



Optimizing Air Filtration with Differential Pressure Sensors

The Importance of Air Filters in HVAC Systems

Air filters are a critical component of HVAC systems and must function efficiently in order to maximize system performance. They ensure that the air being circulated is filtered to avoid the spread of dust or pathogens. As filters block out these particles, over time they can clog and impact the airflow of the entire HVAC system.

Today there are a couple of common practices regarding the replacement of air filters in HVAC systems:

- 1) Schedule to replace (or clean) the air filters at set time intervals. This eliminates the need to monitor them, but can lead to the replacement of filters that are still functioning effectively. Replacing filters before they need to be changed adds unnecessary expenses to the business.
- 2) Have a technician or maintenance person go to each air filter to physically inspect it. This is both inefficient and inaccurate. Having a person go to each filter to inspect is a very inefficient and costly use of labor. Moreover, a visual inspection is subjective and similar to a time-based replacement may result in changing a filter before it is necessary.

While replacing air filters before they need to be changed results in using more filters than needed (incurring additional costs), not replacing (or cleaning) air filters when necessary can have more serious consequences, including:

- a) Lower airflow that negatively impacts the office or factory environment
- b) Utilization of more energy to restore the airflow to required levels
- c) Placing additional wear and tear on the overall HVAC system that can result in long-term maintenance and performance problems

Implementing a system that notifies the maintenance crew when is the right time to replace or clean air filters not only results in near-term cost savings, but also ensures that your overall HVAC system runs well over the long-term. Specific to air filters, you want the ability to accurately measure airflow before and after filtration to determine the effectiveness of the specific filter.



Figure 1 – Industrial Grade HVAC System

The Role of Differential Pressure Sensors in Air Filtration

Differential pressure sensors are a very effective way to measure the difference in air pressure before and after an air filter. One part of the sensor measures the airflow before the filter, commonly known as the upstream side. The other part of the sensor measures the airflow after the filter, commonly known as the downstream side. This is depicted in figure 2.

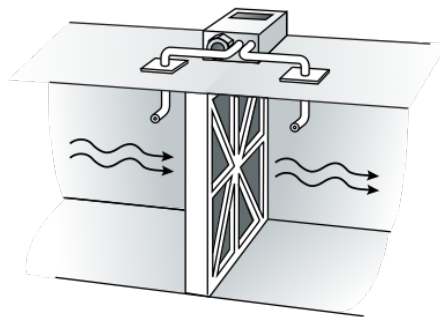


Figure 2 – Air Filter with Differential Pressure Sensing System

The differential pressure sensor provides the air pressure readings of both the upstream and downstream airflows. When the differential air pressure reaches a pre-determined value, a notification is provided to alert those monitoring the HVAC system that the filter needs to be replaced or cleaned. This ensures the system continues to run optimally, while not causing any premature or unnecessary filter replacements.

However, as with all electromechanical systems, differential pressure sensors are subject to external factors that can impact performance. For example, fans and blowers generate noise and vibrations that can impact the accuracy of the sensor. Filtering out that noise before it reaches the sensing element will greatly improve accuracy.

Another consideration in deploying sensors in a complex system is that various parts of the ‘air network’ may have different pressure requirements. Having one differential pressure sensor that can support all these different pressure requirements both simplifies system design and guarantees consistent measures across the HVAC system.

Superior Sensor's Technology Advantages in Air Filtration

Superior Sensors' proprietary [NimbleSense™](#) architecture is the industry's first System-in-a-Sensor integrated platform. Incorporating a highly differentiated advanced pressure sensing system with the ability to integrate optional building blocks enables us to combine the highest accuracy and reliability with application exclusive features. With unique technology deployed in our HV Series of differential pressure sensors, Superior's products offer many advantages for air filter implementations.

Lowest Noise Floor

External noise from blowers, fans and other sources can have a negative impact on the accuracy and performance of differential pressure sensing systems. Utilizing our integrated [advanced digital filtering](#) technology, Superior's pressure sensors eliminate the noise created by these factors prior to their reaching the sensor sub-system. By eliminating the noise before it becomes an error signal, we can offer the industry's lower noise floor.

Highest Levels of Accuracy

Sensor accuracy is important in measuring the effectiveness of air filters, especially for sensitive environments such as healthcare and precision manufacturing. Superior's HV Series of differential pressure sensors have the industry's leading accuracy typically within 0.05% of the selected range, total error band (TEB) typically within 0.15% of FSS and long-term stability typically within 0.15% of FSS per year.

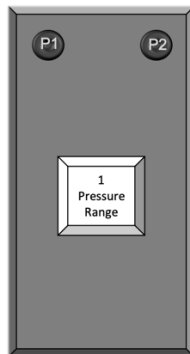
Position Insensitivity

Extremely beneficial for eliminating concerns with sensor orientation and ideal for handheld pressure sensor measuring devices, Superior's unique dual-die implementation with the HV210 maintains consistent and highly accurate readings regardless of physical orientation or movement of the differential pressure sensing device. Rated with a positional sensitivity to within 0.25 Pa, the HV210 is an industry leader with respect to position insensitivity.

Multi-Range™ Technology

Multi-Range technology allows one sensor to replace several different sensors. On the HV Series, Multi-Range can support up to 8 different pressure ranges in one device with each pressure range factory calibrated and optimized to ensure no degradation in total error band, accuracy or stability regardless of the range selected. Figure 3 shows the difference between a typical differential pressure sensor and the Superior Sensor's HV Series.

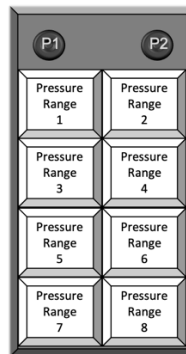
Typical Differential Pressure Sensor



Only 1 predefined pressure range available

VS.

Superior™
SENSOR
TECHNOLOGY
Multi-Range™ Differential Pressure Sensor



Up to 8 user selectable pressure ranges available

Figure 3 – HV Series Multi-Range Technology Comparison

With Multi-Range, pressure ranges can be changed ‘on the fly’ so that one device in the field can be used to serve multiple purposes. Multi-Range also enables manufacturers to bring product variants to market quickly and reduces inventory costs and product obsolescence since only one SKU needs to be stocked.

Conclusion

HVAC systems greatly benefit when differential pressure sensors are utilized to measure the efficiency of their air filters. Knowing when is the optimal time to replace or clean air filters not only results in near-term cost savings, but also ensures that your overall HVAC system runs well over the long-term.

Superior Sensor’s unique differential pressure sensor technology, based on our proprietary NimbleSense architecture, provides many differentiating features resulting in the most accurate air filter monitoring system. For more detailed information about our solutions, please visit our [HV Series product page](#) or [contact us](#).