USE OF K-FACTORS WITH VELOCICALC® PLUS AIR VELOCITY METER AND DP-CALC™ MICROMANOMETER

APPLICATION NOTE TI-114

The VELOCICALC® Plus Models 8384, 8385, and 8386 and the DP-CALC™ Model 8705 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, Duct Size, and an Optional K Factor

The VELOCICALC® Plus and DP-CALC™ models listed above can calculate flow rate from velocity, duct size, and an optional K factor. This type of flow rate calculation applies to any measurement that occurs in a duct or pipe. Velocity is measured by the VELOCICALC® Plus using the hot wire sensor in the permanently attached probe. Velocity is measured by the DP-CALC™ using a Pitot tube that is attached to the pressure ports. The size of the duct or pipe (area is calculated by the instrument) and the K factor must be entered into the instrument. The equations for this flow rate calculation are as follows:

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

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

$$\text{Flowrate} = (v)(A)(K_f)$$

where

A = area
d = diameter of duct
x = horizontal dimension of duct
y = vertical dimension of duct
v = velocity
Kf = optional K factor

The source of the K factor for this type of measurement is the manufacturer of any obstructions to the flow, such as filters or dampers. These manufacturers sometimes specify that a K factor should be used when making measurements before or after objects that obstruct or modify the flow.

NOTE: TSI does not provide K factor values for this measurement. The K factors must come from the manufacturers of the system components in the system where the measurement is made or derived in the field.

Calculation of Flow Rate Using Differential Pressure and a K Factor

The VELOCICALC® Plus Models 8385 and 8386 and DP-CALC™ Model 8705 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 VELOCICALC® Plus and the DP-CALC™ meters using the pressure ports. The K factor must be entered into the instrument. The equations for this flow rate calculation is as follows:

$$\text{Flowrate} = \left(\sqrt{p}\right)\left(K_f\right)$$

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:
The DIP switches on the VELOCICALC® Plus and DP-CALC™ meter must be set so the pressure and flow rate units match the units of the K factor supplied by the manufacturer. When using the VELOCICALC® Plus meter to measure pressure in units of kPa, the K factor must be entered in Pa. In addition, the DIP switch enabling flow rate from pressure must be ON.

NOTE:
TSI 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.

Examples

Example 1

You are making a flow measurement in a duct that is 1.5 feet tall and 2 feet wide. The manufacturer of the ductwork specifies that a K factor of 1.10 should be used when making flow measurements in that type of ductwork. Assume that the velocity in the duct is 2500 ft/min.

To make this measurement, press the **FLOWRATE** key to enter flow rate mode. Enter the shape of the duct (rectangular), the dimensions of the duct (x size = 1.5 ft or 18 inches, y size = 2 ft or 24 inches), and then enter the K factor (1.10). The instrument automatically calculates the flow rate as follows:

Rectangular Area = (1.5 ft)(2 ft) = 3 ft^2

Flow Rate = (2500 ft / min)(3 ft^2)(1.10) = 8250 ft^3 / min

Example 2

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, first make sure the DIP switches are set to the correct units and the flow rate from pressure switch is ON. Press the **FLOWRATE** key to enter flow rate mode. Select the Kf symbol, and then 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

