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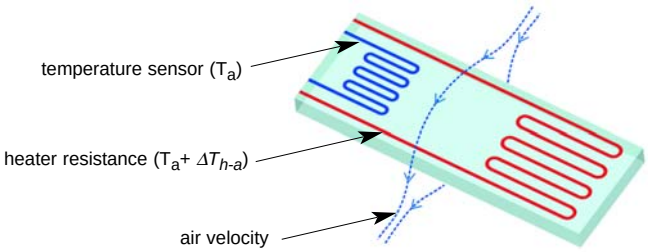
Measuring Air Velocity - Basics

Operating Principle

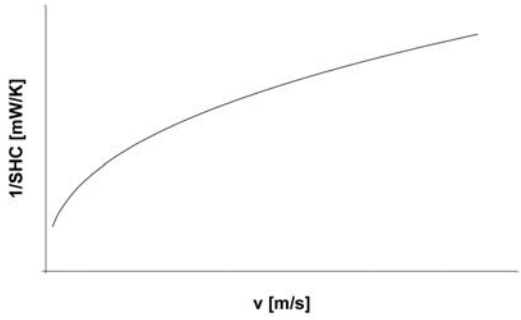
The E+E air velocity sensor utilizes the principle of hot-film anemometry.



The sensor consists of two resistive mesh deposited on a thin glass substrate using cutting-edge thin-film technology. One of the two resistors operates as a temperature sensor and measures the temperature of the flowing medium.
Using electrical current, the other resistive mesh is heated and kept at a constant temperature offset $\Delta T_{h\text{-}a}$ relative to the temperature of the medium. The medium (air or gas) flowing over the sensor with velocity v is cooling the heated resistor. The power P necessary to keep the temperature offset between heater and temperature resistor constant is a measure for the air velocity.

The sensor characteristic is non-linear and can be described using the self-heating coefficient SHC.

$$1/SHC = \frac{P}{\Delta T_{h-a}}$$



Measuring with E+E velocity meters

Generally speaking, the accuracy of the measurement depends not only on the accuracy of the velocity meter, but also to a significant extent on the installation conditions.

The accuracy of the velocity meter depends on the quality of the linearization of the characteristic and the reproducibility of the measuring signal.

The innovative design and electrical circuitry of E+E velocity sensors result in excellent reproducibility and long-term stability.

For the linearization of the characteristic, every E+E velocity meter is calibrated in a low-turbulence wind tunnel at the factory. A high-precision Laser Doppler Anemometer (LDA) is used as a reference, allowing only minimal uncertainties in the calibration of the sensor characteristic. The high quality calibration standards of E+E are traceable to the standards at leading international calibration laboratories.

The velocity meter's total uncertainty of measurement U_{total} is calculated from the meter's accuracy $u_{accuracy}$ (linearisation and reproducibility) and the uncertainty of the factory calibration U_{cal}.

$$U_{total} = k \cdot \sqrt{\left(\frac{U_{cal}}{2}\right)^2 + \left(\frac{u_{accuracy}}{\sqrt{3}}\right)^2}$$

The total uncertainty of measurement is calculated in accordance with EA-4/02, and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).
The enhancement factor k defines the confidence interval. In measurement technique commonly k = 2 is used, corresponding to a confidence level of 95%.

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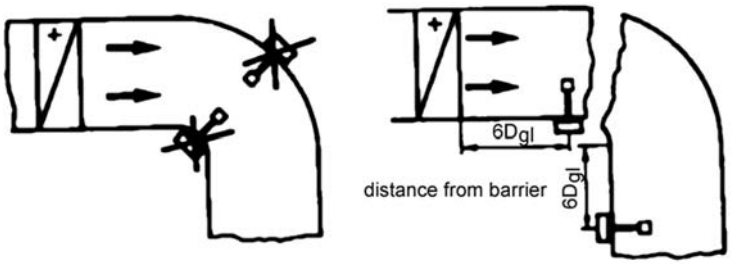
Positioning The Air Velocity Probe

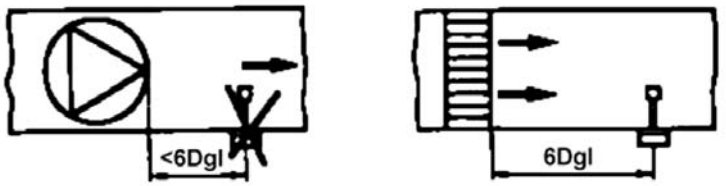
The correct position of the sensing probe is significant for reliable and accurate measurement of the air velocity.
Turbulence appears after fans as well as after bends, junctions or section changes in the duct. Reliable measurements are only possible if the probe is placed far enough from such places. The minimum distance is a function of the duct's diameter. The equivalent diameter of a rectangular duct a x b is

$$D_{gl} = \frac{2 \cdot a \cdot b}{a + b}$$

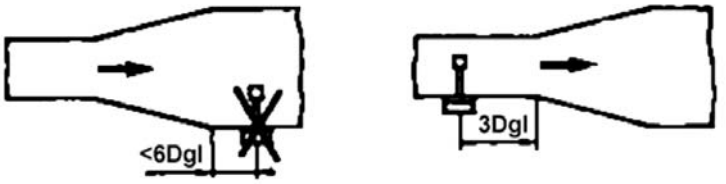


The following pictures are guidelines for correct installation of air velocity transmitters. Reliable measurements can be made by positioning the transmitter after filters (clean rooms), air heaters or air coolers, where the turbulence is very low.

The probe shall be installed in the middle of the duct.



Preferred location after filters, rectifiers, coolers (no turbulences)



The probe shall be placed in front of diffusers or confusers.

Filters and coolers calm down the air flow.

Maintenance of E+E Air Velocity Transmitters

Due to the absence of moving parts, the E+E air velocity transmitters are very reliable. Their innovative hot film anemometer principle makes them highly insensitive to dust and dirt. Under normal environmental conditions no maintenance is required.
For operation in polluted environment we recommend to clean the sensor periodically by washing it in isopropylalcohol and let it dry. Do not touch or rub.

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