Outside Air Flow is the most expensive cost in a mechanical system in most buildings located in a less than "moderate" climate. Expense to heat the outside air in the winter in the northern climates is very costly. Cooling outside air and removing excessive humidity in the warm summer months adds an even higher cost. Heating and cooling Degree Day calculations often render an average annual cost of $6.00 to $8.00 to treat each CFM of outside air supplied to a building annually. In larger cities during peak energy usage times this cost may rise to levels of $9.50 per annual CFM usage. In research and laboratory systems where the supply air is 100% fresh outside air the cost is very high but usually needed for proper ventilation. In a mixed air system where only a minimal amount of fresh air is needed for proper ventilation outside air "overfeeding" is costly, and happens all too often!

Chain Stores, Factories, and K-12 Schools rarely have had a measured outside air flow. The thought was that the air flow was set to a constant delivery and the outside air damper position was set to a constant fixed position so the fresh air delivery was a constant value. In the K-12 schools if it appeared that more fresh air was needed due to observations of student functionality or the presence of odors the OA dampers were simply opened further to allow more fresh air into the classrooms. A similar quick-fix was applied in factories and chain stores and with all three examples it was easier to open the dampers all the way as opposed to going back up on the roof in January or August.

Larger office buildings and medical and college campus buildings have used large air handlers with opposed blade dampers as the outside air dampers for more than 70 years as the function of the dampers is far more linear than that of Parallel Blade dampers. Ideally, when new, these dampers are at a 50% air flow area when the dampers are set at 50% where the parallel dampers may deliver 75% or more air when the dampers are signaled to be 50% opened or less. Many Institutions, Campuses, and large Facilities that have these types of damper banks in their air systems utilize a control signal sent to the dampers as an indication of an outside airflow as there are no actual flow stations in place (a 4 psig or a 1.5 VAC usually indicate a 15% outside air delivery).

The dampers are operated via links between each set of dampers and often the signal operates a controller on a lower section of the damper bank. Since many of these dampers are of a 1960s or 1970s vintage the connecting links between each damper have worn to where the damper openings are not equal across the damper bank and often these dampers have been found to deliver 300% to 500% over the desired and believed amount of outside air required.

Newer Damper Banks have their actuators spread more evenly across the entire damper bank to allow for a more even control across the dampers and a more consistent flow. However these damper banks still rely on end linkages to operate the non-driven damper blades and the operation of these dampers quickly become inconsistent across the entire damper bank

While the need for **Outside Air Measurement** is well known the area for installing air flow measurement stations is very limited and often longer sections of straight duct work are not available in many existing and new buildings. As building space is a highly desired commodity the room for proper lengths of ductwork for air measurement is sacrificed. Often this offers very little duct run linear footage and renders conventional air flow measurement to be unreliable at best.

The Pressure Transmitter converts velocity pressure to an output signal (to the BAS) that can be utilized in the Building Automation System for flow measurement. Velocity pressure is converted to either a 0 to 10 volt DC signal, to a 4 to 20 milliamp signal.

The signal provided to the BAS will need to be converted from a velocity pressu to actual cubic feet per minute. This is usually accomplished by a programming function where CFM = the square root of the velocity pressure / multiplied by 4005 (the weight of air at 72 degrees F and 50% humidity) / multiplied by the measured area / multiplied by a flow coefficient, or "K" factor as determined b Test and Balance contractor.

Since the flow coefficient is set as a constant and the weight of the air being measured is not a constant the accuracy of the flow measurement is questionable at any conditions other than those exactly as verified by the Test and Balance contractor.

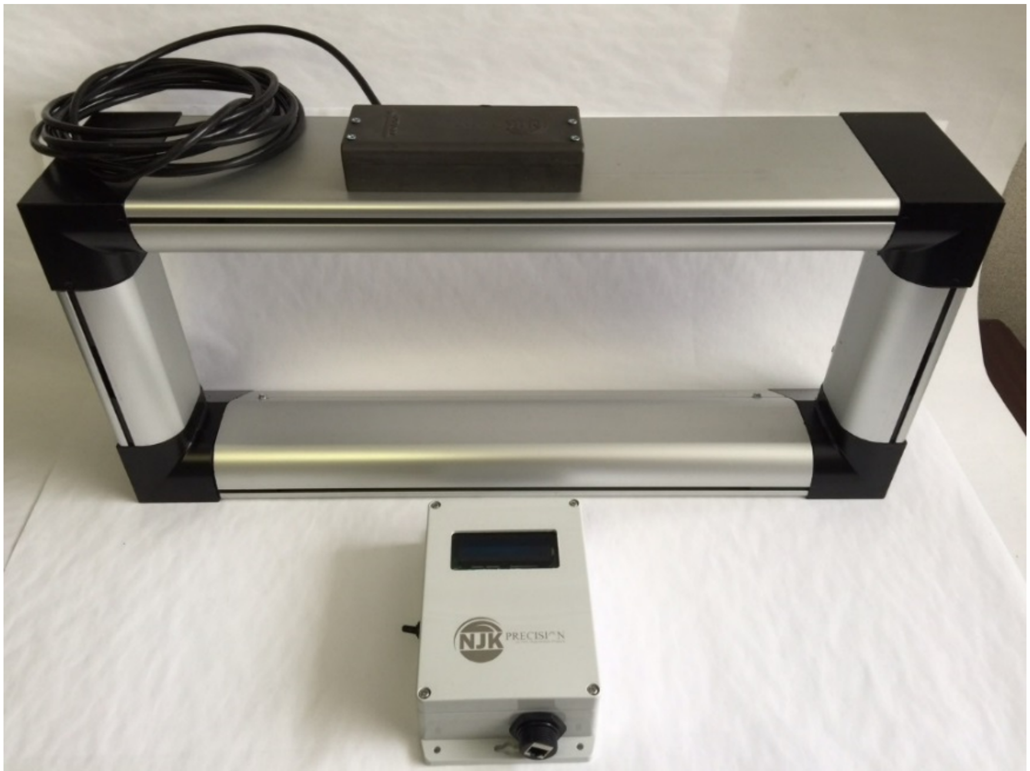
Fan Inlet Air Flow Probes have been used for many years. They are a good indication of the air flowing into the inlet of a centrifugal fan when utilized at one measured condition with no variance. These types of flow measuring devices can be verified and calibrated but if any of the dynamics of the airflow is altered these become inaccurate and unreliable. If ductwork is altered or filters become plugged or coils change their dynamics these types of flow probes will no longer be correct.

These cannot be used on variable volume fans as their accuracy does not remain when air volume and dynamics change. However many flow probe manufacturers still sell these as an acceptable way to measure air flow in a variable speed and volume fan.

Venturi Style Air Valves often do not measure air flow. Their operation is based on a spring loaded plunger that moves in or out based on static pressure of the air provided. Their flow is based on a feedback from the position of the shaft that drives the plunger opened or closed. The main selling feature is that there are no measurement devices in the air flow stream to plug up with debris.

All of the above methods of measuring air flow require a length of ductwork ahead of and after the air flow sensor to offer a chance for the air that is flowing to become less turbulent and to give a more steady and dependable air flow signal..

Mass Air Flow Measurement can only be achieved when the temperature and humidity of the measured air is taken into consideration when calculating airflow measurement. Velocity probes measure a velocity pressure where air temperature and density is assumed and flow is calculated based upon these most often false conditions. **Mass Air Flow Sensors** use the temperature and density of the air flow sampled across a Hot Wire or Thin Film Resistor to accurately measure the sampled air with complete regard to the temperature and density of the air being measured.



NJK Precision Air Flow Monitor Stations:

NJK Precision Has introduced a newer technology for air flow measurement where the Mass Air Flow is being measured. This idea was brought over from the automotive world where air flow measurement is very critical to the engineering of a High Performance automotive engine.

The NJK Precision Air Monitor Station samples the air flow from the outer edge of the ductwork. The sampled air is drawn through a single NJK Precision sensor tube where its half inch diameter and five inch length allow for ten diameters of straight air flow to even out any remaining turbulence in the air being measured.

The **NJK Precision** air flow measurement station utilizes its patented dual chambered airfoil design to dynamically normalize turbulent airflows inherent within the ductwork. The sampled air flow is measured through a single Mass Air Flow "Thin Film" sensing probe. Thin Film resistors accurately measure the total "Mass Air Flow" regardless of changes in the temperature or humidity of the air in the ductwork. Air flows calibrated at one air condition will continue to read accurately when the conditions of the air change with each season or with any changes in air dynamics.

The NJK-02 Sensor transmits a 0 to 10 VDC calibrated flow signal to a Building Automation System. The air flow signal given is actual Cubic Feet per Minute with a guaranteed accuracy calibrated to less than 40 FPM air flow.

NJK Precisions patented dual chambered airfoil design measures airflow through ductwork and requires no duct lead-in or duct lead-out for accurate operation and the NJK-02 Sensor accuracy is not affected by a lack of straight duct runs ahead of, or after the sensor.

The accuracy of the NJK Precision "Mass Air Flow" measurement is greater than 2.0% whereas Velocity Pressure measurement and fan inlet and other unreliable forms of sampling have an accuracy factor of 5.0 to 25.0%.