

RA-1250 Thermal Dispersion Fan Inlet Sensors Airflow Measuring System

Product Bulletin

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RA-1250 Thermal Dispersion Fan Inlet Sensor Airflow Measuring System averages velocity and temperature from fan inlet sensors in a duct or plenum, providing accurate, dependable airflow measurement from 0 to 10,000 fpm (0 to 50.8 mps) within $\pm 2\%$ accuracy.

Each sensor circuit is connected to a router that stores the calibration data. The router's microprocessor calculates flow and temperature and sends this information digitally to the DMPR-RA003 Electronic Controller, which provides air velocity and temperature information on an LCD screen. The transmitter sends the output to a Building Automation System (BAS) through 4–20 mA or 2–10 VDC analog outputs (using a 500 ohm resistor) or a 1–5 VDC analog output (using a 250 ohm resistor).

The factory-assembled RA-1250 Thermal Dispersion Fan Inlet Sensor Airflow Measuring System includes fan inlet sensors, CAT5e cables, router box and a DMPR-RA003 Electronic Transmitter.



Figure 1: RA-1250 Thermal Dispersion Fan Inlet Sensor Airflow Measuring System

Table 1: Features and Benefits

Features	Benefits
Aerodynamically Shaped, Surface Mount Fan Inlet Sensors	Provide nominal fan performance degradation, improves fan speed, and reduces power consumption in comparison with other fan inlet devices.
Multiple-Pivot Hinge Design	Allows fan inlet sensor to conform to the shape of the inlet bell.
Balance Mode for Field Calibration	The controller's built-in balance mode uses one of three flow levels (low, medium, or maximum) to best match the fan system curve.
LCD Screen on DMPR-RA003 Electronic Controller	Provides visual readout of flow, temperature, and diagnostics.
CAT5e Cable with RJ-45 Connectors	Reduces installation and commissioning time; Allows for field repair.

Application

The RA-1250 Thermal Dispersion Fan Inlet Sensor Airflow Measuring System meets the requirements for minimum outside air according to several agency specifications:

- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 62 and ASHRAE 90.1
- California Title 24
- International Mechanical Code (IMC)
- International Energy Conservation Code (IECC)

The RA-1250 Thermal Dispersion Fan Inlet Sensor Airflow Measuring System contributes to earning required Indoor Environmental Quality (EQ) and Energy and Atmosphere (EA) credits for U.S. Green Building Council® Leadership in Energy and Environmental Design (LEED) prerequisites for construction and operation.

Operation

The RA-1250 System is a highly accurate thermal dispersion type air measuring device that averages multiple velocity and temperature points at the fan inlet bell, with nominal fan performance degradation. The RA-1250 System uses two, four, or eight fan inlet sensors (depending on the fan inlet size) to measure velocity and temperature.

Each fan inlet sensor uses two thermistors – one is a heated thermistor and the other is an ambient thermistor (used as a reference point). The heated thermistor is heated to a specified temperature differential above the reference point.

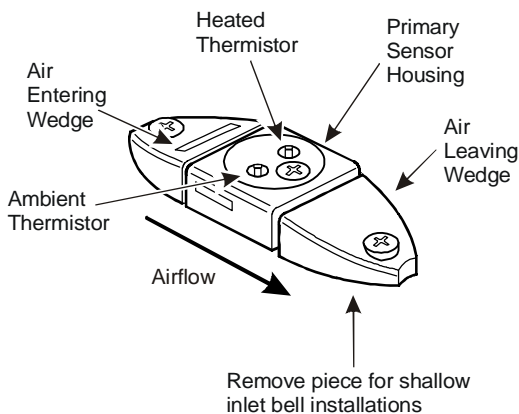


Figure 2: Fan Inlet Sensor

The router contains calibration information for each sensor and sends information to the DMPR-RA003 Electronic Controller. The DMPR-RA003 Electronic Controller calculates the air velocity using the reference point (ambient thermistor), the heat transfer characteristics of the heated thermistor, and the power expenditure necessary to maintain the temperature difference between the heated thermistor and the ambient reference thermistor.

The DMPR-RA003 Electronic Controller averages the inputs and calculates a Cubic Feet per Minute (CFM) value and communicates the velocity and temperature to a Building Automation System (BAS). This CFM value can then be compared to the design CFM setpoint as determined by the particular mode of operation of the HVAC system.

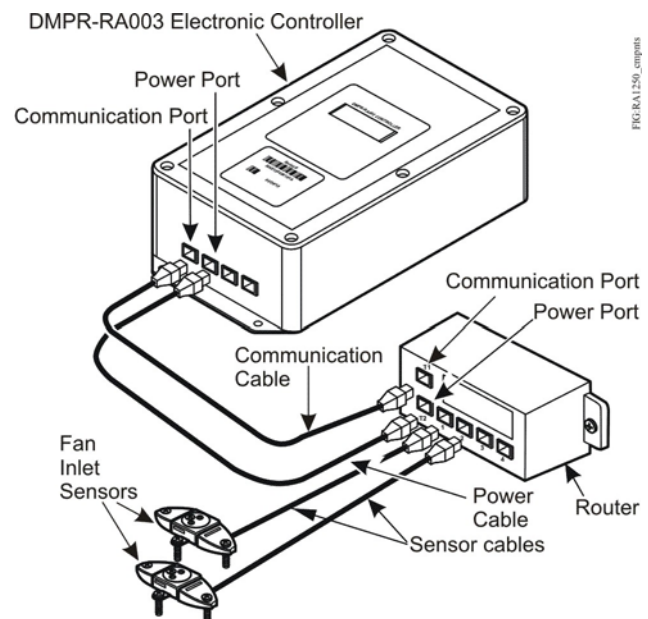


Figure 3: RA-1250 System Components

Note: If a second router is used, the third port is the communication port, and the fourth port provides power for the second router.

Outputs

The DMPR-RA003 Electronic Controller uses two 4–20 mA outputs or two 2–10 VDC outputs (using a 500 ohm resistor) or two 1–5 VDC outputs (using a 250 ohm resistor) – one for airflow velocity and one for air temperature – for input to a Building Automation System.

The DMPR-RA003 Electronic Controller provides a linear output signal proportional to the airflow velocity. The electronic controller automatically adjusts the airflow calculation based on the current air temperature. The linear output signal for velocity is repeatable and not affected by temperature changes.

The high and low limit is scalable from the menu on the electronic controller and uses either Inch-Pound (I-P) or International System (SI) units.

If a user selects the 4–20 mA output, the user can set the 4 mA value to any airflow velocity between 0–10,000 fpm (0–50.8 mps). The 20 mA value can be scaled anywhere between 10,000–500 fpm (50.8–2.5 mps) above the 4 mA value. Once the user sets the 4 mA and 20 mA values in the electronic controller, it displays the coefficients to calculate the CFM and Temperature based on the 4–20 mA output signals.

The DMPR-RA003 Electronic Controller can only be configured for direct-acting control.

Sample Specifications

Furnish and install, at locations shown on plans or as in accordance with schedules, an electronic thermal dispersion type fan inlet Airflow and Temperature Measuring Station (AFTMS). AFTMS shall be surface mount type, with no exceptions.

Communications cable within the fan inlet sensor shall be soldered directly to the fan inlet sensor's Printed Circuit Board (PCB) to ensure absolute connectivity and long term accuracy.

Underwriters Laboratories, Inc.® (UL) Plenum-rated CAT5e communications cable with square terminal connectors, dust boot covers, and gold-plated contacts shall link sensors to the router and router to electronic controller.

Sensor to router communication cable shall be 10 feet (6.1 m) maximum. Router to Electronic Controller communications cable shall be a minimum of 10 feet (6.1 m) in length. Total router to electronic controller communications cable shall be available up to a maximum length of 50 ft (15.25 m) for a single router or 100 ft (30.5 m) for two routers, when specified.

Complete assembly shall be constructed and calibrated in an ISO 9001 certified facility.

The controller's built-in balance mode uses one of three flow levels (low, medium, or maximum) to best match the fan system curve.

Devices creating fan performance degradation (resulting in additional energy consumption) caused from pressure drop associated with probes or mounting apparatus in the center of the fan inlet are prohibited.

Unit shall be capable of monitoring the airflow and temperature at each fan inlet location through two or four sensing circuits. Unit shall be capable of reporting through an electronic controller that communicates with the Building Automation System (BAS).

Sensor circuit casings shall be constructed of UL94 flame-rated, high-impact ABS and include a stainless steel thermistor cap that maintains the precise calibrated flow over the heated and ambient measurement points. Each sensor circuit shall consist of two ceramic base, glass encapsulated thermistors for measuring ambient velocity and temperature. Circuits shall be designed for operation in a wide range of environments, including high humidity and rapid thermal cycling.

Sensors shall terminate at a router containing a multiplexer circuit. Multiplexer shall include a microprocessor that collects data from each PCB and digitally communicates the average airflow and temperature of sensing point to the microprocessor-based electronic controller. Multiplexer board shall be completely encased in electrical potting material to prevent moisture damage.

Electronic controller shall be capable of processing up to 4 independent sensing points per airflow measuring location and shall operate on a fused 24 VAC supply.

Electronic controller shall feature a 16 x 2 character alphanumeric LCD screen, digital offset/gain adjustment, continuous performing sensor/controller diagnostics, and a visual alarm to detect malfunctions.

LCD screen shall be field-adjustable to display either I-P or SI units. Electronic controller output shall be 4 to 20 mA.

All electronic components of the assembly shall be Restriction of Hazardous Substances (RoHS) Directive compliant and UL rated.

Dedicated transformers shall be used for each air measurement station. If additional devices are connected to the same transformer, transformers with sufficient capacity for the total load shall be used.

System design shall avoid wiring multiple low-voltage devices from a common transformer that results in lower- than-expected voltage at the device and higher- than-expected current draw when devices are connected a great distance from the power source.

Standard Materials and Construction

Surface-mount fan inlet sensor is an 3 x 1 x 1/2 in. (76 x 25 x 13 mm) UL 94 flame-rated, high-impact Acrylonitrile Butadiene Styrene (ABS) plastic with stainless sensor cap.

The fan inlet sensor circuit comprises of two ceramic based, hermetically sealed, bead-in-glass thermistors.

Router enclosure is made of UL94 flame-rated, High Impact ABS plastic.

CAT5e shielded communications cable (10 foot standard) is UL plenum-rated with RJ-45 connectors, dust boot covers, gold-plated pins, and a digital interface between the multiplexer and the electronic controller.

Electronic controller is microprocessor-based within a 6-1/8 x 11-3/8 in. (156 x 290 mm) nominal control enclosure, and has seamless plug-and-play connectivity to one or two routers with two or four thermal dispersion sensors per router.

Electronic controller includes 16 x 2 character LCD screen (airflow, temperature, and diagnostics) and a 24 VAC internally fused power supply.

Dimensions

See Table 2 for minimum and maximum fan inlet sizes for use with the RA-1250 System. See Figure 4 through Figure 6 for dimensions of components.

Table 2: Fan Inlet Dimension

Size Limits	Diameter, inches (mm)
Minimum	12 (305)
Maximum	44 (1118)

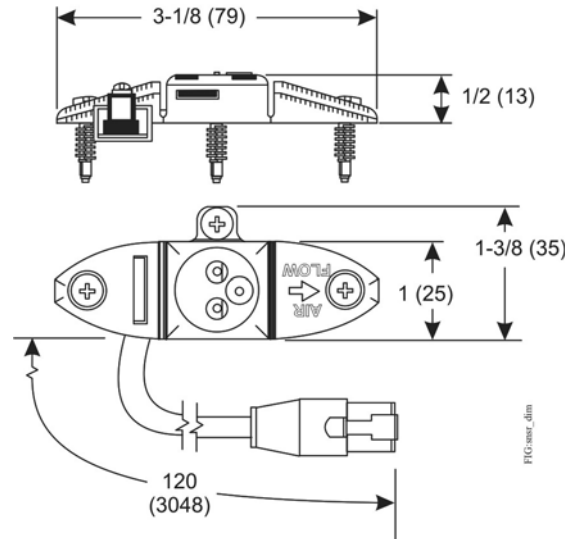


Figure 5: Fan Inlet Sensor Dimensions, in. (mm)

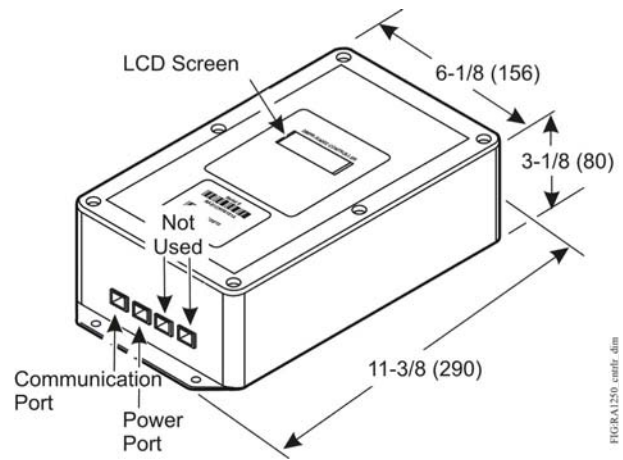


Figure 6: DMPR-RA003 Electronic Controller Dimensions, in. (mm)

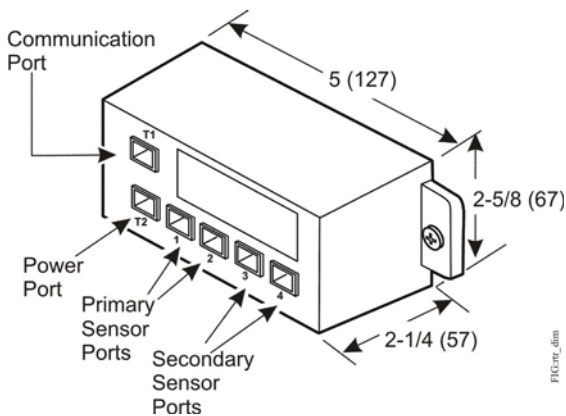


Figure 4: Router Dimensions, in. (mm)

Selection Information

Use the following to select the product:

1. Select the product code number required where **dd** is the diameter of duct (4 to 32 inches in 1-inch increments). See Table 4 for ordering information and Figure 7 for fan types.
2. Enter option for desired cable length between router(s) and controller(s). See Table 3.

Note: Cable length between sensor and router is 10 ft (3 m) maximum length.

Example: RAF20NO is an RA-1250 Fan Inlet Thermal Dispersion Airflow Measuring System for use with forward-curved fans having a single inlet and a standard sensor density. This model has a controller, a router, two inlet sensors, and a 20 ft (6 m) CAT5e cable between the router and controller.

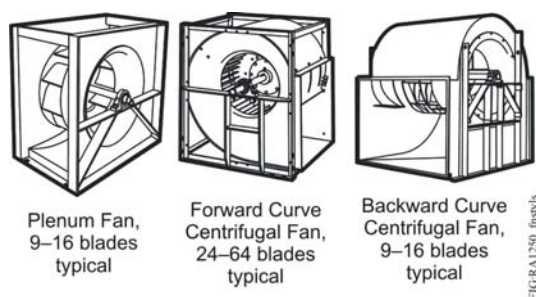


Figure 7: Fan Types

Table 3: Router-to-Electronic-Controller Communication Cable Length Options

Letter	Cable Length ¹
O	20 ft (6 m)
P	30 ft (9 m)
Q	40 ft (12 m)
R	50 ft (15 m)

1. Total router-to-electronic-controller communication cable is a maximum length of 50 ft (15 m) for a single router or 100 ft (30 m) for two routers.

Table 4: RA-1250 Fan Inlet Thermal Dispersion Airflow Measuring System Ordering Information

Product Code Number ¹	Fan Type ²	Inlet Type and Sensor Density ³	Fan Inlet Thermal Dispersion Airflow Measuring System with
RAFddD	Forward Curve	Double Inlet - Standard Density	Controller, router, and 4 sensors
RAFddH		Single Inlet - High Density	Controller, router, and 4 sensors
RAFddN		Double Inlet - High Density	Controller, 2 routers, and 8 sensors
RABddD	Backward Curve	Single Inlet - Standard Density	Controller, router, and 2 sensors
RABddH		Double Inlet - Standard Density	Controller, router, and 4 sensors (brackets provided if inlet is wider than 15 in.)
RABddN		Double Inlet - High Density	Controller, 2 routers, and 8 sensors (brackets provided if inlet is wider than 15 in.)
RAPddD	Plenum / Plug	Single Inlet - Standard Density	Controller, router, and 2 sensors (brackets provided if inlet is wider than 15 in.)
RAPddH		Double Inlet - Standard Density	Controller, router, and 4 sensors (brackets provided if inlet is wider than 15 in.)
RAPddN		Double Inlet - High Density	Controller, 2 routers, and 8 sensors (brackets provided if inlet is wider than 15 in.)

1. dd is the diameter of plenum (4 to 50 inches in 1-inch increments).
2. If you are not sure of the fan type, select backward or plenum. The accompanying mounting brackets work on any of the three fan types listed here. RA-1250 products do not work on vane axial or propeller fan types.
3. Standard Density is 2 sensors per inlet (recommended). If you are unable to mount the sensors on one side of the system, measure the other side and double the area. High Density is 4 sensors per inlet.

Return Policy

All Johnson Controls RA-1250 Thermal Dispersion Fan Inlet Sensor Airflow Measuring Systems are built to order, just in time, and cannot be returned due to customer ordering errors. All RA-1250 System products are backed by a 3-year warranty, which covers defects in materials or workmanship. Refer to terms and conditions of sale for specifics.

Repair Information

If the RA-1250 Thermal Dispersion Fan Inlet Sensor Airflow Measuring System fails to operate within its specifications, replace the unit. For a replacement RA-1250 System, contact the nearest Johnson Controls representative.

Maintenance

Johnson Controls RA-1250 Thermal Dispersion Fan Inlet Sensor Airflow Measuring Systems have no components that require routine scheduled maintenance.

Wiring

Whenever possible, use a dedicated transformer for each RA-1250 System. If you use a dedicated transformers for multiple RA-1250 Systems, ensure that the transformer is rated with sufficient capacity for the total connected load.

Errors in the load calculations can lead to problems. Wiring multiple low-voltage devices from a common transformer can result in lower-than-expected voltage at the device and higher-than-expected current draw when devices are connected a great distance from the power source.

Transformers for the DMPR-RA003 controller are not required to be isolated from other devices. Isolation is only required to prevent electrical fluctuations due to intermittent high loads from causing problems with electronic devices.

Technical Specifications

RA-1250 Thermal Dispersion Probe Fan Inlet Sensor Airflow Measuring System

Velocity Requirements	Minimum 0 fpm (0 mps) Maximum 10,000 fpm (50.8 mps)
Fan Degradation	Minimal
Sensor Accuracy	Airflow: $\pm 2\%$ of reading and $\pm 0.15\%$ repeatability Temperature: $\pm 0.10^\circ\text{F}$ 24 VAC internally fused power supply Velocity Output: 4 to 20 mA (Std.) or 2 to 10 VDC (requires 500-ohm resistor) Temperature Output: 4 to 20 mA (Std.) or 2 to 10 VDC (requires 500-ohm resistor) Fused outputs
Power Requirement	Dedicated 24 V, 20 VA with one router connected and 40 VA with two routers connected
Power Consumption	18 VA Maximum per router
Operating Conditions	-25 to 140°F (-32 to 60°C); 0-99% RH, noncondensing
Router Unit (One per Fan Location)	One microprocessor based multiplexer circuit Sensor/communications circuit Router circuits encapsulated in electronic potting compound
Approximate Weight	Controller: 2.9 lb (1.32 kg) Router: 1 lb (0.45 kg) Sensor: 0.5 lb (0.22 kg)

Measuring stations are tested at an AMCA Certified Laboratory using instrumentation and procedures in accordance with AMCA Standard No. 610-93, Air flow Station Performance.

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.

United States Emissions Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the users will be required to correct the interference at their own expense.

Canadian Emissions Compliance

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.



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