OWNER'S MANUAL

Model RVA+

Rotating Vane Anemometer

ALNOR®

TSI Incorporated

LIMITATION OF WARRANTY AND LIABILITY

Seller warrants that this product, under normal use and service as described in the operator's manual, shall be free from defects in workmanship and material for a period of 24 months, or the length of time specified in operator's manual, from the date of shipment to the customer. This limited warranty is subject to the following exclusions:

a. Batteries and certain other components when indicated in specifications are warranted for a period of 90 days from the date of shipment to the customer.

b. With respect to any repair services rendered, Seller warrants that the parts repaired or replaced will be free from defects in workmanship and material, under normal use, for a period of 90 days from the date of shipment to the customer.

c. Seller does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies.

d. Unless specifically authorized in a separate writing by Seller, Seller makes no warranty with respect to, and shall have no liability in connection with, any goods which are incorporated into other products or equipment by the Buyer. All goods returned under warranty shall be at the Buyer's risk of loss, Seller's factory prepaid, and will be returned at Seller's risk of loss, Buyer's factory prepaid.

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The purchaser and all users are deemed to have accepted the terms of this LIMITATION OF WARRANTY AND LIABILITY, which contains the complete and exclusive limited warranty of Seller. This LIMITATION OF WARRANTY AND LIABILITY may not be amended or modified nor may any of its terms be waived except by a writing signed by an authorized representative of Seller

Service Policy

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call Customer Service department at (800) 424-7427 (USA) and (1) 651-490-2811 (International).

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SECTION 1
General Description

The RVA+ is intended for measurement of air velocity and volume flow at return grilles, fume hoods, kitchen exhausts etc. It uses rotating vane anemometer technology. Air movement causes rotation of a multi-blade fan mounted in low-friction bearings. An infrared sensor translates fan blade movement into measured air velocity.

The RVA+ features a 270-degree rotating head with detents at every 90° and will function satisfactorily in any angular position. This allows the LCD display to be viewed from the front of the instrument while the head is oriented with the flow direction.

In addition, the temperature of the air flow is measured and displayed simultaneously with the flow reading.

SECTION 2
Safety

Observe common sense safety precautions when using the RVA+. Exercise care to ensure that the instrument does not interfere with any moving equipment or electrical wiring

This instrument is not designed for gas mixtures other than air. Use with explosive and/or other dangerous gas mixtures is not recommended and is at the user's own risk.

SECTION 3
About the RVA+

Installing the Batteries

The RVA+ requires 4 AA batteries. The batteries are not installed when the instrument is shipped. Remove the battery cover by pressing on the latch. Install the batteries noting the correct polarity orientation.

For replacing the batteries, remove the top batteries first.

LCD display

The large four digits will display the velocity or volume reading. The smaller digits near the upper left corner will always display temperature.

There are a total of 13 arrow indicators, seven along the top of the display and six along the bottom of the display. These indicators show: units of measure, statistics (min, max, avg.), the X1000 multiplier, and area.

Auto Shut Off

The RVA+ has an auto shut off feature to help preserve battery life. If no keys are pressed for 10 minutes, the instrument will automatically turn itself off. This function cannot be disabled by the user.

SECTION 4
Detailed Operation

Press the ON\OFF key to turn the RVA+ on and off. When the instrument is first turned on, it briefly illuminates all the LCD display segments. Next, the instrument will display

"***rdY***" indicating it is ready to take a measurement.

The RVA+ powers up to the unit of measure used last.

English/Metric Unit Selection

To select between English and metric units, be sure that the display indicates "***rdY***". Press and hold the ▼ key for approximately five seconds. The display will show ***"EnG"*** or ***"NNEt"***. Release the ▼ key. Use either the ▲ or ▼ key to make your selection. Press MODE/CLEAR key to accept the selection and return to ***"rdY"***.

Measuring Air Velocity

With the RVA+ displaying ***"rdY"***, select velocity units using the ▲ or ▼ arrow keys. In order to take a velocity reading, hold the rotating vane in the airstream noting the flow direction arrow on the instrument head. Keep the vane in the airstream about five seconds before pressing READ key to take a reading. This enables the vane anemometer to reach steady speed and the average reading will be more accurate.

To take a single reading, press READ key momentarily. The instrument will beep and the measured value will be displayed.

To take a time averaged reading, press and hold READ key for the desired time period. The instrument will beep approximately every second. Release the READ key to stop the measurement and display the average value.

After a time averaged reading is made, the user can view the average, maximum and minimum values of the measuring sequence. Press the ▲ or ▼ key to display a particular value. Press MODE/CLEAR key to return to "***rdY***".

Measuring Air Volume

The operation for air volume measuring is the same as air velocity. Once a volumetric unit of measure is chosen, the RVA+ is in volume mode. Use the arrow keys to choose your units of volume measurement. When the display shows ***"rdY***", press MODE/CLEAR key. The display will change to "***ArEA***" (if ***"ArEA***" does not show on the display, RVA+ is not in volume mode).

Press READ key. The display will show the previously entered area value. Use the ▲ or ▼

key to enter a new value. Press MODE/CLEAR key to accept the value and return to ***"rdY"***. To take a volume measurement, use the READ key as you would when taking a velocity measurement.

The area value must be in either ft^2 for English units or m^2 for metric units. To calculate the square area of your measurement area, use the formulas:

square or rectangle:
length x width = square area
round:
$\pi \times r^2$ = square area
where $\pi \approx 3.14$ and r = radius

***Note**:* If dimensions are in inches, divide the result by 144 to obtain ft^2, if in centimeters, divide the result by 10000 to obtain m^2. Refer to Section 5 for more details.

Low Battery Indication

When the "**LO BATT**" icon appears, the RVA+ has about 10 minutes of battery life remaining after which the instrument will display ***"Batt"*** and shut off.

SECTION 5
Helpful Information in Using Rotating Vane Anemometers

When used in airstreams of similar size to or smaller than the RVA+ head, blockage effects may occur. Velocity readings should be considered a relative measurement in this case. This effect is somewhat variable depending on the size of the airway and the distance from the duct walls. If the area is larger than 2.15 ft^2 (0.2 m^2) the effect should be minimal.

***Note**: The RVA+ can display an averaged result of multiple readings in both velocity and volumetric modes.*

Flow Rate in Larger Areas

When checking air velocity or volume flow rate over large areas, multiple spot readings should be taken. When taking multiple readings, it should be noted that large variations may be observed between individual readings. In general, the more readings taken, the more accurate the averaged result will be.

Use on Grilles

Better measuring conditions can be obtained on grilles with adjustable direction vanes if the vanes on the grilles are temporarily straightened before making measurements. This should not significantly affect the flow rate as long as any built in dampers are not accidentally disturbed. It is advisable to use the aperture (the actual effective area of air flow), not the surface area of the grill, in any flow rate calculation. The RVA+ is suitable for both supply and exhaust grilles, and the procedure for both is the same except that the direction arrow on the instrument head must be aligned correctly with the direction of the air flow. The head should be held close to the grille on exhaust, but the head should not touch the grille.

"Sweep" Technique

In addition to traditional traverse methods some users prefer to use a "sweep" technique. A continuous and uniform movement of the RVA+ over the entire measurement plane while READ key is depressed will produce a time averaged reading.

Users attempting to rely solely on this method should verify their "sweep" technique against conventional traverse methods.

Calculating Volume Flow Rate

Volume flow rates through airways or apertures may be calculated if the cross-sectional area of the airstream and its average velocity are known. To arrive at volume flow rate, the cross-sectional area of the airstream is multiplied by the average airstream velocity, using the same units of linear measurement throughout the calculation.

EXAMPLE:
The dimensions of a rectangular opening to a kitchen exhaust hood is 36 x 72 in. The average air velocity is 138 ft/min (fpm). Using the formula for determining the area of a rectangle, you would obtain an area of 18 square feet.
36 x 72 in. = 2592 in.^{2} 2592 / 144 = 18 ft^2

Inputting the area and the average velocity into the volume flow formula, you will obtain 2484 ft^3/min (cfm).

Q = AV *(area x velocity)*
Q = 18 ft^2 x 138 ft/min (fpm)
Q = 2484 ft^3/min (cfm)

The procedure is the same when working in metric units, but the velocity readings will be in m/s. The opening area should be calculated in m^2, and the answer will be in m^3/s.

EXAMPLE:
A rectangular opening measures 600 x 400 mm (0.6 x 0.4 m) and twelve readings of velocity have been taken. The readings are added together and the result is divided by 12. In this example, the average velocity is 3.025 m/s. The opening's cross-sectional area is: 0.6 x 0.4 m = 0.24 m^2. Therefore, the volume flow rate is 0.24 m^2 x 3.025 m/s = 0.726 m^3/s. This figure should be multiplied by 3600 to arrive at cubic meters per hour, or by 1000 to give the answer in liters per second. 0.726 x 3600 = 2613.6 m^3/h or 0.726 x 1000 = 726 l/s.

SECTION 6
Care and Maintenance

- Remove batteries from instrument if not used for an extended period of time.
- Do **not** bend or touch blades, accuracy will be affected.

- Do **not** immerse in liquids.
- Do **not** drop the instrument.
- Use carrying case for storage, transport, and protection from dust.
- Use a clean damp cloth to wipe the instrument case. Do **not** wipe the blades.

Return the RVA+ for service in case the instrument was dropped, blades were deformed, or liquid spilled on the instrument, the blades in particular.

SECTION 7
Service and Calibration Information

Please return your Product Registration Card immediately. This allows us to send service reminders, special offers, and important information about your product.

Before sending your instrument for calibration or repair, you should call Customer Service. The service department will provide you with the cost of service or calibration, Return

Material Authorization (RMA) number, and shipping instructions.

Send the instrument prepaid. Securely package your instrument in a strong container surrounded by at least two inches (5 cm) of suitable shock-absorbing material. Mark the outside of the shipping container with the RMA number. Also include the purchase order showing instrument model number, cost of service and/or calibration, and the RMA number. This will expedite processing of your instrument when we receive it. See back cover for factory address.

Damaged in Transit

All orders are carefully packed for shipment. On receipt, if the shipping container appears to have been damaged during shipment, the instrument should be thoroughly inspected. The delivering carrier's papers should be signed noting the apparent damage. DO **NOT** DISCARD THE BOX.

If the instrument itself has been damaged, a claim should be promptly filed against the carrier by the customer. The selling agent will assist the customer by supplying all pertinent shipping information; however, the claim must

be filed by the insured. If the instrument is damaged beyond use, a new order should be placed with TSI while awaiting reimbursement from the carrier for the damaged instrument. Call TSI directly for assistance if necessary.

MODEL RVA+ SPECIFICATIONS

(subject to change without notice)

Measurement Range:

Velocity	50 - 6000 fpm (0.25 - 30 m/s)
	0.57 - 68 mph (0.9 - 110 km/h)
Temperature	32 - 140 °F (0 - 60 °C)

Displayed Volumetric Flow Rate:

4 - 5400 x 1000 cfm (1.9 - 2548 x 1000 l/s;
6.8 - 9174 x 1000 m^3/h)

Actual range is a function of velocity x area input.

Area Input	0.08 - 900 ft^2 (0.007 - 83 m^2)

Display Resolution:

Velocity	1 fpm (0.001 m/s under 10.00 m/s, 0.01 m/s otherwise)
Temperature	1 °F (1 °C)

Accuracy:

Velocity	±(1% reading + 4 fpm or 0.02 m/s)
Temperature	±2 °F (1 °C)

Display:

4 digit, 0.45 in. (11 mm) high LCD with 2.5 digit, 0.15 in. (3.8 mm) high temperature indicator

Instrument Storage Temperature:

14 - 140 °F (-10 - 60 °C)

Instrument Operating Temperature:

32 - 140 °F (0 - 60 °C)

Power Source:

4 AA-size Alkaline or NiCd batteries

Battery Life:

Approximately 24 hours continuous use

Overall Dimensions:

11.5 L x 4.0 H x 1.8 D in. (29.2 L x 10.2 H x 4.7 D cm)

Weight: (batteries included) 13.1 oz. (370 g)

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