NOTE TSI-114 (US)

Micromanometers with flow rate capability can calculate flow rate using two different methods. These calculations can include K-factors that are applied to the flow rate. These calculations are done automatically by the instrument when the necessary information is entered.

Calculation of Flow Rate Using Velocity and Duct Size

The instrument can calculate flow rate from velocity and duct size. This type of flow rate calculation applies to any measurement that occurs in a duct or pipe. The velocity in the instrument can be measured using the hot wire sensor or using a pitot tube that is attached to the pressure ports. Velocity is measured by the instrument using a pitot tube that is attached to the pressure ports. The size of the duct or pipe can be calculated off the duct dimensions or entered directly. The equations for this flow rate calculation are as follows:

$$\text{Circular Area} = A = \frac{\pi(d)^2}{4}$$

$$\text{Rectangular Area} = A = (x)(y)$$

$$\text{Flow rate} = v^* A$$

Where: A = area
d = diameter of duct
x = horizontal dimension of duct
y = vertical dimension of duct
v = velocity

Calculation of Flow Rate Using Differential Pressure and a K-Factor

The instrument can calculate flow rate from the square root of differential pressure and a K-factor. This type of flow rate calculation applies to measurements made on diffusers or flow stations with pressure taps designed for this purpose. Differential pressure is measured by the instruments using the pressure ports. The K-factor must be entered into the instrument. The equations for this flow rate calculation are as follows:

$$\text{Flow rate} = (\sqrt{p})(K_f)$$

Where p = differential pressure
Kf = K-factor

The source of the K-factor for this type of measurement is the manufacturer of the diffuser or flow station. These manufacturers specify the K-factor that must be used when making flow measurements using the pressure taps. Several K-factors are usually supplied, depending on the pressure and flow rate measurement units that are being used.

NOTE
TSI® Incorporated does not provide K-factors for this measurement. The K-factors must come from the manufacturers of the diffusers or flow stations through which the flow is being measured.

Example

You are making a flow measurement using a diffuser with pressure taps. The manufacturer of the diffuser specified the K-factors listed in the table below.

Manufacturer-Supplied K-Factors

K-Factor	Pressure Units	Flow Units
112.3	inches H_2O	ft^3 / min
3.36	Pa	l/s
139.5	mm Hg	m^3 / hr

To make this measurement, select **pressure/K-factor** in the Flow menu and enter the K-factor (112.3 or 3.36 or 139.5, depending on the pressure and flow rate units). The instrument automatically calculates the flow rate.

If the differential pressure measurement was 0.876 inches H_2O and the K-factor entered was 112.3, the flow rate displayed by the instrument would be:

Flow Rate = *(sq root of 0.876)(112.3) = 105.1 ft^3 / min*

If the differential pressure measurement was 218 Pa (0.218 kPa) and the K-factor entered was 3.36, the flow rate displayed by the instrument would be:

Flow Rate = *(sq root of 218)(3.36) = 49.6 l/s*

If the differential pressure measurement was 1.64 mm Hg and the K-factor entered was 139.5, the flow rate displayed by the instrument would be:

Flow Rate = *(sq root of 1.64)(139.5) = 178.6 m^3 / hr*

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