

FAN-Evaluator

Airflow Measuring Station



Accurate airflow measurement for demanding applications



AIR MONITOR CORPORATION

FAN-Evaluator

Product Description

The FAN-E is a multi-point, self-averaging Pitot traverse station with integral air straightener-equalizer honeycomb cell, capable of continuously measuring fan discharges or ducted airflow with an accuracy of 2% or better. The FAN-E derives its high degree of measurement accuracy from a combination of precision sensor locations, honeycomb airflow processing, pneumatic averaging of

a large number of sensed airflow pressures, and patented "symmetrical averaging" (Patent No. 3,685,355), which requires that all stages in the averaging process occur at a point where there is a balanced array of sensors present, thereby assuring that each sensed pressure is given the same "equal weight" in the averaging process as other sensed pressures.

2% Certified Measurement Accuracy



Air Monitor Corporation certifies that the FAN-Evaluator Airflow Measuring Station shown herein is licensed to bear the AMCA Certified Ratings Seal – Airflow Measurement Station Performance. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 611 and comply with the requirements of the AMCA Certified Ratings Program.

Performance ratings include the effect of an integral air equalizer-straightener cell in the AMS.

Test Data

Model. FAN-E and FAN-E/SS

Type. Differential Pressure

Conversion Formula. $Velocity = 1096 \sqrt{\frac{AMS \text{ Velocity Pressure}}{Air \text{ Density}}}$

Sizes & Shapes Tested. 36" x 36" Rectangular; 36" dia. Circular

Applicable Sizes Rated. Rectangular stations with cross-sectional areas between 4.5 and 18.0 square feet.
Circular stations with cross-sectional areas between 3.5 and 14.1 square feet.

Test Setup. AMCA Standard 610, Figure 1

Test Results – Rectangular Stations

Reference Volume, ACFM	Reference Velocity, AFPM	% Accuracy	Airflow Resistance IN w.c.
35,838	3,982	1.72	.297
29,689	3,299	1.59	.225
24,616	2,735	1.51	.158
20,400	2,267	1.14	.089
14,434	1,604	0.84	.046
8,629	959	2.08	.021

Test Results – Circular Stations

Reference Volume, ACFM	Reference Velocity, AFPM	% Accuracy	Airflow Resistance IN w.c.
29,141	4,123	0.64	.272
24,275	3,434	– 0.17	.200
20,176	2,854	– 0.51	.112
14,550	2,058	– 0.77	.067
10,215	1,445	0.33	.038
8,672	1,227	1.24	.021

How It Works

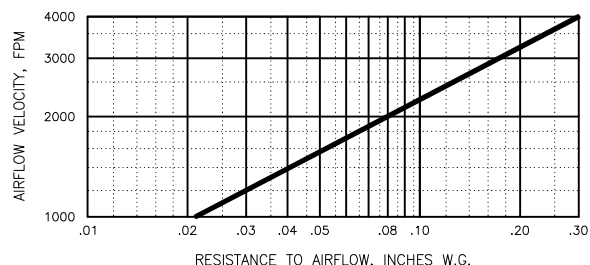
Log-Tchebycheff Sensor Location. A high concentration of total and static pressure sensors positioned according to the log-Tchebycheff rule sense the multiple and varying flow components that constitute the airstream's velocity profile. The log-Tchebycheff's perimeter weighted sensor pattern is utilized to minimize the positive error (measurements greater than actual) caused by the failure to account for slower velocities at the duct wall when using traditional equal area sensor locations. Spacing of total pressure sensors is per *ASHRAE 1993 Fundamentals Handbook* which is summarized below. Since the static pressure across the station is relatively uniform, a lesser number of static pressure sensors are utilized to minimize unrecovered pressure drop.

Duct / Station Configuration	ASHRAE 1993 Fundamentals Handbook
Rectangular	25 or more points, maximum 6" or 8" apart, depending on duct size.
Circular	12 to 30 points, along 2 or 3 diameters.

Fechheimer Pitot Flow Measurement. The FAN-E operates on the Fechheimer Pitot derivative of the multi-point, self-averaging Pitot principle to measure the total and static pressure components of airflow. Total pressure sensing ports with patented (U.S. Patent No. 4,559,835) chamfered entrances, and Fechheimer pairs of offset static pressure sensing ports combine to minimize the effect of directional airflow. When located downstream of honeycomb airflow processing cell, the Fechheimer Pitot method is extremely effective at accurately measuring airflow in limited straight duct runs.

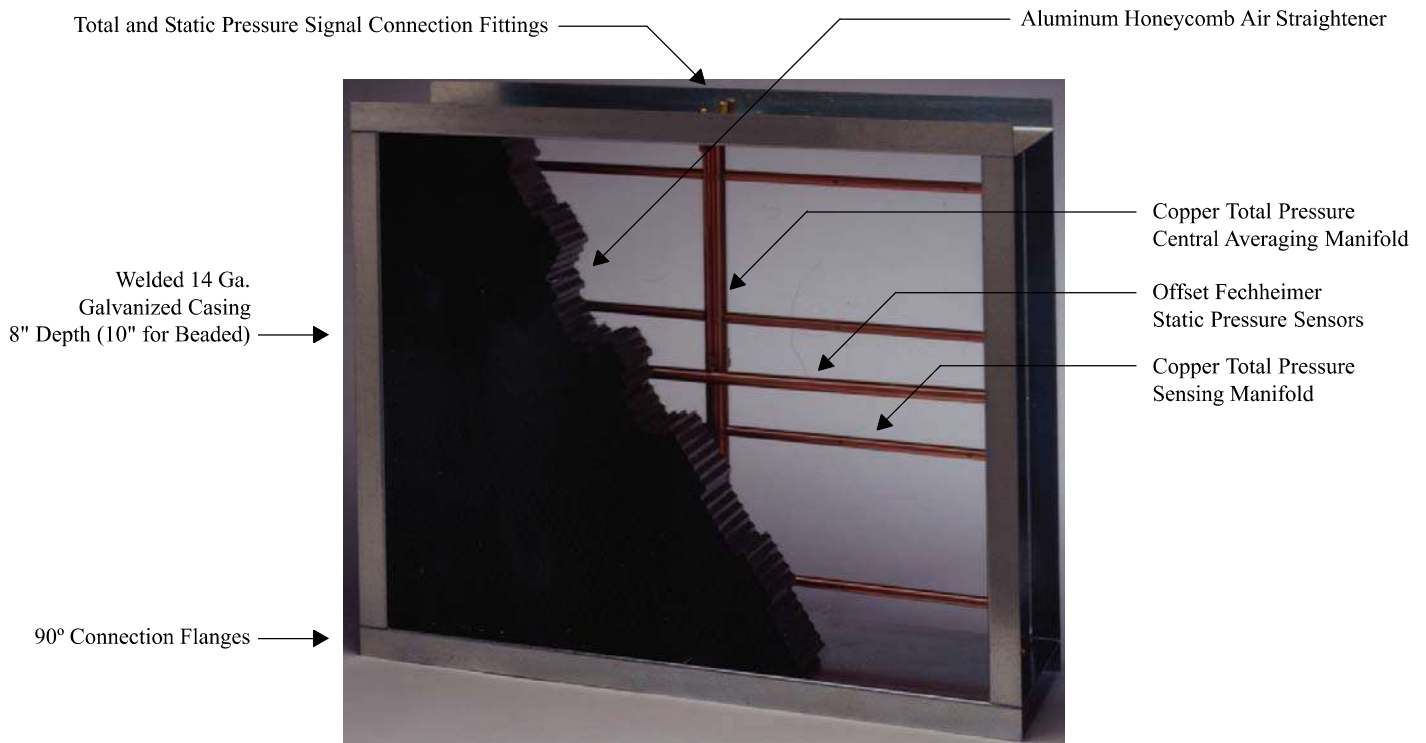
Airflow Processing. To assure extremely high levels of measuring accuracy (2% of actual flow or better) under extreme conditions caused by turbulent, rotating, and multi-directional airflows normally present near fan inlets or discharge ducts and directly downstream from duct elbows, transitions, etc., the FAN-E uses open, parallel cell, honeycomb panels to "process" the air into straightened flow just prior to the total pressure measurement plane. These honeycomb panels sharply reduce the need for long, straight runs of duct before and after the station to obtain accurate flow measurement.

Negligible Airflow Resistance. The FAN-E airflow measuring station is designed to function while producing a minimum of resistance to airflow, due to the unique honeycomb air straightener-equalizer section having a free area of 96.6%. The unique, non-restrictive characteristic of the FAN-E is seen in the Resistance vs. Airflow Velocity graph below. The values indicated are total resistance and do not include any allowances for static regain (a potential 20% reduction to the values).



Airflow Measuring Station

Construction Features



Specifications

Configurations.

Rectangular, Circular, and Flat Oval.

Accuracy.

2% of actual flow.

Operating Temperature.

Continuous operation to 300°F.

Casing.

Rectangular. 14 gauge galvanized sheet metal, intermittent welded casing sealed with metal caulking.

Circular and Flat Oval. 18 gauge galvanized sheet metal, spot welded casing seams.

Casing Depth.

8" deep for stations with 90° flanges.

10" deep, 8" from bead-to-bead for stations with beaded edges.

Flanges.

Rectangular. 1-1/2" wide, 90° formed. Sizes up to 144" x 144".

Circular and Flat Oval.

Sizes 10" to 24". 1" wide flanges, or beaded edge.

Sizes > 24" and < 45". 1-1/2" wide flange.

Sizes > 45". 3/16" x 2" bar stock flanges.

Air Equalizer – Straightener Cell.

Corrosion resistant 3003 aluminum. 3" deep x 1/2" cell.

Total Pressure Manifold.

Copper tubing assembled with 50/50 tin/lead solder.

Galvanized mounting and support brackets.

Static Pressure Header and Sensors.

Copper tubing. Galvanized mounting bracket.

Connection Fittings.

1/4" brass compression type located on the long dimension of rectangular and flat oval stations.

Special Construction.

Casing and Flanges: Aluminum, Carbon Steel, Stainless Steel, PVC and Fiberglass, Hastelloy, Inconel.

Air Equalizer–Straightener Cell: Type 304 and 316 Stainless Steel, Carbon Steel, PVC, Hastelloy.

Total and Static Pressure Manifolds: Type 316 Stainless Steel, Hastelloy, Inconel, PVC, Kynar.

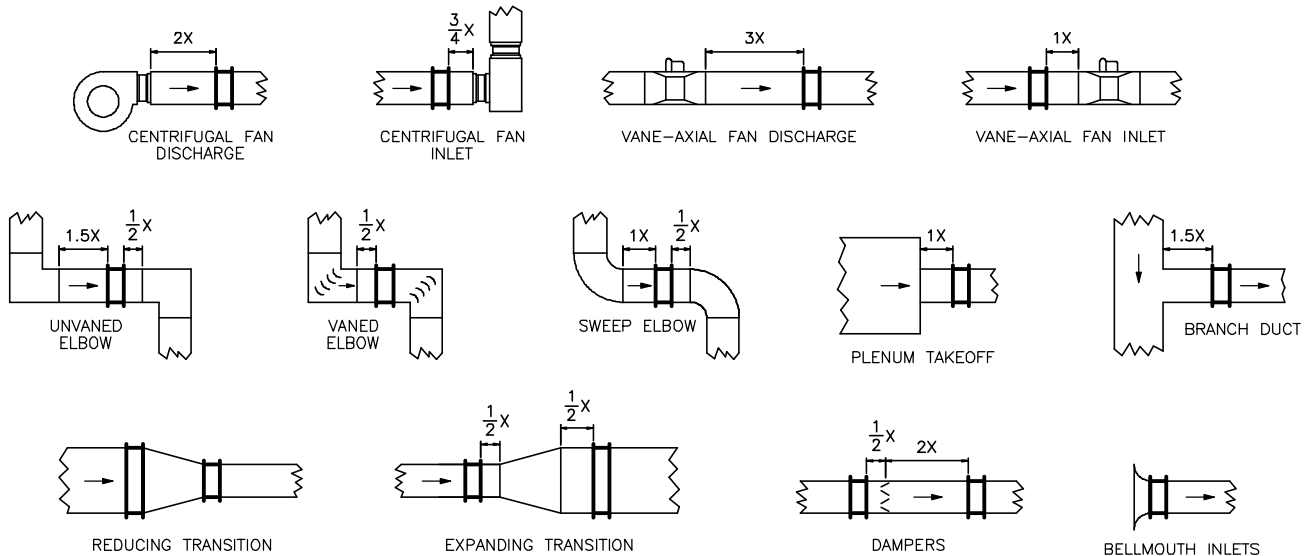
Connection Fittings: Stainless Steel, Hastelloy, Nylon.

Contact the Factory for special construction stations using the above listed and other materials.

FAN-Evaluator

Minimum Installation Requirements

Note: FAN-E locations shown are not ideal. The locations indicate the **minimum** clearance required from air turbulence producing sources. Wherever possible, the FAN-E should be installed where greater runs of straight duct (or clearances) than shown below exist.



$$\text{Rectangular Duct: } x = \frac{2(H \times W)}{H + W}$$

$$\text{Circular Duct: } x = \text{Duct Diameter}$$

Suggested Specification

Provide where indicated, airflow measuring station(s) capable of continuously monitoring the fan or duct capacities (air volumes) they serve.

Each airflow measuring station shall contain multiple total and static pressure sensors positioned in a log-Pitot-static probe pattern. Rectangular stations having a cross-section greater than 4 square feet will have a minimum of 25 points of measurement. For stations having a dimension less than 18", locate the points of measurement at the center of equal areas not more than 6" apart, and use a minimum of two measurement points per side. For a station having a dimension greater than 56", the maximum distance between measurement points will be 8". For circular ducts having a diameter of 18" or greater, locate measurement points on three systematically disposed diameters. For round stations smaller than 18", locate the measurement points on two perpendicular diameters.

The airflow measuring station(s) shall be fabricated of a minimum of 14 ga. galvanized steel, welded casing in 8" depth with 90° connecting flanges in a configuration and size equal to that of the duct it is mounted into. Each station shall be complete with an open parallel cell air straightener-equalizer honeycomb mechanically fastened to the casing, and external signal connection fittings. An identification label shall be placed on each station casing listing the model number, size, area, and specified airflow capacity.

Stations shall be AMCA certified and be capable of measuring the airflow rates within an accuracy of ±2%. The maximum allowable unrecovered pressure drop caused by the station shall not exceed .085" wc. at 2000 FPM, or .30" wc. at 4000 FPM.

The airflow measuring station(s) shall be the FAN-Evaluator as manufactured by Air Monitor Corporation, Santa Rosa, California.

