DEGREE CONTROLS, INC.

Your Partner for Airflow Sensing & Controls

Application Note Series
Velocity Compensation

Product Platforms: Airflow Sensors

Purpose: Describe compensation for standard velocity

Thermal anemometers, or hot wire flow sensors, typically indicate velocities with reference to a set of standard conditions. For Degree Controls sensors, standard conditions are defined as:

21°C (70°F), 760mmHg (101.325kPa), and 0%RH

This standard velocity is equal to the actual velocity of the air when the air is at standard density. The density of air changes with variations in temperature, barometric pressure, and humidity. Differences between standard and actual velocities under some common conditions are shown in the table below.

Standard Velocity (m/s)	Tamb (°C)	Pamb (mmHg)	RH (%)	Dew Point (°C)	Pvapor (mmHg)	Actual Velocity (m/s)	% Difference (%)
6	21	740	30	2.78	5.6	6.21	3.5
6	21	760	30	2.78	5.6	6.04	0.7
6	21	780	30	2.78	5.6	5.89	1.9
6	21	740	50	10.19	9.33	6.24	4.0
6	21	760	50	10.19	9.33	6.07	1.2
6	21	780	50	10.19	9.33	5.92	1.4
6	33	760	70	26.79	26.42	6.22	3.6

Density Correction

In applications where the density of air is significantly different from standard density, some users wish to apply a density correction to standard air velocity measurements.

Use the equation below to convert standard velocity to actual velocity with compensation for temperature and barometric pressure.

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Degree Controls, Inc., a Nova Instruments Company

NOVA INSTRUMENTS

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For Degree Controls sensors:

$$Actual\ Velocity_{TempPress} = (Standard\ Velocity) \times [(273 + T_{amb}) / (273 + 21)] \times 760 / P_{amb}$$

- *Actual Velocity$_{TempPress}$* (m/s) = Standard velocity compensated for temperature and pressure
- *Standard Velocity* (m/s) = Indicated velocity
- *T_{amb}* (°C) = Ambient temperature
- *P_{amb}* (mmHg) = Ambient pressure

Since Degree Controls sensors automatically compensate for temperature, the equation becomes:

$$Actual\ Velocity_{TempPress} = (Standard\ Velocity) \times 760 / P_{amb}$$

Humidity Correction

In many applications, the effect of humidity on velocity is negligible. However, in applications where relative humidity and temperature are high, some users wish to apply a humidity correction to standard air velocity measurements.

Use the following equation to compensate air velocity for humidity. Note: The air velocity represented here has already been corrected for temperature and pressure.

$$Actual\ Velocity_{Humid} = (P_{amb} \times Velocity_{TempPress}) / (P_{amb} - P_{vapor})$$

- *Actual Velocity$_{Humid}$* (m/s) = Air velocity compensated for humidity
- *Velocity$_{TempPress}$* (m/s) = Air velocity compensated for temperature and pressure
- *P_{amb}* (mmHg) = Ambient pressure
- *P_{vapor}* (mmHg) = Vapor pressure

You will need the dew point of the air stream being measured to look up the corresponding vapor pressure. Calculate dew point based on ambient temperature and relative humidity, or use a psychometric or dew point chart to look it up. You may also use a convenient online calculator such as the one offered by Good Calculators to determine dew point.

Once dew point is known, find the corresponding vapor pressure. The National Weather Service offers an easy to operate vapor pressure calculator which may be used for this.

CONTACT:

To find out more about Degree Controls' sensor products and solutions, contact us at 1-877-degreeC, or visit our website at www.degreeC.com. Email sales inquiries to sales@degreec.com.

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