PARAGON CONTROLS INCORPORATED

INSTALLATION, OPERATION & MAINTENANCE MANUAL

FE-1000 & PE-5000 INSERTION TYPE SENSING ELEMENTS

Model **FE-1000** and **PE-5000** units are insertion-type primary sensing elements. The **FE-1000** is an airflow sensing element containing multiple total and static pressure sensing ports. The **PE-5000** is a static pressure sensing element containing multiple static pressure sensing ports. The elements are designed for quick, easy installation through a small cutout in the existing ductwork. Where multiple elements are required for proper duct traversing, the output ports are manifolded together, external to the ductwork.

The **FE-1000** airflow sensing element is a head type device, which generates a differential (velocity) pressure signal similar to the orifice, venturi, and other head producing primary elements. The **FE-1000** is constructed so that strategically located sensing ports (based on duct size) continually sample the total and static pressures, when inserted normal to flow. The total pressures sensed by the upstream ports are continually averaged within the element in an isolated chamber. The static sensing ports (located where the influence of the velocity head is zero) are averaged in a second isolation chamber. Each chamber is then connected to one side of a differential measurement device (gauge, transmitter, etc.) for flow measurement and indication purposes.

The **PE-5000** pressure sensing element is designed to achieve pressure signal accuracy and stability. The accuracy and low signal-to-noise ratio of the output is made possible by the placement of multiple sensing ports along the length of the element and the averaging effect of the internal manifold.

For **FE-1000** and **PE-5000** sensing elements less than or equal to 36 inches in length, a 9/16 inch diameter element is used. For elements greater than 36 inches in length, a 1 inch diameter element is used.

INSTALLATION GUIDELINES

The elements may be installed in any duct configuration. However, the accuracy of the installation is dependent on the flow conditions in the duct. The minimum installation requirements for the elements based upon a uniform velocity profile approaching the duct disturbance for flow rates less than 2,500 fpm are shown in Figure 1.

Add one duct diameter to the installation requirements shown below for each additional flow rate of 1,000 fpm. These are not ideal locations. It is always best to locate the elements as far as possible from all duct disturbances, with upstream disturbances being the most critical consideration.

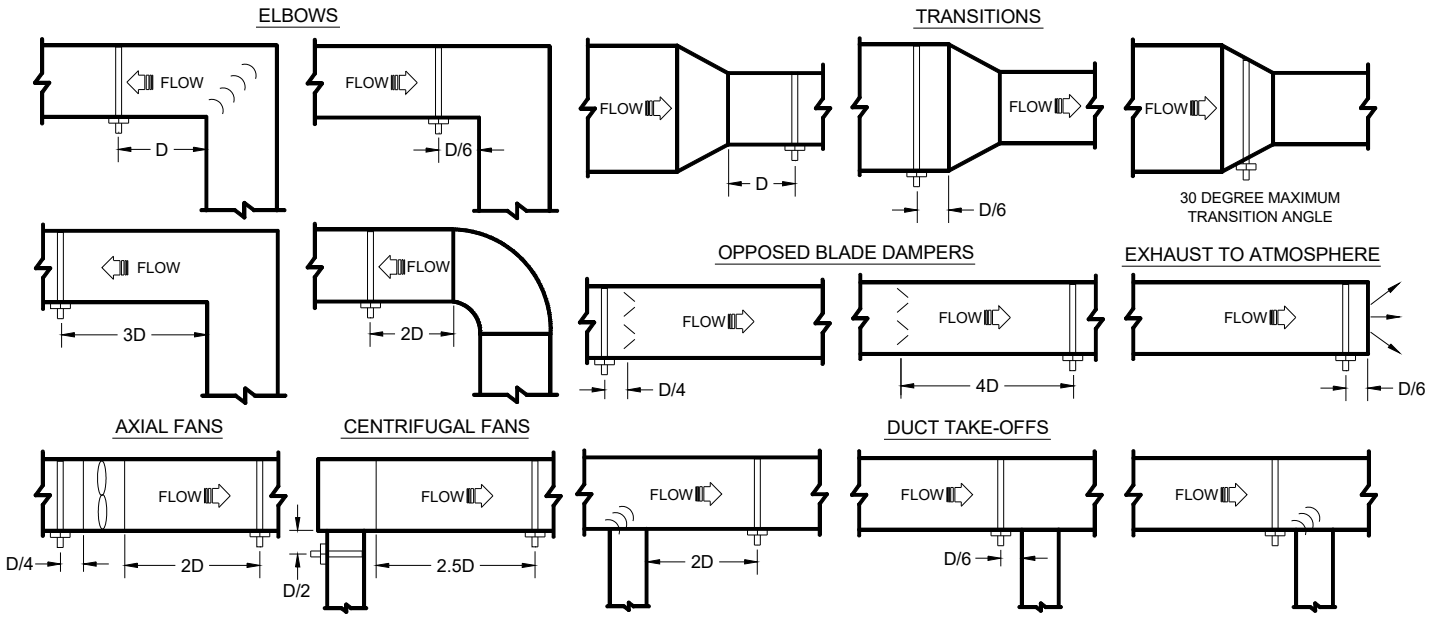

FIGURE 1

FITTING ASSEMBLY PROCEDURE

For both the 9/16-inch and 1-inch diameter elements the total and static pressure connection ports are 1/8 FPT. For the PE-5000, only the SP (static pressure) port is used. When making the joint, a sealing tape or joint compound **must** be used to assure against leaks (see Figure 2).

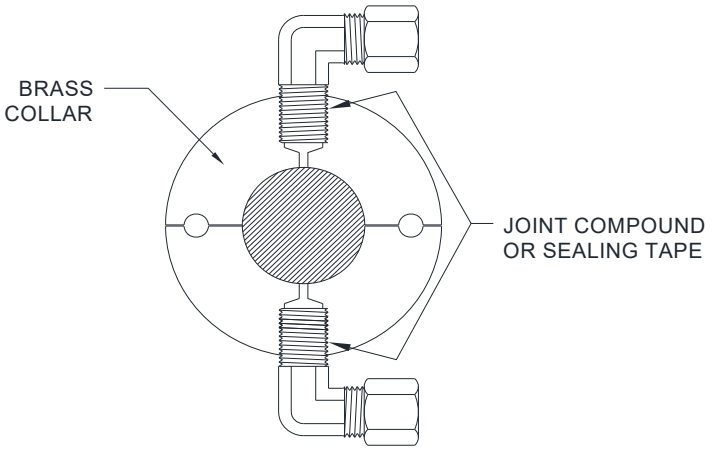

FIGURE 2

MOUNTING PROCEDURE

A standard accessory package is supplied with each set of elements which includes gaskets, mounting screws, washers, and nuts.

STEP 1: DETERMINE MOUNTING LOCATION

Figure 3 shows how to determine the element mounting locations for rectangular, circular, or oval ducts. Layout these locations on the duct by marking large centerlines at the location where the take-off blocks mount and on the opposite side of the duct (see Figure 4). Be sure that there are no obstructions around the duct in these areas.

Note: For oval ducts the short element must be installed upstream of the long element (see Figure 4).

STEP 2: INSTALL ELEMENTS

For 9/16 inch diameter elements drill a 5/8 inch diameter hole through the centerlines at the location where the take-off blocks mount and a 1/4 inch diameter hole on the opposite side of the duct. For 1 inch diameter elements drill a 1 1/16 inch diameter hole through the centerlines at the location where the take-off blocks mount and a 1/4 inch diameter hole on the opposite side of the duct.

Place the end of the element through the large gasket and slide up to the take-off block. Insert the elements into the duct, normal to flow as indicated by the label on the element. Be sure the stud goes through the 1/4 inch hole on opposite side. For stations with three or more elements, the elements with the elbows are always mounted on each end of the manifold array.

Screw the elements to the duct, using the self-drilling screws provided. Place the small gasket, washer, and nut on the stud end of the element. Tighten the nut to compress the gasket to about ¼ of its original height. Do not over tighten.

STEP 3: MANIFOLD ELEMENTS

Figure 3 shows the method to connect and manifold all the signal ports together using thermoplastic or copper tubing. The smallest tube size permissible is 1/4 inch OD, with no less than 1/8 inch ID. The final output connections should be teed as close as possible to the center of the connection manifold. For example, for a two element station the output signal tees would be placed approximately half way between the two take-off blocks; for a three element array, the output tees would be mounted nearest to the center take-off block.

Always be certain all tube connections are tight, as poor connections may affect the output signals, giving erroneous readings.

The magnitude of the output signal for velocity (differential between total and static) will normally be below 1.0 inches of water column for the full flow condition, and static will usually be above 1.0 inches of water column. Therefore, be certain that the proper range measuring device is used when checking the operation of the installed elements.

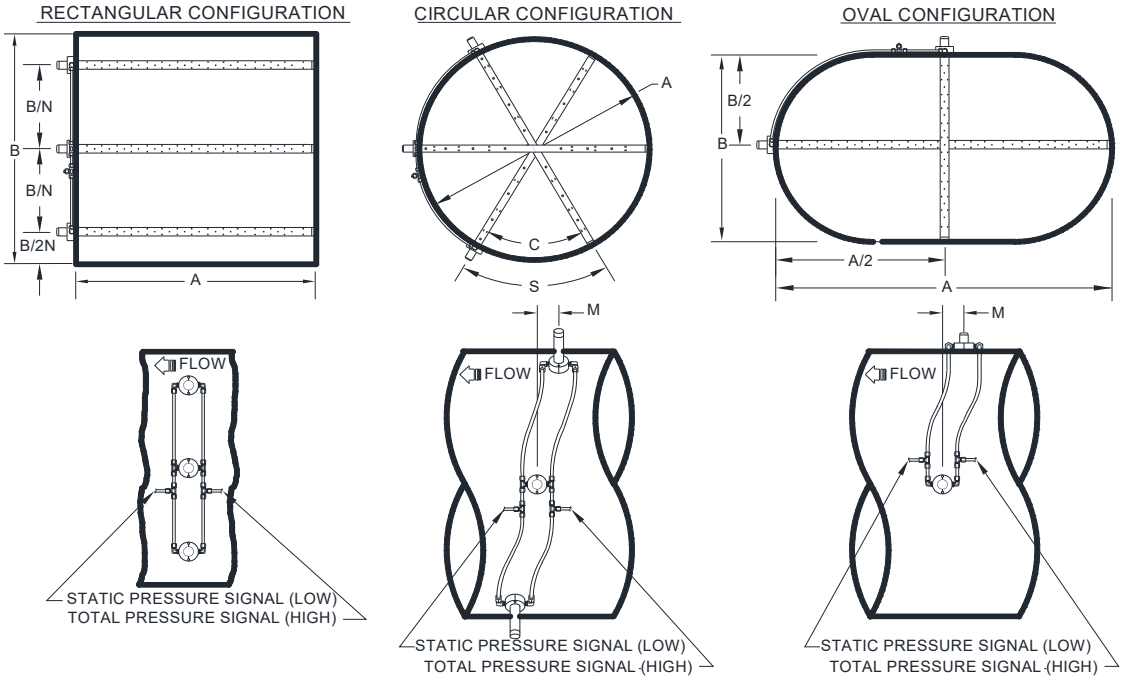

FIGURE 3

Notes:

A = Inside duct dimension (element length side)
B = Inside duct dimension (element mounting side)
C = Angle between elements, 360°/2N
M = Offset between elements measured on the duct axis, 1 ¼ inches
N = Number of elements mounted on 'B' dimension
S = Distance between elements measured on the duct, 3.14D/2N

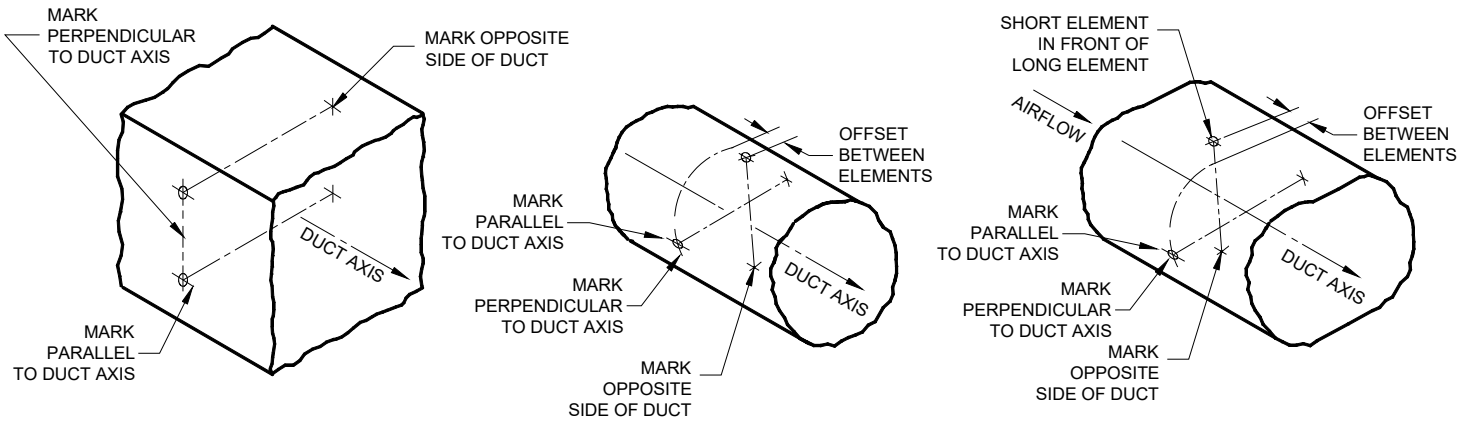

FIGURE 4

OPERATION

The FE-1000 airflow measuring elements produce pneumatic output signals referred to as total (high) and static (low) pressure. These two pressures are piped to a differential pressure sensing device (i.e. magnehelic, transducer, etc.) where the static pressure is subtracted from the total and the result indicated as velocity pressure. This measured differential pressure is equal to the average velocity of the air stream moving through the plane that the flow elements are located in.

This signal can be converted to air volume using the following equations:

$$V = \frac{Q}{A} \qquad P_V = \left(\frac{V}{C}\right)^2 \times \rho$$

Where:
V = Velocity, in fpm
Q = Flow, in cfm
A = Area, in ft^2
C = 1096.7
ρ = Density of air, in lb/ft^3
P_V = Velocity pressure, in inches H_2O

MAINTENANCE

Since the sensing elements have no moving parts, only periodic cleaning may be required. The sensing elements should be inspected for fouling of the sensing holes as part of an annual preventative maintenance program. Installations having viscous airborne particles may require more frequent inspection. If the sensing holes on the elements have become fouled or plugged, the following procedure is recommended. ***Caution, all instruments must be isolated (removed) from the sensing lines prior to performing the following cleaning procedure.***

Backpurging: Connect clean/dry compressed air, set at a maximum pressure of 25 psi, to the output pressure ports (total and/or static) of the sensing element being cleaned. While purging the sensing element, wipe the surface of the cylinder with a cloth or brush to loosen and remove all contaminant buildup.

Cleaning: In applications where the sensing elements are subject to viscous contaminants it is recommended that the surface be washed with a cleaning agent. The cleaning agent used ***must*** be suitable for use on the type of material the sensing element is constructed of (i.e. aluminum, stainless steel, etc.)

SITE STORAGE, HANDLING, AND SPARE PARTS

The sensing elements must be stored indoors, in the original shipping package, and in a dry place. Failure to do so may result in internal blockage of averaging chambers due to dust migration and/or insect infestation. Although the sensing elements are not fragile by design, care must be taken not to damage or disfigure the cylinder surface when handling and installing.

Particular attention must be given to the surface areas in which sensing ports are located. The sensing elements come as a complete fabricated assembly. ***No spare parts are required.***

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Revision Level 001