ENGINEERING REPORT

TOPIC: EAMP & EFAMS Wind Filter & mA Output Filter

Report No. 312 **MARCH 2012** **By Glenn Esser**

We have many adjustments in the EAMP and EFAMS controllers to help compensate for different conditions encountered in various applications. This paper will explain how two of those adjustments, the Wind filter and mA Output Filter adjustments function and what types of installations may benefit from changing the factory default settings.

Understanding how these adjustments work is critical in helping solve site specific problems.

The items that need to be considered are as follows:

- Application - Fan control, damper control, pressure control
- Probe Location
- Air Flow displayed in CFM or FPM
- Building Automation System (BAS) response time
- Number of Sensors and how that affects Program SCAN TIME

The electronic air measurement station has adjustable digital filtering on the sensor input to the controller (Wind Filter) and on the signal output to the building automation system (mA Output Filter).

The Wind Filter adjustment range is from 10% of change added to current running average to 100% of change added to current running average.

Smaller numbers for the digital wind filter setting tend to stabilize the display and slow the rate of change as seen on the LDC display. See the graph for illustration of rate of change as a function of filter settings.

As the input becomes less variable, the output is also less variable too.

Air Flow Displayed as CFM or FPM

If the display is set to display CFM any change in velocity that takes place is simply multiplied by the Sq Ft of the area. For example a small change in velocity of 100 FPM (1.1 MPH) when multiplied times a 25 Sq Ft opening results in a change in the CFM displayed value of 100 FPM x 25 Sq Ft = 2500 CFM.

To reduce this change as seen by the building automation system the output can be stabilized by reducing the mA Output Filter value. Factory default is 0.35 (35%). Here again as with the wind filter adjustment only a percentage of the change is added to the running average to arrive at the new measurement. A very small filter value can result in an output to the automation system that is different, typically less, than the displayed value at the air measurement station, when air flow is increasing and greater than the displayed value when the air flow is decreasing. This is illustrated on the right hand side of the graph as the flow increases and decreases the measurement follows, trails the change.

Building Automation System Response Time

Problems can occur when the time required to arrive at the reported air flow is greater than expected. We have a factory default setting for the wind filter value of 0.25 (25%) of change added to the running average and 0.35 (35%) of the change for the mA output filter value. In the example above an instantaneous change of 2500 CFM x 0.25 x 0.35 would be reflected in the first scan as a change of 219 CFM to the automation system. This difference between the measured air flow and the running average air flow becomes less and less as the measured output approaches the actual air flow. As the measured air flow catches up with actual air flow, fans, dampers and other devices that modulate in response to the reported air flow will have to be repositioned or adjusted. This can result in an unstable system or "Hunting" as the system tries to come under "Control." Outside air measurements for the purpose of building ventilation rates need to update in tens of minutes. Flow measurement rates that effect building pressure or room pressure controls need to update in seconds. These two applications would have very different filter settings.

Number of Sensors & Scan Time

The yellow flashing lights on the bottom of the transmitter box flash as data is read from each of the sensors. The time required to read one sensor is fixed but the number of sensors in an air measurement station can vary from 2 to 16. The scan time for each program scan cycle varies from less than one second to about 3 seconds depending on the number of sensors in the system. The Scan time can be observed by watching one probe's yellow flashing LED and timing how long it takes a cycle to repeat. All of the sensors are read before the average of all the sensors is calculated and the output is updated. The filter values as stated above adjust how much of the change is added to the running average. Air measurement will approach actual air flow in less time on systems with fewer numbers of sensors and take longer on systems with more sensors.

Probe Location

Trying to report the instantaneous amount of water in a lake on a windy day by looking at a float on the top of the water can result in reported volume of the lake that changes by the height of the wave times the surface area of the lake. It would change a lot! When the waves die down that large change in volume goes away and the reported volume is more accurate. We know the level of the lake will not change instantly by an amount equal to twelve, two or even one inch every few seconds so we would only add a small change, positive or negative, to our running average. Given enough time the reported level in the lake will equal the average water level in the lake, even on a very windy day with big waves.

Installing the air measurement probes in the outside air intake hood is like the float on the lake with whitecaps on the waves. We see lots of changes taking place around our measurement. A smaller wind filter setting could be very beneficial.

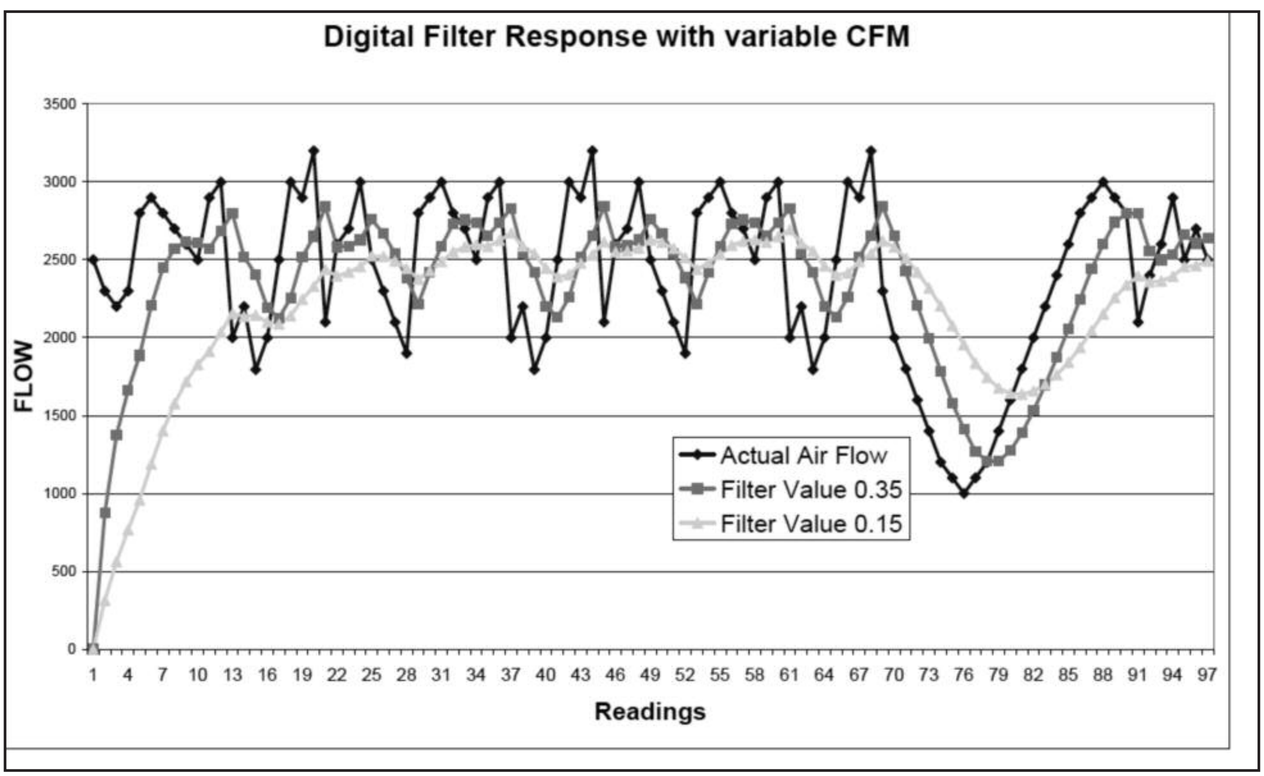
Installing the air measurement probes in a long straight duct run, is like the level in the lake when the surface is glass smooth. An instantaneous air measurement will track the actual air flow and a larger wind filter value would be appropriate. The displayed air flow and the output to the automation system could both take place almost instantly.

Few installations approach the ideal. Turbulence from hoods, elbows, takeoffs, dampers , louvers, fans and other duct obstructions create undesirable system effects that can be lessened by prudent application of adjustable wind filter and mA Output Filter settings.

The factory default Wind Filter setting is 0.25

The factory default mA Output Filter setting is 0.35

Based on the information presented in this paper it should be easier to select filter values that will enhance the performance of the air measurement station to match the application.



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