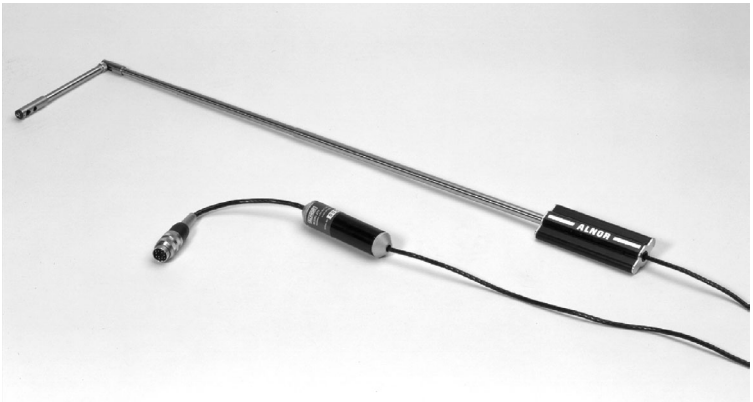
OWNER'S MANUAL

# Thermo-Anemometer Probe Model 275




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).

# TABLE OF CONTENTS

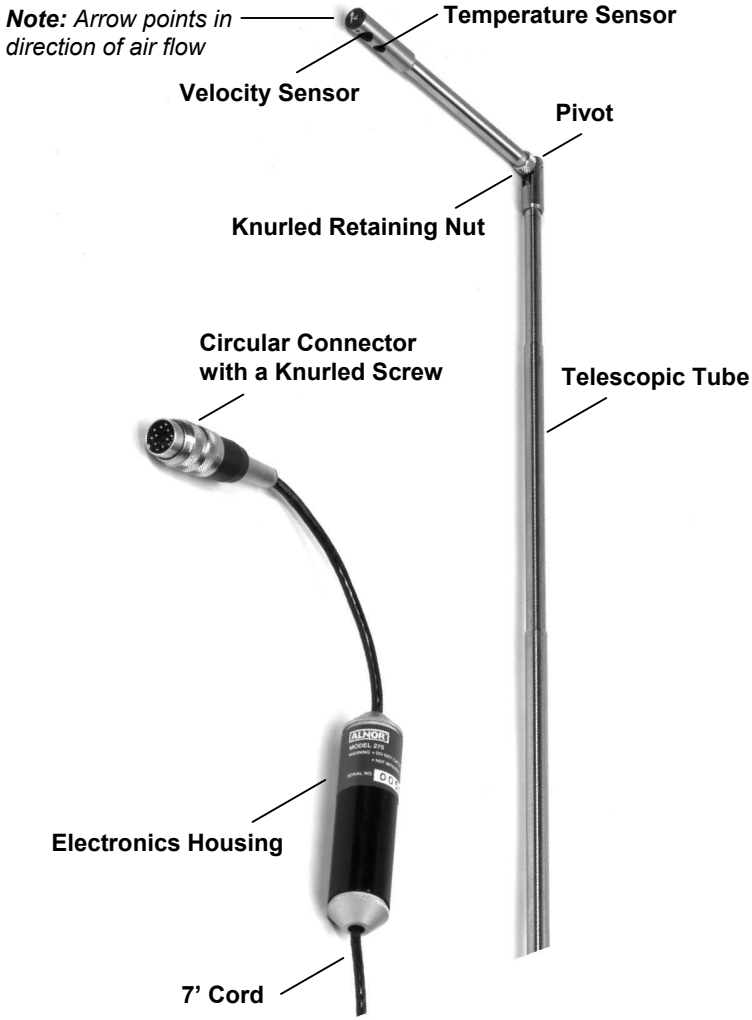
# 1. GENERAL DESCRIPTION

The Model 275 is a thermo-anemometer probe that can be used with Alnor 8575 CompuFlow®, APM 150, or APM 360 meters to measure air speed and temperature. The probe can measure air speed from 20 to 6000 feet per minute (0.1 to 30 meters per second). Air temperature can be measured from 32° to 122°F (0° to 50°C). Calibration information is stored digitally within the probe. When used with either meter, measurements can be made in the following units:

- fpm Feet per minute
- m/s Meters per second
- ft/s Feet per second
- mph Miles per hour
- km/h Kilometers per hour
- °C Degrees Centigrade
- °F Degrees Fahrenheit
- *cfm Cubic feet per minute
- *l/s Liters per second
- *$m^3$/h Cubic meters per hour

*When a Volume mode has been chosen and an area has been input.

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 flow speed. The sensor below it is a nickel resistance temperature detector (RTD) used to measure air temperature and to make corrections to the air flow speed when air temperature changes. The thermal anemometer probe is operated in a constant temperature mode. 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.


**Note:** *Arrow points in direction of air flow*
Temperature Sensor
Velocity Sensor
Pivot
Knurled Retaining Nut
Circular Connector with a Knurled Screw
Telescopic Tube
Electronics Housing
7' Cord

# 2. SAFETY

All ordinary precautions must be observed when operating the Model 275 thermo-anemometer 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.

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

The Model 275 probe is **not** designed for gas mixtures other than air. Use with corrosive or other dangerous gas mixtures is not recommended.

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. See Instructions for Return.

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

# 3. OPERATION

1. The probe can 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.
3. Remove the plastic tip protector from the probe and store in a safe place.
4. Place the probe in the air stream with the arrow on the tip of the probe pointing in the same direction as the air flow. Hold the probe perpendicular to the flow.

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

# 4. THEORY/CORRECTION FACTORS

Thermo-anemometers operate on the principle of heat transfer. A sensor is heated above room temperature by passing current through a resistance. Electrical energy is converted to heat. Through convective heat transfer, the heat is passed on to the fluid passing over the heated element. The fluid in this case is air. There are a variety of air properties that affect the heat transfer. The most important is the velocity of the air passing over the heated element. Others include the temperature difference between the heated element and the air, and density. As the density increases, the number of molecules that come in contact with the heated element increases. Thermo-anemometers are corrected to account for the change in heat transfer due to different ambient air temperatures. These are considered "temperature corrected." However, temperature also has an effect on the density. This means that for the same velocity, you will have a different displayed velocity if the density changes. Temperature corrected thermo-anemometers are mass flow rate sensors that can be corrected to give actual velocities.

Velocity is generally expressed in one of two ways: actual (true) velocity or standard velocity. Actual velocity is the average speed at which the molecules are traveling. Standard velocity is referenced to standard conditions and is equal to the actual velocity of the air only when the air is at standard density. The calibration facilities at TSI Incorporated adjust the actual velocity so that the same number of molecules per unit time are passing over the heated element as if the density were standard density. This makes the instrument display standard velocity.

To correct the standard velocity to actual velocity use the equations below.

$V_a$ = Actual velocity

$V_{std}$ = Standard velocity (this is displayed by the instrument)

$\rho_{std}$ = Standard density 0.075 lb/ft$^3$ (at 70°F and 29.92 in Hg)

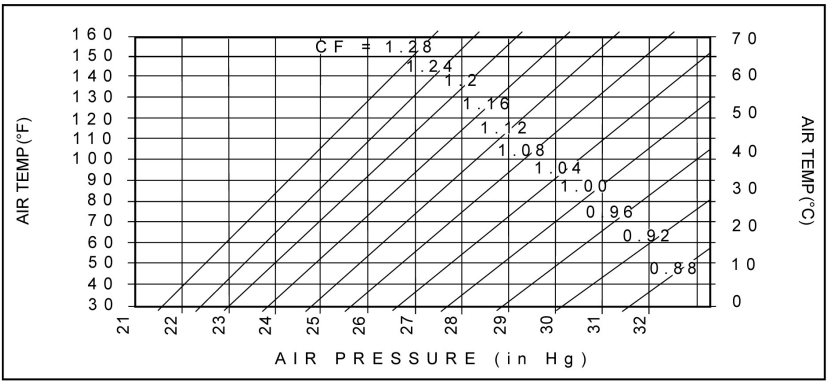
$\rho_a$ = Actual density in lb/ft$^3$

$CF = \rho_{std}/\rho_a$ (Correction Factor)

$V_a = V_{std} \times CF$

For your convenience we have made a chart for determining the correction factor given temperature and pressure.

***Note**: The atmospheric pressure as reported by the National Weather Service is corrected to sea level and cannot be used if measurements are not at sea level.*




For more information on calculating local air density, call the Customer Service Department at TSI.

# 5. TROUBLESHOOTING GUIDE

| Symptom | Possible Causes and Corrective Actions |
|---|---|
| Measurement is erratic | Probe is not being held steady—secure probe on test stand.<br>Flow field is unstable.<br>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.<br>Arrow on probe tip is not pointing in same direction as flow—make sure arrow is parallel to flow and in same direction.<br>Probe stem is not held perpendicular to flow—orient probe stem to be perpendicular to flow.<br>Density is significantly different from standard conditions—calculate correction factor.<br>Probe is out of calibration—return to factory for calibration. See Service Information. |
| Meter shows 0 or over | Air flow is beyond range of the instrument. It is either above or below the measurable range. The measurement cannot be made.<br>Probe tip sensing element is broken—probe must be repaired. |
| Meter shows No Probe | Probe connection is bad—make sure connector is tight. |

# 6. MAINTENANCE

The 275 probe is manufactured with solid state components. However, periodic maintenance consisting of a performance check should be made every six months as described in the Performance Check section of this manual. The probe should also be cleaned and checked for signs of physical damage.

There are no adjustable potentiometers in the probe's circuits. Calibration adjustments are done digitally at the factory.

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

# 7. CLEANING

### Handle, Telescopic Tube and Electronics Housing

Use mild soap (dishwashing 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 the sensors are free of foreign particles. If cleaning is required, use denatured or isopropyl 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 sensor. The preferred method is to immerse the probe tip briefly in denature or isopropyl alcohol and then dry it in a gently stream of air. If moisture appears on the probe, allow it to dry thoroughly before use. Do **not** apply direct heat.

# 8. PERFORMANCE CHECK

Performance of the 275 probe should be checked every six (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 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 2000 fpm (10 m/s).
2. The probe stem must be perpendicular to the direction of flow. Small angular differences (about 10%) from the true perpendicular may affect the calibration by as much as 5% of reading. This effect is less severe at flow rates below 2000 fpm (10 m/s).
3. Ideally, velocity should be checked against a standard that is at least 4 times more accurate than the 275 probe. This is likely to be very difficult to accomplish. Therefore, a standard at least as good as the 275 probe must be used. This means that a pitot-static probe will generally not be a good standard at flows under 1000 fpm (5 m/s). Thermal anemometers, orifice plates, or venturis are preferred standards below 1000 fpm (5 m/s).
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. You 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 8 in. (200 mm) 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.
6. The 275 probe reads standard fpm. Read the Theory section describing standard conditions and how the probe should be corrected. Be sure that the proper corrections for temperature and atmospheric pressure are applied to both the probe being tested and the measurement standard being used. Measurement standards may require a different correction technique. Know your equipment and the theory behind each before proceeding.
7. Turbulence levels in the air stream can affect the calibration accuracy.
8. The temperature distribution in an air stream may not be evenly distributed. Temperature differences of 1°F (0.5°C) can easily exist. 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.

***Note**: Any adjustments void all calibration certification that may have accompanied this probe.*

# 9. 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.

# 275 PROBE SPECIFICATIONS

| | |
|---|---|
| **Range** | |
| **Air Velocity** | 20 to 6000 feet per minute fpm |
| **Temperature** | 32 to 122°F |
| **Resolution** | 0.001 below 1<br>0.01 from 1 to 10<br>0.1 from 10 to 100<br>1 above 100 |
| **Accuracy*** | |
| **Standard Conditions** | ±5 fpm from 20 to 100 fpm<br>±3% of reading ±2 fpm from 101 to 700 fpm<br>±3% of reading ±20 fpm from 701 to 4000 fpm<br>±3% of reading ±200 fpm from 4001 to 6000 fpm<br>±1°F from 68 to 86°F<br>±5% of reading ±1.0°F from 32 to 68°F and 86 to 122°F |
| **Non-Standard Conditions** | 20 to 200 fpm (0.1 to 1 m/s)<br>±0.1 fpm per °F (±0.001 m/s per °C)<br>201 to 6000 fpm (1 to 30 m/s)<br>±0.1% of reading per °F (±0.2% of reading per °C) |
| **Storage Temperature** | -40°F to 150 °F (-40°C to 65°C) |
| **Dimensions** | 0.355" (9 mm) max. diameter<br>Handle—3 1/2" long x 1 1/2" wide<br>Length—20" closed, extendable to 45" (508 mm extendable to 1143 mm)<br>Flexible cable 7 ft. (2.1 M) long<br>Pivoting section 4.5" (114 mm) long at tip end, lockable in straight or either 90° position |
| **Weight** | 12 oz (340 g) |
| **Operating Temperature of Heated Thermistor** | Approximately 194°F (90°C) |

*With 8575, APM 150, or APM 360 meter.

Specifications subject to change without notice.

ALNOR®
TSI Incorporated


TSI Incorporated
Alnor Products
500 Cardigan Road
Shoreview, MN 55126 USA
Toll Free (800) 424-7427
Telephone (651) 490-2811
Fax (651) 490-3824
www.alnor.com
customerservice@alnor.com

July 2002
Printed in USA
Patent # 5,162,725
Part No. 116-159-075 Rev. 4