RA-2001 Center-Averaging Flow Probe Kit

Product Bulletin

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The RA-2001 Center-Averaging Flow Probe Kit was developed to satisfy the requirement for an accurate center-averaging flow probe for use in spiral duct applications. The RA-2001 probe installs in a cut slot in the existing duct. The DMPR-RA001 Pressure Transducer with LCD screen and field-selectable ranges ships with the device. All necessary mounting hardware and gasket material is included.

Figure 1: RA-2001 Center-Averaging Flow Probe Kit

Table 1: Features and Benefits

Features	Benefits
Multipoint Center Averaging	Provides accurate flow readings.
Insertion Mounting	Allows easy installation.
Factory-Piped Differential Pressure Transducer with Display	Provides convenient visual reading for flow and allows easy installation.

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Application

The airflow measuring probes were developed to meet the market need for an air measuring station that is easily installed in an existing duct.

Each fully factory-assembled probe unit contains everything needed to install an air measuring station.

The standard 0 to 10 Volt transducer output signal is proportional to Cubic Feet per Minute (CFM) and may be routed to any Building Automation System (BAS) for continuous monitoring of the airflow. The transducer output signal may also be configured for 0–5 V or 4–20 mA.

All products are perfect for measuring airflow in existing ducts and install in minutes.

Sample Specification

Install, at all locations indicated on plans and in accordance with schedules, a center-averaging differential pressure flow probe assembly.

Device shall be cross shaped, multi-point, center-averaging.

Device shall be made of high-impact ABS material.

Flow probe shall output an amplified differential pressure signal that is at least 1.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube and be capable of measuring air volume to ±5% accuracy.

The complete assembly shall be equipped with a gasketed mounting plate and all necessary hardware.

Flow probe shall be assembled in an ISO9001-certified facility.

Accuracy shall be supported by testing done in accordance with AMCA test standards.

Operation

Strategically placed sensing cross flow tubes within the air stream perform airflow measurements. Air tubing or piping connections provided connect the sensing probes to the DMPR-RA001 Pressure Transducer.

Using the velocity pressure provided from the sensing cross flow tubes, the BAS calculates a CFM value. This value can then be compared to the design CFM setpoint as determined by the particular mode of operation of the HVAC system. In normal operation, this setpoint corresponds to the minimum outside air ventilation required by the system design to meet American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62.1.

Multi-Point Center Averaging

Multi-point center averaging flow probes take the pressure readings at the center of the assembly. Center averaging improves performance because flow probes are not as affected by poor inlet conditions when compared to linear averaging flow devices.

In linear averaging flow devices, each total pressure port has the same priority (importance) in determining the pressure reading. In contrast, in multi-point center averaging flow devices, the total pressure port closest to the point where the reading is taken has a higher priority (importance) than the port that is farthest away from the reading.

Amplification

Amplification is the ability of the flow probe to produce a signal greater than the velocity pressure. Pitot tubes read true velocity pressure, which requires 4,005 FPM to produce a 1 in. W.C. signal.

Velocity pressure is the difference between total pressure and static pressure. Amplified flow probes improve upon this signal by taking the difference between total pressure and a reduced static pressure. Amplification is critical to accurate control of minimum flow rates.

Inlet Sensitivity

Inlet sensitivity is a measure of flow sensing accuracy that can be lost to less than ideal inlet conditions. The Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) recommends a minimum of three duct diameters of straight duct in front of any flow measuring device. This is not generally the standard practice on many job sites. Duct obstructions result in jogs and turns in both rigid and flexible supply duct. Real world conditions require a flow probe that is capable of measuring air volume to a ±5% accuracy, regardless of inlet conditions. If excessive inlet sensitivity results in a reduced flow signal for a given flow volume, the benefit of amplification has been lost. Regardless of sophistication, no controller can overcome less than adequate accuracy from a flow sensor under common field conditions.

The RA-2001 probe has less inlet sensitivity than any other flow probe on the market, with no more than ±5% error regardless of inlet condition. In contrast, other center-averaging designs are capable of ±10% error. Linear averaging designs can range from ±10% to 35% depending on exact condition and angle of approach.

Differential Pressure Transducer (DPT)

Brass fittings are used to connect the high and low pressure chambers of the sensing probe to a high performance piezoresistive sensor with a 4.5-character LCD screen transducer through 1/4 in. (6 mm) outside diameter (O.D.) polyethylene tubing.

The DPT output signal is field-selectable and can be routed to a BAS for continuous monitoring of airflow.

With simple DIP switch settings, you may choose the output signal (factory set at 0 to 10 Volts), which is proportional to airflow. The transducer output signal may also be configured for 0-5 V or 4-20 mA.

The housing is hinged 4 x 5 x 2-1/2 in. (102 x 127 x 64 mm) IP66-rated polycarbonate.

The sensor is a micro-machined, piezoresistive, single-crystal silicone wafer.

The LCD screen is a 4.5-character display of actual differential pressure in inches of water column (in. W.C.).

Dimensions

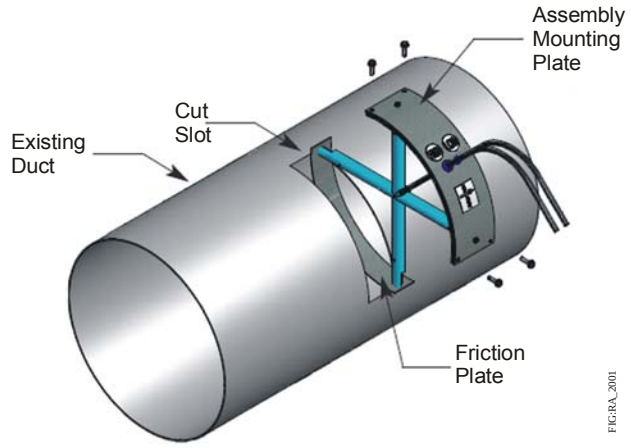

Figure 2: RA-2001 Dimensions

Table 2: Dimensions

Item	Dimension
Assembly Mounting Plate	3 in. wide
Friction Plate	1-1/2 in. wide
Diameter (Distance Between the Plates at the Center of the Curve)	(as ordered)

Flow Calculations (CFM)

$$CFM = (Area \times Ka) \times \sqrt{PAMS}$$

Area = $\pi R^2/144$

PAMS = Velocity Pressure Inches Water Gage

Figure 3: Flow Calculation (CFM)

Table 3: Ka Factors by Inlet Size

Inlet Size, in. (mm)	Ka
6 (152)	2,282
7 (178)	2,496
8 (203)	2,590
9 (229)	2,642
10 (254)	2,633
12 (305)	2,408
14 (356)	2,820
16 (406)	2,749

Ordering Information

Table 4: Selection[1]

	R	A	A	x	x	N
R = Round Damper						
A = Air-Measuring						
A = Galvanized Steel Frame and Plastic Cross-Flow Probes						
x x = Diameter, (6 to 16 in.)						
N = No Actuator						

1. The DMPR-RA001 transducer comes with the product (shipped loose).

Repair Information

If the RA-2001 Center-Averaging Flow Probe Kit fails to operate within its specifications, replace the unit. For a replacement RA-2001 Center-Averaging Flow Probe Kit, contact the nearest Johnson Controls® representative.

All Johnson Controls® RA-2001 Center-Averaging Flow Probe Kits are built to order and cannot be returned due to ordering errors. All RA-2001 Center-Averaging Flow Probe Kits are backed by a 3-year warranty, which covers defects in materials or workmanship. Refer to terms and conditions of sale for specifics.

Maintenance

The RA-2001 Center-Averaging Flow Probe Kit has no components that require routine scheduled maintenance.

Technical Specifications

RA-2001 Center-Averaging Flow Probe Kit

Frame	20 gage galvanized steel
Probe Material	High-impact ABS plastic
Seal Material	3/16 in. (5 mm) thick polyurethane foam
Pressure Transducer	DMPR-RA001 Pressure Transducer
Accuracy	±5% of flow
Velocity Range	400 to 5,000 fpm (2.03 to 25.4 mps)
Operating Temperature	20° to 120ºF (-6.7° to 48.9ºC)
Minimum Size	6 in. (152 mm) diameter
Maximum Size	16 in. (406 mm) diameter

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

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