

OAFE²⁰⁰⁰ Outdoor Airflow Measurement System



- ✓ Accuracy of $\pm 0.5\%$ of Reading
- ✓ Fully Customizable Sheet Metal to Match OA Intake, Damper, Louver, etc.
- ✓ Factory Calibrated for Plug-N-Play Installation
- ✓ Measurement of Min and Max OA Flow Rate for Economizing
- ✓ Aerodynamically Designed to Resist Fouling by Airborne Particulates
- ✓ Not Susceptible to Condensation or Moisture
- ✓ Single Point Comm Connection to BMS or Local Controller via Field Selectable BACnet or Modbus Protocols

OAFE-2000 OUTDOOR AIRFLOW MEASUREMENT SYSTEM

The **OAFE-2000** is a packaged and specifiable outdoor airflow measuring system capable of producing an overall $\pm 0.5\%$ of reading accuracy and will satisfy LEED, ASHRAE 62.1, ASHRAE 189.1, ASHRAE 170 and California Title 24 requirements for verifying the required ventilation rates or air changes per hour.

The **OAFE-2000** is designed to tackle the challenges of outside airflow measurement which is often low velocity, loaded with particulate, and application specific. The packaged system consists of an integral transmitter and multiple airflow elements, factory mounted and pre-piped in a casing designed for flanged connection to ductwork, control dampers, louvers, etc. The airflow measurement station is constructed to comply with ASHRAE Standard 111 for equal area traversing of an airflow measurement plane.

Utilizing Paragon Controls' full sheet metal capabilities, the **OAFE-2000** can match up with almost any new or existing ductwork, hood, or outside air opening for a seamless engineered solution. An optional inlet bell is available for plenum applications. Application specific materials such as 316 Stainless Steel are available where salt-air may be a concern.

The integral **MTSE** Transmitter is a flow and pressure transmitter that has been engineered to provide a cost effective solution for accurate airflow measurement of up to three systems; perfect for air handling or rooftop units requiring ventilation rate monitoring at the outside air intake and supply and return fan/fan array airflow monitoring. The MTSE can connect to each fan's existing piezometering airflow sensors or to field installed airflow stations; up to five flow sensing points. The MTSE can simultaneously measure up to four additional differential pressure sensing points such as pressure drop across filters or coils, duct static pressure, and plenum pressure. The total (summed) airflow rate for the individual flow systems differential pressure points is indicated on a 3.5-inch HMI touch screen.

The total airflow rate of each system is available to the BMS or local controller via dedicated field selectable 0-10 VDC or 4-20 mA analog outputs and via field selectable BACnet®-MS/TP Master or Modbus® RTU Slave network communications. Independent flow and pressure values for each of the nine sensing points is also available to the BMS or local controller via network communication.

Additional Features

Airflow Station:

- Sensing elements are factory mounted and pre-piped in a flanged duct section (casing)
- Optional inlet bell for plenum applications
- Multiple total and static pressure sensing ports to comply with ASHRAE Standard 111 for duct traversing
- Standard construction includes a galvanized casing and 6063-T5 anodized aluminum flow sensors

MTSE Transmitter:

- NEMA 4X and IP66 rated enclosure
- Calibrated using NIST Traceable Reference Standards
- Easy and intuitive 3.5-inch touchscreen display
- Software updates via MicroSD
- True AutoZero
- User defined high and low airflow alarm visual and BMS/BAS indication
- Optional supply, return, or exhaust fan/fan array flow measurement



SPECIFICATIONS

Outdoor Airflow Measurement System

Performance Specifications

Accuracy	±0.5% of Reading
Operating Velocity Range	100 to 10,000 fpm

Airflow Station

Material

Elements	6063-T5 anodized aluminum (standard)
Casings	16 ga G90 galvanized steel (standard)

Note: Corrosive resistant and high temperature materials are available. Consult factory for further information.

Temperature

Continuous Operation	350°F (in air)
Intermittent Operation	400°F (in air)

Humidity

Continuous Operation	0 to 100%
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MTSE Transmitter

Performance Specifications

Flow Summation	Up to 3 Unique Systems (i.e. OA/SA/RA)
Flow Sensing Points	Up to 5 Unique Transducers
Additional Pressure Sensing Points	Up to 4 Transducers (i.e. Filter Loading)

Accuracy	+/- 0.25% F.S. ¹
Long Term Stability	0.15% F.S. Annually
Standard Response Time	1 second
Warmup Temperature Shifts	+/- 0.2% F.S. Span ² +/- 0.2% F.S. Offset ²

Proof Pressure	100 in. H2O
Burst Pressure	300 in. H2O

Pressure Media	Non-corrosive, non-ionic dry gases and air
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Alarm	User defined high and low
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Display	3.5" Capacitive Touchscreen
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Note¹: Accuracy includes typical linearity, hysteresis & repeatability.

Note²: Temperature shift relative to 77°F

Electrical Specifications

Power Requirements	20 - 28VAC/VDC
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Circuit Protection	Polarity Protected Self-Resetting Fuse
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Power Consumption	8.5 Watts, 15.3 VA Max
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Digital Outputs	(2) Open Collector Digital Outputs
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Digital Inputs	(2) Dry Contact Digital Inputs
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Analog Outputs	(4) 16-bit Analog Outputs Field Selectable 0-10V & 4-20mA Overvoltage and Overcurrent Protected
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Analog Inputs	(4) 12-bit Analog Inputs Field Selectable 0-5V, 0-10V & 4-20mA
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Terminal Blocks	Pluggable Screw Type
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Wiring	16 to 24 AWG
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Environmental Specifications

Operating Temperature	-4°F to 158°F (-20°C to 70°C)
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Temperature Compensated Range	-4°F to 158°F (-20°C to 70°C)
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Storage Temperature	-40°F to 257°F (-40°C to 125°C)
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Operating Humidity	0 to 95% RH (non-condensing)
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Physical Specifications

Pressure Connections	1/4" OD Barbed Brass Fittings
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Dimensions	9.50" L x 5.69" W x 3.56" H
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Enclosure	IP-66, NEMA 4X Rated Fire Retardant Impact Resistant Polycarbonate
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Mounting	Built in top and bottom mounting tabs 1/4" Through hole
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Outer Connections	Molded opening for 1/2" conduit fitting
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Weight	2lbs
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Compliance

UL	Conforms to UL 94 V-0 Conforms to UL 50E
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CE	RoHS directive 2011/65/EU REACH 1907/2006/EC Low Voltage Directive 2014/35/EU EMC Directive 2014/30/EU
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Conflict Minerals	DRC Conflict Free
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FCC	FCC Part 15, Subpart B
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BACnet	Application Specific Controller B-ASC
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Communications

Hardware	EIA-485
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Supported Protocols	Modbus RTU Slave, BACnet MS/TP
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Modbus RTU data bits	8
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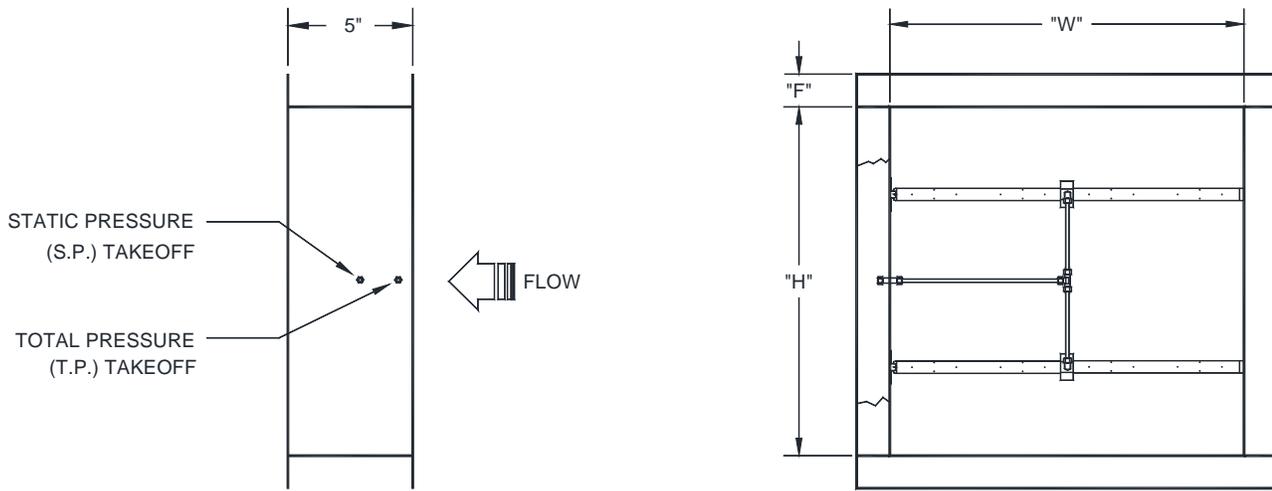
Modbus RTU parity	None
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Modbus stop bits	1
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Max communication length	4000 ft. (EIA-485)
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DIMENSIONS

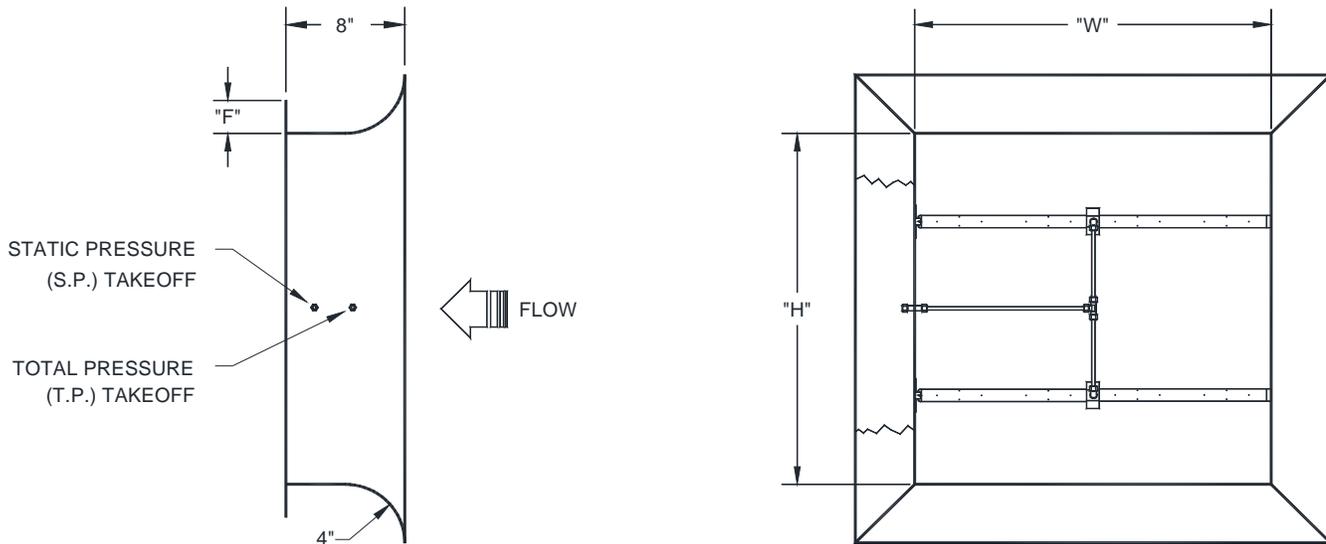
Flanged Airflow Stations for Ducted Applications



Note: Custom casing depths are available; consult factory for details.

Station Size	Flange Size
8" - 72"	1½"
73" & Over	2"

Stations with Optional Inlet Bell for Plenum Applications

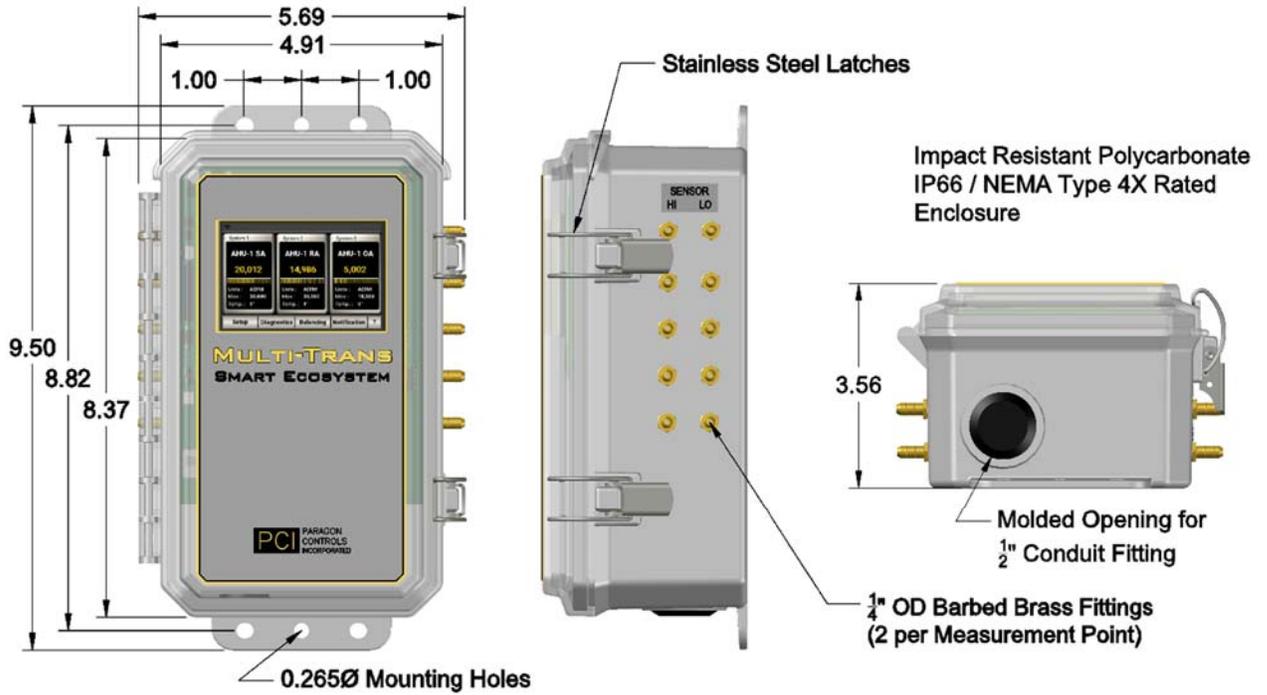


Note: Custom casing depths are available; consult factory for details.

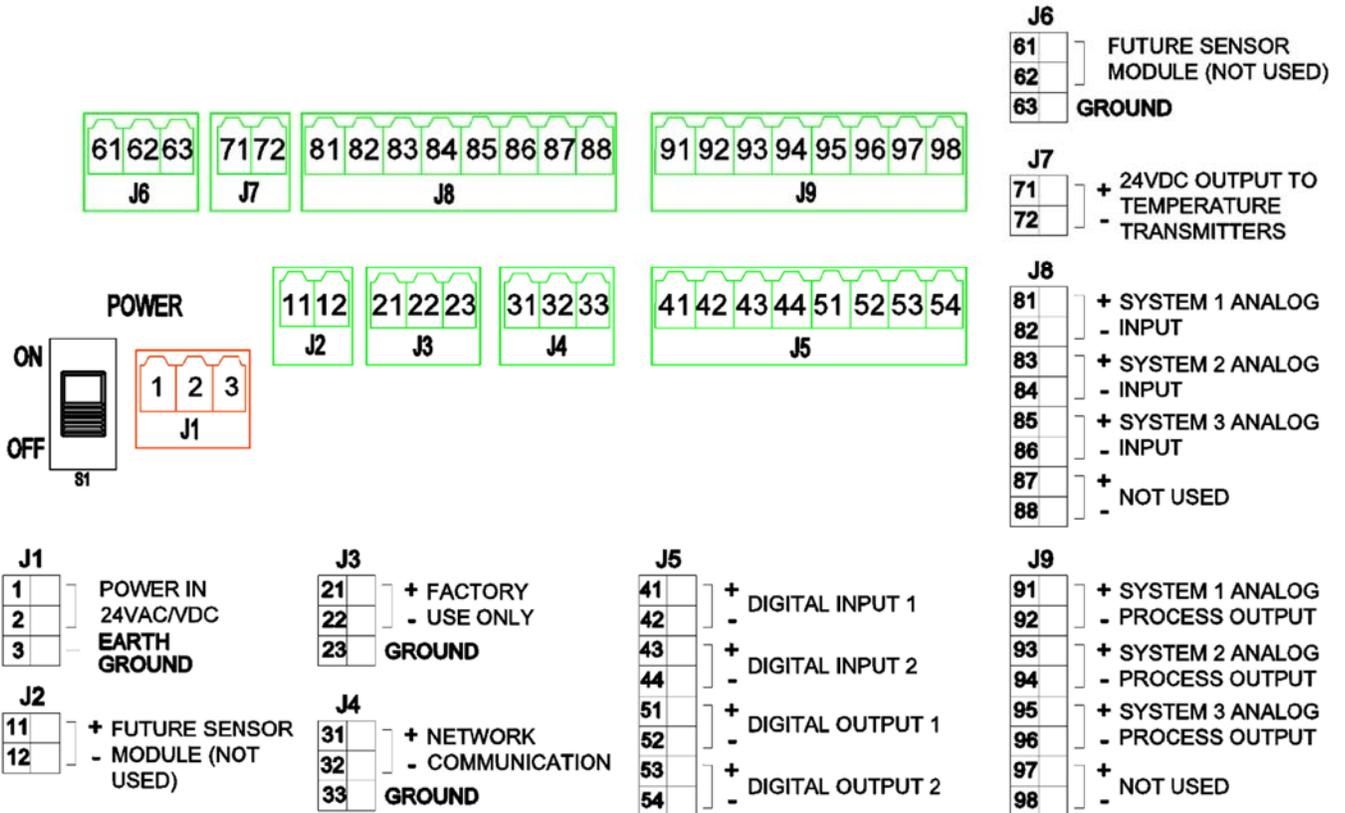
Station Size	Flange Size	Inlet Bell Radius
8" - 72"	1½"	4"
73" & Over	2"	4"

DIMENSIONS

MTSE Transmitter



ELECTRICAL CONNECTIONS



TYPICAL INSTALLATIONS

It is recommended that airflow measuring stations be sized so that the minimum velocity at the point of measurement is at least 180 fpm (0.9144 m/s), which can be accomplished using an integral inlet bell and/or blank off plate. Figures 1 through 12 below show various installations of the Outdoor Airflow Measurement System in rooftop air handling units, outdoor air plenums, and ducted outdoor air intakes. For applications with dampers, the element orientation with respect to the duct width and height should be taken into consideration (elements should run perpendicular to the damper blades).

Rooftop AHU with Rain Hood - Exterior Mounted Airflow Station

On a rooftop air handling unit with a rain hood, the airflow measuring station can be mounted on the exterior of the unit with the rain hood remounted on the intake side of the airflow measuring station. The airflow measuring station can be made with a 5 inch deep casing (see Figure 1) with mounting flanges matching the rain hood flanges. To accelerate the velocity and improve the velocity profile for better measurement accuracy, the airflow measuring station can also be constructed with an integral 4 inch radius inlet bell with an 8 inch deep casing (see Figure 2). Custom inlet bell radii and casing depths are also available; consult factory for details.

FIGURE 1

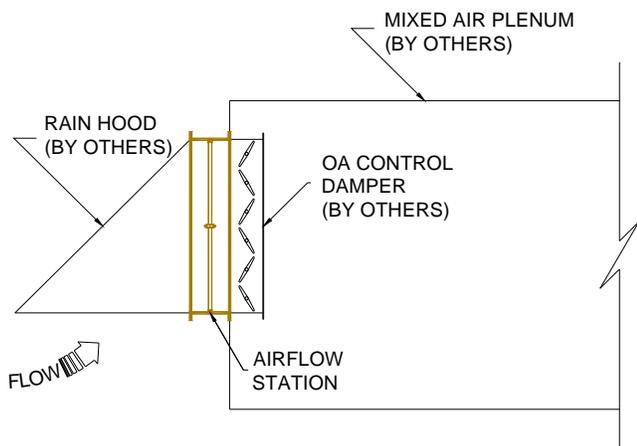
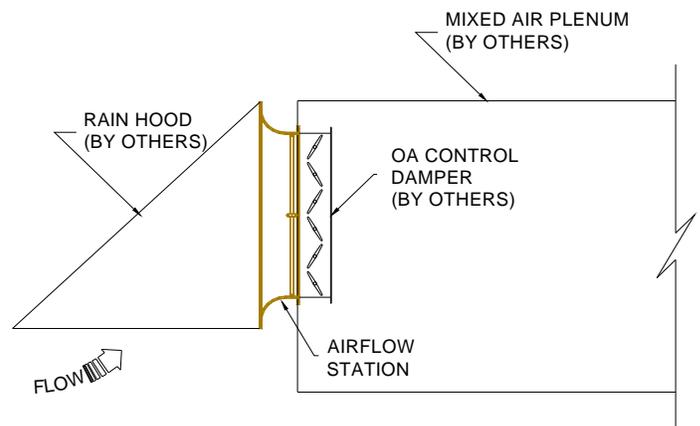


FIGURE 2



Rooftop AHU with Rain Hood - Interior Mounted Airflow Station

On a rooftop air handling unit with a rain hood, the airflow measuring station can be mounted on the interior of the unit just upstream of the OA control damper. The airflow measuring station can be made with a 5 inch deep casing (see Figure 3) with mounting flanges matching the OA control damper flanges. To accelerate the velocity and improve the velocity profile for better measurement accuracy, the airflow measuring station can also be constructed with an integral 4 inch radius inlet bell with an 8 inch deep casing (see Figure 4). Custom inlet bell radii and casing depths are also available; consult factory for details. The OA control damper is remounted on the downstream side of the airflow measuring station.

FIGURE 3

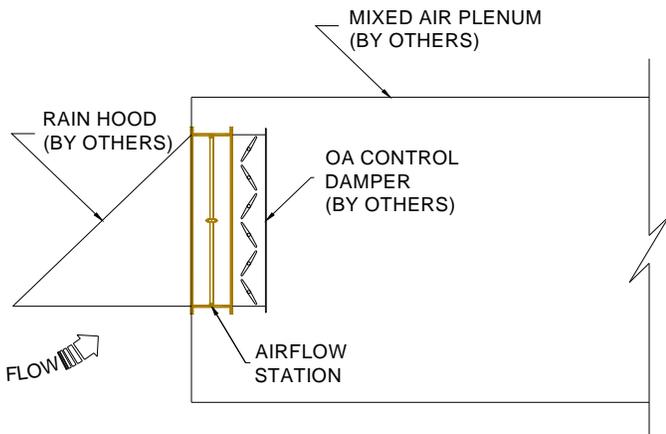
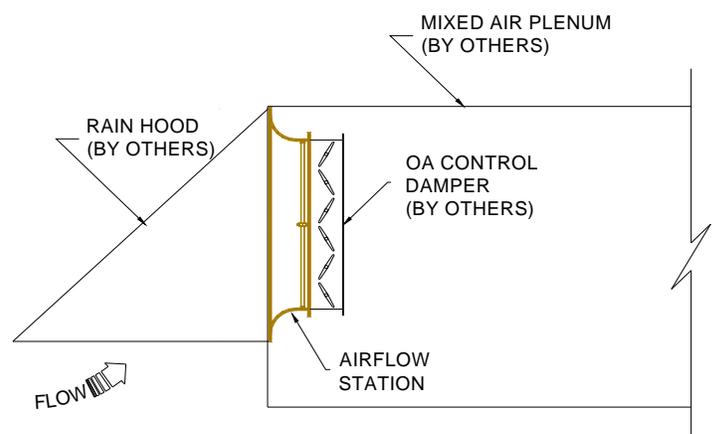


FIGURE 4



TYPICAL INSTALLATIONS

Rooftop AHU with Airflow Station Mounted Under Rain Hood

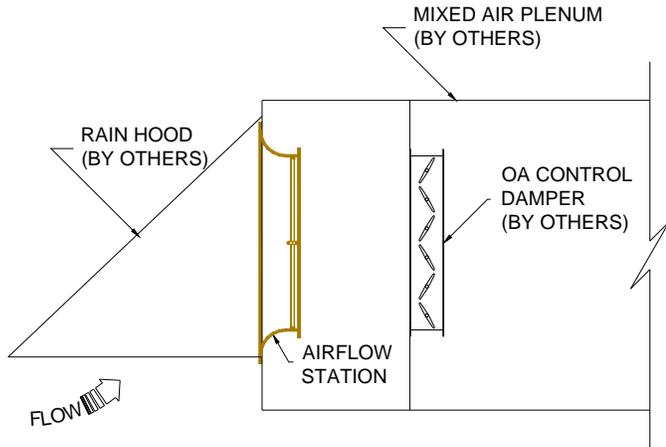


FIGURE 5

On a rooftop air handling unit with a rain hood, the airflow measuring station can be mounted under the rain hood, screwed to the exterior wall, with the depth of the station transitioning into the outdoor air plenum. To accelerate the velocity and improve the velocity profile for better measurement accuracy, the airflow measuring station is constructed with an integral 4 inch radius inlet bell with an 8 inch deep casing. Custom inlet bell radii and casing depths are also available; consult factory for details. On the air entering side a flat 1 inch flange is provided to accommodate mounting to the exterior of the AHU.

Outdoor Air Plenum - Airflow Station Mounted Downstream of Louver

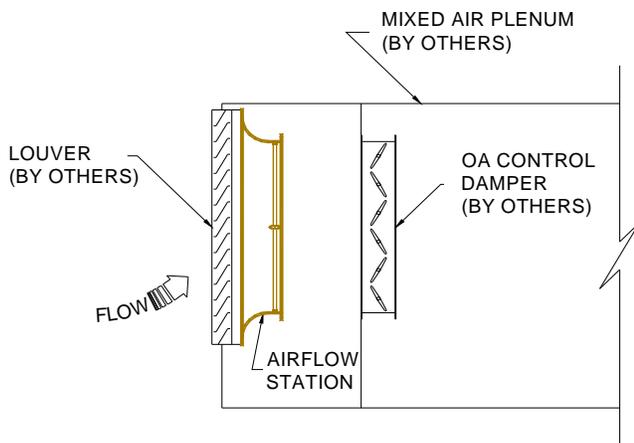


FIGURE 6

In an outdoor air plenum, the airflow measuring station can be mounted directly to the interior of the plenum just downstream of the louver. To accelerate the velocity and improve the velocity profile for better measurement accuracy, the airflow measuring station is constructed with an integral 4 inch radius inlet bell with an 8 inch deep casing. Custom inlet bell radii and casing depths are also available; consult factory for details. On the air entering side a flat 1 inch flange is provided to accommodate mounting at the interior of the louver.

Outdoor Air Plenum - Airflow Station Mounted to OA Control Damper

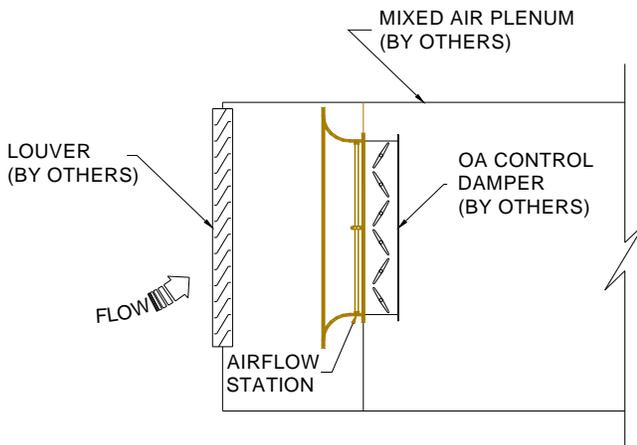


FIGURE 7

In an outdoor air plenum, the airflow measuring station can also be mounted directly on the upstream side of the OA control damper. To accelerate the velocity and improve the velocity profile for better measurement accuracy, the airflow measuring station is constructed with an integral 4 inch radius inlet bell with an 8 inch deep casing and mounting flanges matching the OA control damper flanges. Custom inlet bell radii and casing depths are also available; consult factory for details.

TYPICAL INSTALLATIONS

Outdoor Air Plenum - Airflow Station Mounted to Min OA Control Damper

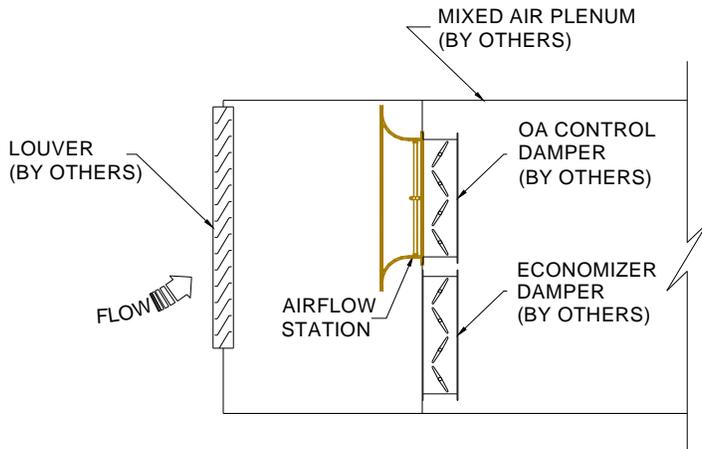


FIGURE 8

In an outdoor air plenum, where the OA control dampers are divided into minimum OA and economizer sections, the airflow measuring station can be mounted directly on the upstream side of the minimum OA control damper section for measurement of the minimum OA intake flow rate only. To accelerate the velocity and improve the velocity profile for better measurement accuracy, the airflow measuring station is constructed with an integral 4 inch radius inlet bell with an 8 inch deep casing and mounting flanges matching the OA control damper flanges. Custom inlet bell radii and casing depths are also available; consult factory for details.

Outdoor Air Plenum - Airflow Station Mounted Between Louver and OA Control Damper

In an outdoor air plenum, the airflow measuring station can be mounted directly to the interior of the plenum between the louver and OA control damper. The airflow measuring station is made with a 5 inch deep casing (see Figure 9) with mounting flanges matching the louver flanges on the air entering side of the station and mounting flanges matching the damper flanges on the air exiting side. To accelerate the velocity and improve the velocity profile for better measurement accuracy, the airflow measuring station can also be constructed with an integral 4 inch radius inlet bell with an 8 inch deep casing (see Figure 10). Custom inlet bell radii and casing depths are also available; consult factory for details.

FIGURE 9

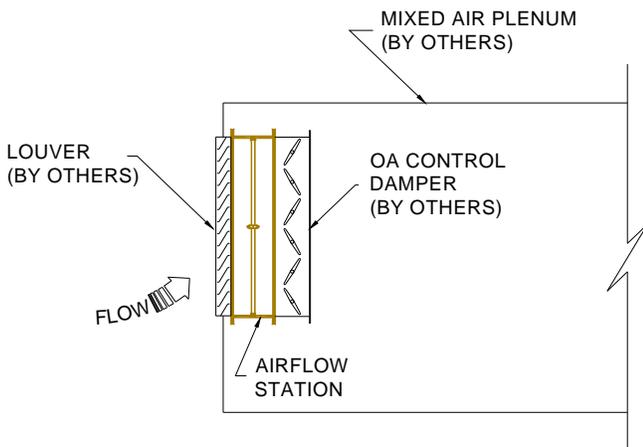
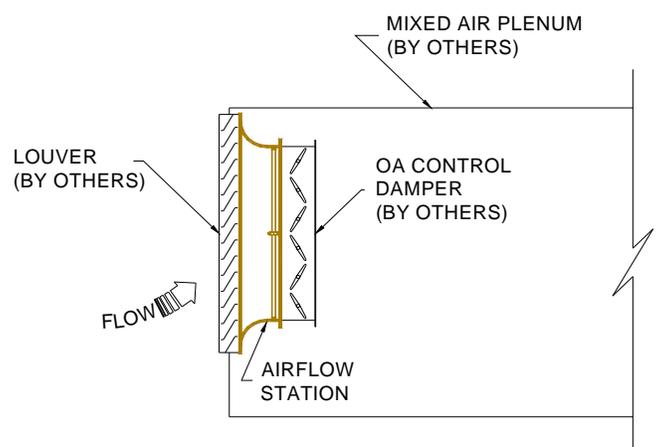


FIGURE 10



TYPICAL INSTALLATIONS

Ducted Outdoor Airflow Measuring Station

For applications with a ducted outdoor air intake to the air handling unit, a standard construction airflow measuring station is typically used. This airflow measuring station is 5" deep with 1.5" flanges (see Figure 11). The airflow measuring station may be installed in any duct configuration. However, the element orientation with respect to the duct width and height should be taken into consideration for ducted inlet applications with stations being mounted on the downstream side of an elbow (elements should run perpendicular to the axis of flow and across the velocity gradient). The accuracy of the installation is dependent on the flow conditions in the duct. The minimum installation requirements for the airflow measuring stations based upon a uniform velocity profile approaching the duct disturbance for flow rates less than 2,500 fpm are shown below (see Figure 12). These are not ideal locations. It is always best to locate the airflow measuring stations as far as possible from all duct disturbances, with upstream disturbances being the most critical consideration.

FIGURE 11

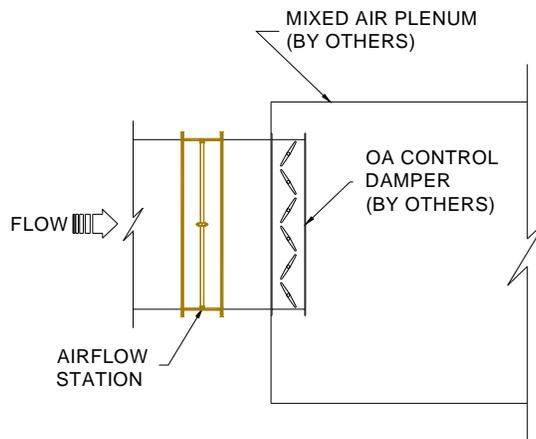
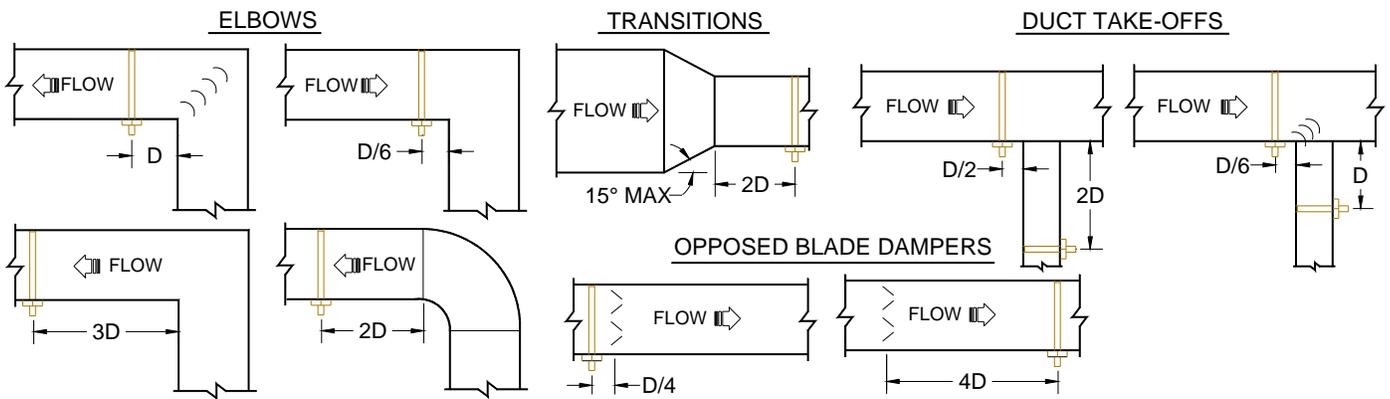


FIGURE 12



Notes:

Rectangular Ducts:

$$D = \sqrt{\frac{4HW}{\pi}} \quad H = \text{Duct height} \quad W = \text{Duct width}$$

OAFE²⁰⁰⁰ Outdoor Airflow Measurement System

SPECIFICATION GUIDE

- 1.1 Outdoor Airflow Measurement Systems: Air Handling and Rooftop Unit(s) shall be equipped with a Paragon Controls Inc. OAFE-2000 for simultaneously measuring the outside air intake ventilation rate with an accuracy of $\pm 0.5\%$ of reading, and [fans/fan arrays airflow rate], [pressure drop across filters], [pressure drop across energy recovery wheel], [pressure drop across coils], [plenum pressure]. The transmitter shall be housed in a hinged compact NEMA4X enclosure to provide flexibility in mounting location. Transmitter shall include a color touchscreen display with on-screen keypad. The total (summed) airflow rate for each system shall be available to the Building Automation System (BAS) or local controller via dedicated field selectable 0-10 V or 4-20 mA analog outputs and via field selectable BACnet®-MS/TP Master or Modbus® RTU Slave network communications. Independent flow and pressure values for each of the sensing points shall also be available to the BAS or local controller via network communication.
- i. Outside Air Intake: Provide airflow monitoring stations with multiple total and static pressure sensing ports to comply with ASHRAE Standard 111 for duct traversing. Airflow stations shall be sized such that the minimum velocity at the point of measurement is above 180 fpm.
 - ii. Fan/Fan Array: Each fan shall include a piezometer ring airflow station factory installed in each fan inlet. The device shall have a measurement accuracy of $\pm 5\%$. If piezometer ring airflow stations are not available for the fans being supplied, the use of Pitot-type fan inlet airflow sensors is acceptable.
 - iii. Pressure Drop: Static pressure tips shall be installed to monitor the pressure drop across [filters], [energy recovery wheel], [coils], to indicate when maintenance is required.
 - iv. Plenum Pressure: Static pressure tips shall be installed to monitor plenum pressure for [supply air], [return air], [exhaust air], [mixed air], [outside air].

