OWNER'S MANUAL

Thermo-Anemometer Probe

Model 175

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 twenty-four (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.

The foregoing is IN LIEU OF all other warranties and is subject to the conditions and LIMITATIONS stated herein. NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR PARTICULAR PURPOSE OR MERCHANTABILITY IS MADE.

THE EXCLUSIVE REMEDY OF THE USER OR PURCHASER, AND THE LIMIT OF THE LIABILITY OF SELLER FOR ANY AND ALL LOSSES, INJURIES, OR DAMAGES IN CONNECTION WITH THIS PRODUCT (INCLUDING CLAIMS BASED ON CONTRACT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT, OR OTHERWISE) SHALL BE THE RETURN OF THE PRODUCT TO THE FACTORY OR DESIGNATED LOCATION AND THE REFUND OF THE PURCHASE PRICE, OR, AT THE OPTION OF SELLER, THE REPAIR OR REPLACEMENT OF THE PRODUCT. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES. SELLER SHALL NOT BE RESPONSIBLE FOR INSTALLATION, DISMANTLING, REASSEMBLY OR REINSTALLATION COSTS OR CHARGES. NO ACTION, REGARDLESS OF FORM, MAY BE BROUGHT AGAINST THE SELLER MORE THAN ONE YEAR AFTER THE CAUSE OF ACTION HAS ACCRUED.

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).

SAFETY NOTICE

All ordinary precautions must be observed when operating the Model 175 Thermoanemometer probe near moving equipment such as motors and blowers. Exercise care to ensure that the probe or instrument does not interfere with any moving equipment.

WARNING

The operational range of the probe is 0° to 50°C (32° to 122°F) and must not be exceeded.

The Model 175 probe is NOT designed for gas mixtures other than air. Use with corrosive or other dangerous gas mixtures is not recommended and is at the user's risk.

Although the sensing element is protected, it can be damaged if subjected to abuse. If broken, it must be repaired and recalibrated at the factory or an authorized Alnor repair facility. See Instructions for Return.

WARRANTY

Warranty information is specified on the first page of the manual. The reply card is enclosed elsewhere in this package. Failure to return the reply card may void the warranty.

Opening or otherwise attempting to service your Alnor instrument may void the warranty or factory calibration. Please read the warranty statement carefully.

TABLE OF CONTENTS

GENERAL DESCRIPTION

The Model 175 is a thermoanemometer probe that can be used with selected ALNOR multipurpose meters to measure air speed and temperature. The probe can measure air speed from 0.1 to 30 meters per second (20 to 6000 feet per minute). Air temperature can be measured from 0° to 50°C (32° to 122°F). Calibration information is stored digitally in the probe. When used with ALNOR meters, measurements can be made in the following units:

Velocity Measurement

ft/m	feet per minute
m/s	meters per second
ft/s	feet per second
m/h	miles per hour
km/h	kilometers per hour
°C	degrees Celsius
°F	degrees Fahrenheit

Volume Measurement

cfm	cubic feet per minute
l/s	liters per second
m^3/h	cubic meters per hour

OPERATION

1. The probe may be shipped separately from the meter. Make sure that you have read the meter manual before proceeding.

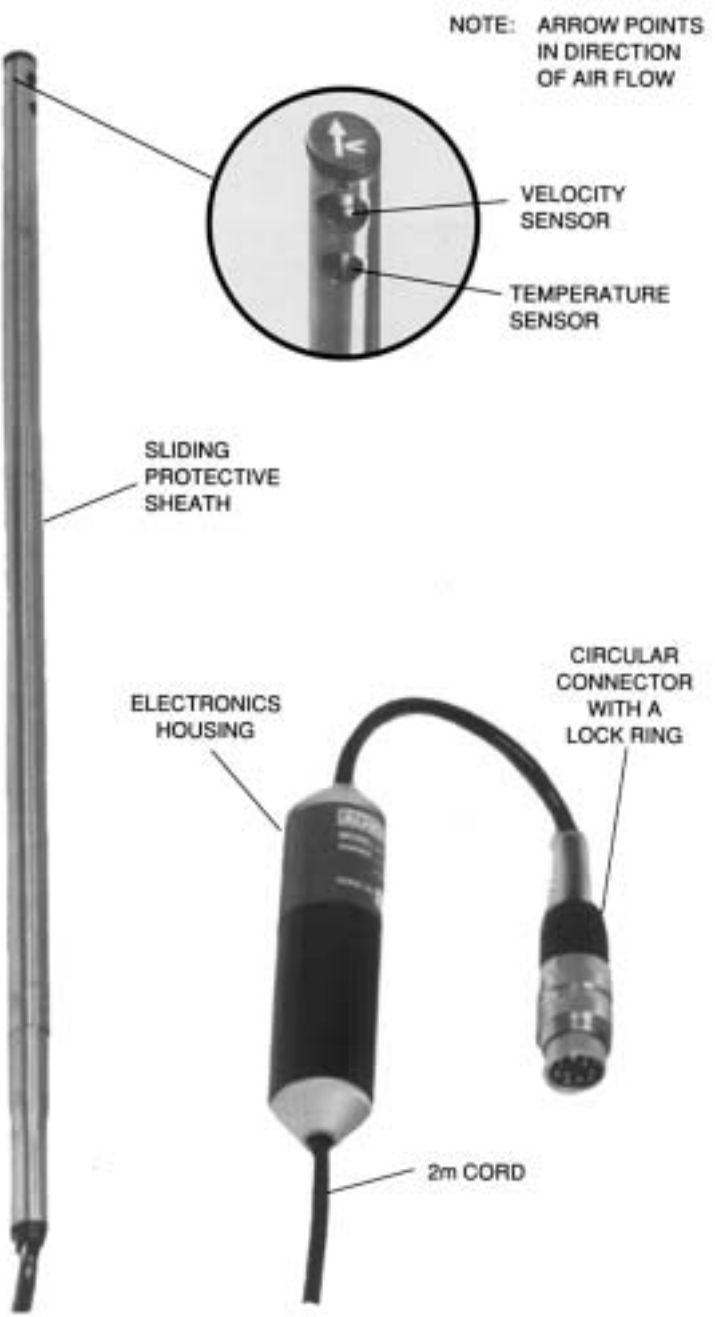
2. Connect the probe to the matching connector located on the meter. Make sure that the connector is tight, but do not over-tighten.

3. Slide the protective sheath down exposing the flow and temperature sensors.

4. Place the probe in the air stream with the arrow on the tip of the probe pointing in the same direction as the flow of air. Hold the probe perpendicular to the flow.

5. To avoid collecting of dust or other contaminants on sensors, always store the probe with its protective sheath covering the sensors.

6. The markings on the probe tube (calibrated every 5 cm starting at the sensors) are provided to help in estimating the desired depth of insertion of the probe in the air duct.


NOTE: ARROW POINTS IN DIRECTION OF AIR FLOW
VELOCITY SENSOR
TEMPERATURE SENSOR
SLIDING PROTECTIVE SHEATH
CIRCULAR CONNECTOR WITH A LOCK RING
ELECTRONICS HOUSING
2m CORD

THEORY OF OPERATION

GENERAL

There are two sensors located at the tip of the probe. The small round sensor at the very tip is a heated thermistor used to measure air velocity. The sensor below it is a nickel resistance temperature detector (RTD) used to measure air temperature and to make corrections to the air velocity when air temperature changes. The thermaoanemometer probe is operated in a constant temperature mode. In order to maintain long term calibration stability, the probe's calibration constants are stored digitally in memory. The probe's memory and other functional components reside on a printed circuit board located within the electronic housing.

Flow Sensor

The flow sensor is a small bead thermistor which is heated to constant temperature regardless of the air speed or air temperature. The bead is covered with a glass coating.

The flow sensor voltage obeys "King's Law" equation, which is

$$(\text{Voltage})^2 = A + B(\text{Velocity})^n$$

The calibration constants A, B and n are determined at the factory and are stored in the probe's memory.

Changes in atmospheric pressure also affect the displayed output. However, atmospheric pressure cannot be sensed by the probe and these changes must be made manually as described in the section CORRECTION FACTORS.

Temperature Sensor

The temperature sensor is made of fine nickel wire that is wound around a substrate. The sensor changes resistance with temperature.

Memory

Probe identification, calibration constants, last set of units used, and other information are stored in the probe's memory.

Analog Circuits

Amplifiers and electronic reference circuitry are used to process the sensor signal for reading by the meter. There are no adjustable potentiometers in the probe's circuits. Calibration adjustments are done digitally.

Power Regulation Circuit

Power is supplied by the meter. This power is regulated by a circuit located in the probe's electronic housing. There are no batteries in the probe.

CORRECTION FACTORS

Probes are calibrated under local conditions of temperature and atmospheric pressure. Temperatures range between 20° and 25°C (68° and 77°F). Pressures range between 729 and 767 mm (28.7 and 30.2 inches) of mercury. The probe is not compensated for changes due to atmospheric pressure. If it is desired to take this effect into account, use the following equation:

$$\text{Actual Velocity} = \text{Displayed Velocity} \times \frac{P_{calibration}}{P_{actual}}$$

Where:

$P_{calibration}$ = atmospheric pressure at time of probe calibration

P_{actual} = actual atmospheric pressure

NOTE

This correction can be incorporated in the meter's multiplier constant.

PERFORMANCE CHECK

Performance of the 175 probe should be checked every 6 months. If the probe is used in dirty environmental conditions, calibration should be checked more often. When checking the performance of the probe, verify that all instructions in both the probe manual and the meter manual are being followed. If a calibration check is made by the user, the following points should be considered:

1. The probe is calibrated with the arrow pointing in the same direction as the air flow. The arrow must also be parallel to the flow. Small angular differences (as small as 10°) between the arrow and the flow may affect the calibration by as much as 2% of reading. This effect is less severe at flow rates below 10 m/s (2000 ft/m).

2. The probe stem must be perpendicular to the direction of flow. Small angular differences (about 10°) from true perpendicular may affect the calibration by as much as 5% of reading. This effect is less severe at flow rates below 10 m/s (2000 ft/m).

3. Ideally, velocity should be checked against a standard that is 5 to 10 times more accurate than the 175 probe. This is likely to be very difficult to accomplish. Therefore, a standard at least as good as the 175 probe must be used. This means that a pitot-static probe will generally not be a good standard at flows under 5 m/s (1000 ft/m). Thermoanemometers, orifice plates or venturis are preferred standards below 5 m/s (1000 ft/m).

4. Air velocity is rarely distributed evenly in a duct or in an air stream. Usually, the velocity will be higher in the center of the air stream and lower at the periphery. This may cause discrepancies when comparing different probes in the "same" air stream. The user should also realize that the insertion of a probe in a channel of relatively small cross-sectional area, changes the air velocity from the undisturbed case. Flow blockages generally should not exceed 5%. This means that a 200 mm (8 in.) diameter duct is about the smallest size that can be measured without considering blockage effects.

5. If the probe has been inserted through insulation in a duct, be sure that the tip is clean. Dirt can adversely affect the calibration of the probe. In order to avoid collecting insulation particles on or around the sensors, slide the protective sheath up to cover the sensor holes. Back the sheath off to expose the sensor once the probe is in the desired position in the duct to take readings.

6. The probe is not automatically compensated for changes in atmospheric pressures. A change of atmospheric pressure of 25 mm (1 inch) of mercury will change the indicated reading by about 3%. See the section on Correction Factors for detailed information.

7. Turbulence levels in the air stream can affect the calibration accuracy. Generally, very low turbulence levels will make the instrument read differently.

8. Thermoanemometer instruments are often sensitive to changes in air temperature. Many instruments of this type measure mass flow. The 175 is temperature compensated to give actual velocity as opposed to mass velocity. If a mass flow type thermoanemometer is used as a standard, correction to actual velocity must be made.

9. When checking for temperature, it is very unusual for air temperature to be evenly distributed in an air stream. Differences of 0.5°C (1°F) or more are typical. When temperature comparisons are made against a standard, it must be verified that the temperature is the same between the location of the standard and the probe. Furthermore, temperature usually changes over time. If there is a difference between the time response of the standard and the time response of the probe, this may result in a perceived error.

10. The AM-300 and AM-600 hoods are primarily intended for measurements on round ventilation ducts, e.g., where the direction of flow is in, towards the duct. However, they can be used to measure in both directions. When using them on input vents where the direction is toward the room, a turbulent flow pattern may form inside the horn which affects the measurement accuracy. To avoid this source of error, a piece of straight duct or tubing should be placed between the vent and the AM-hood. It should have a length of at least three times the hood mouth diameter to ensure that a laminar flow pattern is established inside the hood.

NOTE

Any attempt at calibration voids all calibration certification that may have accompanied this probe.

MAINTENANCE

The 175 probe is manufactured with solid state components. However, periodic maintenance consisting of a calibration check should be made every six months as described in the CALIBRATION section of this manual. The probe should also be cleaned and checked for signs of physical damage.

CLEANING

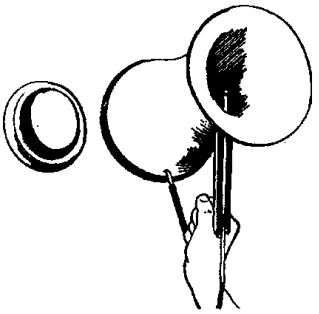
STEM and ELECTRONICS HOUSING: Use mild soap (dish-washing detergent) and water solution on a damp cloth to remove finger marks, oils or residue. Do not use abrasives or solvents. Do not immerse or allow liquids to enter the electronics housing. Dry the electronics housing thoroughly after cleaning.

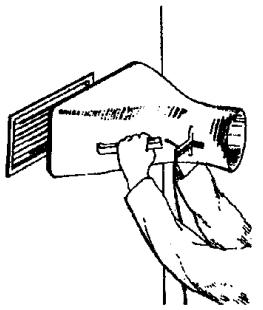
PROBE TIP: Periodically check to be sure that the sensing area of the probe is clean, and sensors are free of foreign particles. If cleaning is required, use denatured or iso-propyl alcohol. If denatured alcohol is used, make sure that the denaturizing agent leaves no solid residue material after evaporation. Extreme care must be used to avoid damaging the sensors. The preferred method is to immerse the probe tip briefly in denatured or iso-propyl alcohol and then dry it in a gentle stream of air. If moisture appears on the probe, allow it to dry thoroughly before use. Do NOT apply direct heat.

NOTE

There are no user serviceable parts or batteries inside the electronics housing. Do not open the housing.

USING THE ALNOR AM SERIES FLOW HOODS†





Typical Applications

By combining the Model 175 probe and the AM Series anemometer hoods, it is possible to measure volume flows at duct input and output vents. ALNOR meters have built in multiplying factors for calculating the volumetric flow from the velocity measured inside the hoods.

(Note that the multiplying factors for the AM hoods were increased with an average 10% in 1992 in order to take into account the amount of back pressure introduced in practical measurement situations).

AM-100: l/s = <m/s> x 5.6, m^3/h = <m/s> x 20
AM-300: l/s = <m/s> x 7.0, m^3/h = <m/s> x 25
AM-600: l/s = <m/s> x 17.25, m^3/h = <m/s> x 62
AM-1200: l/s = <m/s> x 27.7, m^3/h = <m/s> x 100

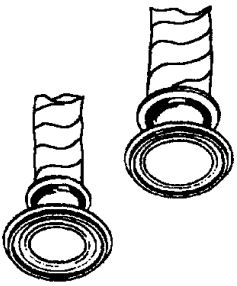
There are four different types of AM-hoods available:

† Available only in Europe

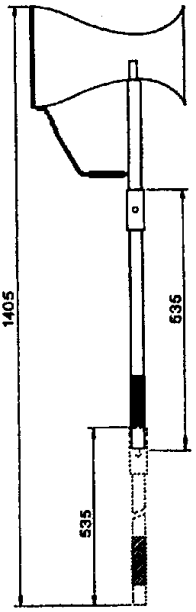
Model	Description
AM-100	Rectangular "Cone" for max. 100 x 300 mm Supply Air Grilles. Range: 18–120 m³/h or 5–34 l/s
AM-300	Round "Horn" for Max Diam. 180 mm Vents. Range: 10–150 m³/h or 3–42 l/s
AM-600	Round "Horn" for Max. Diam. 300 mm Vents. Range: 25–370 m³/h or 8–104 l/s
AM-1200	Rectangular "Cone" for Max. 200 x 600 mm Supply Air Grilles. Range: 75–600 m³/h or 20–170 l/s

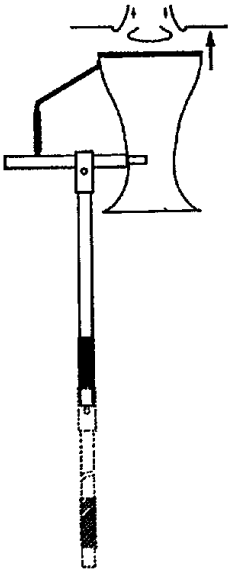
Accessories for AM-hoods

AR-300	Adaptor Ring Set for AM-300 for use on protruding standard diam. 100 mm and 125 mm exhaust vents
AR-600	Adaptor Ring Set for AM-600 for use on protruding standard diam. 125 mm and 160 mm exhaust vents.
EXT-300	1000 mm extension shaft for the AM hoods



AR300 and AR600





EXT-300

Using the AM-hoods

Fasten the Model 175 probe in the handle of the AM hood.

Check that the direction of the flow will be correct, by looking at the arrow on the probe tip. It is good practice to assure that the probe tip holes are in the middle of the hood's cross section.

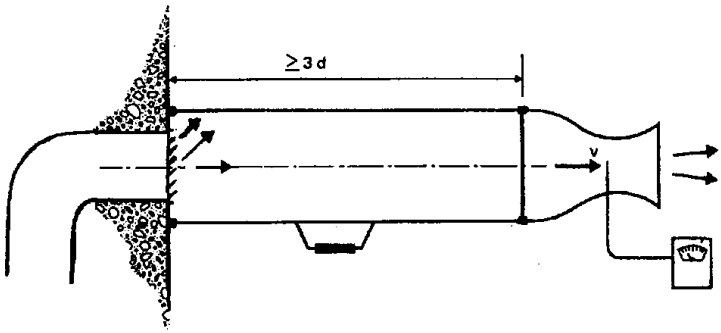
To select the proper AM HOOD press the VOLUME (VOL/CLR) button when the meter is in the normal measurement mode. The display then offers you the AREA option of the volumetric measurement menu. Use the ▲ or ▼ key until the display shows "VOLUME HORN (horn)". Press the VOLUME/SELECT (UNIT/↵) in order to select the AM hood mode. The meter now offers you the AM-100 (An1) hood. Use the ▲ and ▼ keys to select the AM hood type you will use and then push the VOLUME/SELECT (UNIT/↵) KEY. The meter now suggests a measurement unit. Use ▲ and ▼ keys to select the unit of your choice: m^3/h, l/s and ft^3/min are available. Push once more on VOLUME/ SELECT (UNIT/↵). The meter now shows you the volumetric flow with the hood you selected. If the MicroPrinter Model 8521 was connected, the type of hood selected would have been recorded.

Precautions

- Due to high turbulence usually present in the flow through ventilating openings, use a long time constant when taking measurements.
- Do not exceed the specified measurement range. Otherwise the excess back pressure caused will reduce the flow through the vent being measured.
- Although designed fundamentally for a single flow direction, (The AM-300 and AM-600 for exhaust air, and the AM-100 and AM-1200 for supply air), all hoods may be operated in both flow directions. However: the following should be kept in mind:

  If measuring exhaust air with AM-100 or AM-1200, the air volume should not be larger than half of the top of the measurement range, because these hood's aerodynamics cause extra resistance on air sucked from the room in the hood.

If measuring on supply air openings which have a throw direction to the side, or if a curve exists in the duct just behind the vent, or if there is any other reason which could cause the AIR VELOCITY DISTRIBUTION over the cross section of the hood's throat NOT to be EVEN, then a piece of straight duct should be used between the vent and the AM hood. A minimum length of three times the AM hood's mouth's diameter is found to be sufficient to equalizing the flow profile before it passes through the throat of the hood. This applies to ALL types of AM hoods when measuring supply air.



- When measuring very small volumes, where the air velocity at the throat of the hood is less than one meter per second, the assumption of a linear relationship between the volumetric flow and the air velocity in the hood is not valid. For this reason, the given measurement ranges for the horns do not start at zero.

  Unfortunately, no formula can be given for correcting for measurements below the specified ranges.

LIST OF MODELS AND PARTS

Part No.	Model	Description
634-493-010	8521	Microprinter, RS232
634-431-023	175	Velocity Probe Alone
633-100-110	220A	Humidity Probe Alone
634-493-404		PC Serial Cable
632-200-002		Calibration Cable
534-493-147		Carrying Case
459-000-000		NiCad Batteries
325-000-010		300 mm extension
325-000-015		600 mm extension

Available only in Europe

701-231-010	AM-100
701-231-011	AM-300
701-231-012	AM-600
701-231-013	AM-1200
701-231-014	EXT-300
701-231-007	AR-300
701-231-009	AR-600

TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES and CORRECTIVE ACTIONS
Measurement is erratic	Probe is not being held steady—secure probe on test stand. Flow field is unstable. Measurement is being made at edge of jet or behind fan—try slower time constant as described in meter manual.
Erroneous readings	Probe sensing element is dirty—clean probe tip Arrow on probe tip is not pointing in same direction as flow—make sure arrow is parallel to flow and in same direction. Probe stem is not held perpendicular to flow—orient probe stem to be perpendicular to flow Atmospheric pressure is significantly different from factory calibration—perform manual correction factor Probe is out of calibration—Return for calibration. See Instructions for Return.
Meter indicates a reading above or below measurement range	Air flow is beyond the range of the instrument. It is either above or below measurable range. The measurement cannot be made. Probe tip sensing element is broken—probe must be repaired.
Meter indicates that there is not a probe connected	Probe connection is bad—make sure connector is tight.

SERVICE INFORMATION

Contact TSI Incorporated directly, before returning your instrument. See INSTRUCTIONS FOR RETURN. Follow the procedure carefully as it will expedite processing. Failure to follow the procedure may cause return of the unit unrepaired. Send your instrument to the factory transportation prepaid. To assure fast turn-around time, photocopy and fill out this form with as much detail as possible and attach it to the instrument.

RMA No. _____

Instrument Model _____

Serial Number _____

Date of Purchase _____

Where Purchased _____

Describe Malfunction _____

Describe Environment _____

Return Instrument to:

Name _____
(Your name or company)

Address _____

Telephone _____

Address Correspondence to:

Name _____

Address _____

Telephone _____

SERVICE AND REPAIR

Service and Repair

Please return your Product Registration Card immediately. This allows us send you 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.

Please have the following information available when you call:

- Owner's name, address, and phone number
- Billing address, if different and applicable
- Instrument name or model
- Serial number
- Date of purchase
- Where purchased

TSI recommends that you keep a "calibration log" and keep all records of service on your instrument.

Instructions for Return

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. Include the Purchase Order showing instrument model number, cost of service and/or calibration, and the RMA number. Mark the outside of the shipping container with the RMA number. This will expedite processing of your instrument when we receive it.

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.

OWNERSHIP/CALIBRATION LOG

Equipment Log

Date of Purchase _____

Calibration Record _____

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

7. _____ 8. _____ 9. _____

10. _____ 11. _____ 12. _____

Notes: _____

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SPECIFICATIONS
175 PROBE

RANGE	Velocity: 20 to 6000 ft/m (0.1 to 30 m/s) Temperature: 32 to 122 °F (0 to 50 °C)
ACCURACY	
STANDARD CONDITIONS	±5 ft/m from 20 to 100 ft/m ±(3% + 2 ft/m) from 101 to 700 ft/m ±(3% + 20 ft/m) from 701 to 4000 ft/m ±(3% + 200 ft/m) from 4001 to 6000 ft/m ±0.025 m/s from 0.1 to 0.5 m/s ±(3% + 0.01 m/s) from 0.5 to 3.5 m/s ±(3% + 0.1 m/s) from 3.5 to 20 m/s ±(3% + 1 m/s) from 20 to 30 m/s
NON-STANDARD CONDITIONS	±0.1 ft/m per °F from 20 to 200 ft/m ±0.001 m/s per °C from 0.1 to 1.0 m/s ±0.1% reading per °F from 201 to 6000 ft/m ±0.06% reading per °C from 1.0 to 30 m/s
TEMPERATURE ACCURACY	±1°F from 68 to 86°F ±0.5°C from 20 to 30°C ±(5% + 1°F) from 32 to 68°F and from 86 to 122°F ±(5% + 0.5°C) from 0 to 20°C and from 30 to 50°C
STORAGE TEMPERATURE	–40 to 150°F (–40 to 65°C)
DIMENSIONS	0.35″ (9 mm) diameter, 11-3/4″ (300 mm) length
WEIGHT	5.5 oz. (155g)
OPERATING TEMPERATURE OF HEATED THERMISTOR	Approximately 194°F (90°C)

Specifications subject to change without notice
% denotes % of reading

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