

OWNER'S MANUAL

Hygrometer Probe Model 220B



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 one year, 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.
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- 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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Using the 220B Safely

All ordinary precautions must be observed when operating the Model 220B hygrometer probe near exposed electrical wiring or 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 140°F (0 to 60°C) and must not be exceeded.

The Model 220B probe can be damaged by exposure to certain chemical environments. See the Maintenance & Troubleshooting appendix in this manual for a partial list of these compounds.

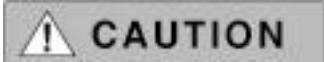
Do **not** remove the probe end cap to expose the sensing element. If damaged, the probe should be returned for repair.

Getting Started

The Model 220B is a hand-held hygrometer probe that is used with selected Alnor meters to measure relative humidity and temperature. Calibration information is digitally stored with the probe.

Preparation for Use

1. The probe is shipped separately from the meter. Make sure that you have read the owner's manual for the meter before proceeding with these instructions.
2. Connect the probe to the meter using the 12-pin circular connector located on the meter. As a precaution, always turn the meter off before you connect or disconnect the probe. Make sure that the lock ring on the probe connector is hand tight, but do **not** overtighten, or use tools.
3. Follow the preparation for use instructions outlined in the owner's manual.



Do **not** remove the metal cap from the probe housing. If either the humidity sensor or temperature sensor are bent or damaged in any way, inaccurate measurements will result. It is strongly suggested that the metal cap be installed on the probe tip at all times.

Description of Probe

Index No.	Name	Description
1	Humidity Sensor	Special hygroscopic polymer
2	Temperature Sensor	Platinum resistance temperature detector (RTD)
3	Probe Housing	Aluminum probe tube
4	Probe Handle	Plastic handle
5	Cable with Suppressor	Flexible cable
6	Connector	12 pin circular DIN-style connector
7	Lock Ring	Threaded ring used to tighten the probe to the meter

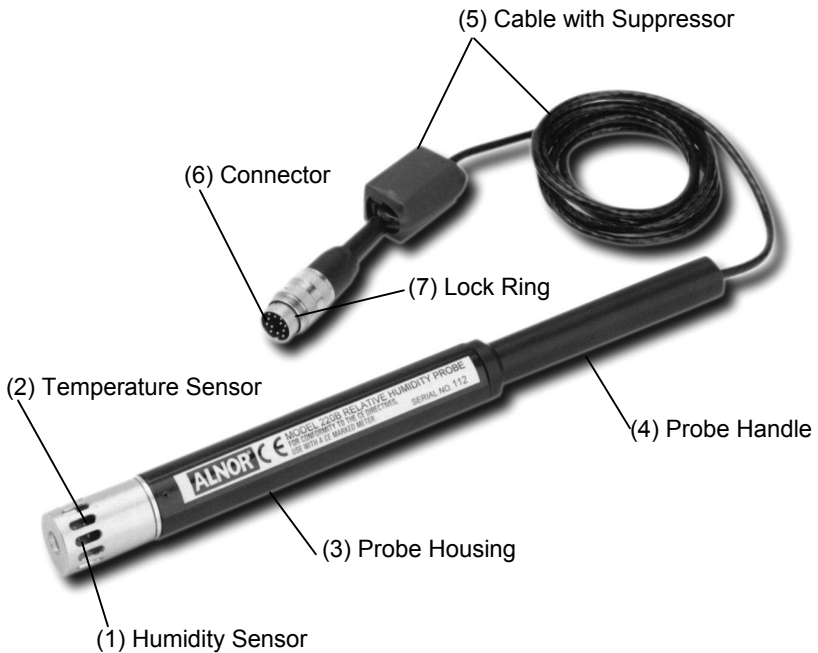


Figure 1: Description of Probe

Using the 220B

1. For maximum accuracy, always hold the probe by the handle. Allow the probe to acclimate to the environment in which the measurements are to be taken. Waving the probe in the air to be measured will accelerate this process. However, if the probe has not been acclimatized, then the temperature of the shield and base where the sensors are located will have a local influence on the air near the RH sensor. Other factors which may influence the accuracy of the measurement are:
 - The proximity of the operator's hands near the sensor either before or during measurement.
 - Sources of heat or cold near the probe such as a heating duct or an air conditioner.
 - Any other cause of environmental change in or near the probe which is not representative of the larger area to be measured.

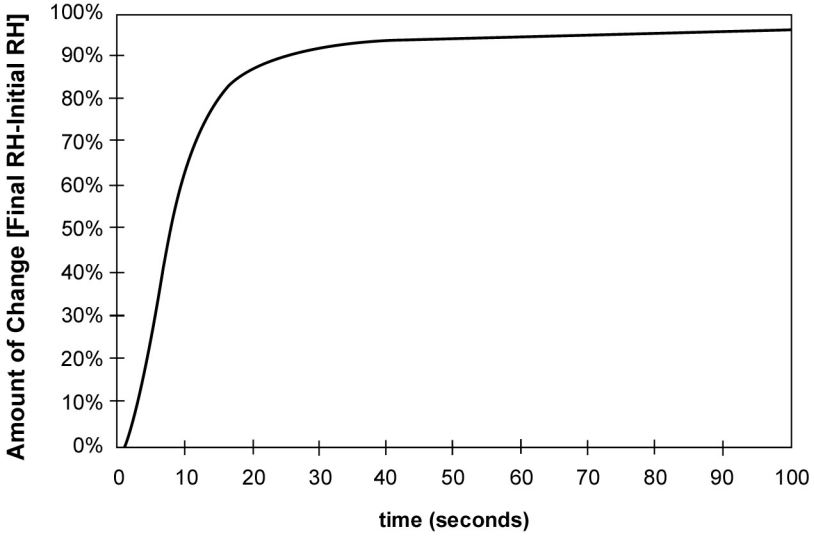
Do **not** allow moisture to condense on the probe when in use. If the temperature of the probe is allowed to be lower than the dew point, condensation will occur when the probe is used to measure the environment. Condensed water will immediately cover the sensors and the protective metal shield. This moisture will not damage the probe, but it will be necessary to thoroughly dry the probe before taking further measurements.

2. Select Relative Humidity (RH) units on the meter in use or select Temperature units. Observe the values on the meter display. Use the meter's time constant function, if available, to smooth the fluctuation of readings.
3. The probe should be stored in approximately the same environment as that to be measured. This will eliminate the time necessary to attain thermal equilibrium. For example, if the probe were brought in from an environment of 30 degrees Fahrenheit and the temperature to be measured was 75 degrees, the time to achieve thermal equilibrium may be 2 to 3 hours.

Response Time

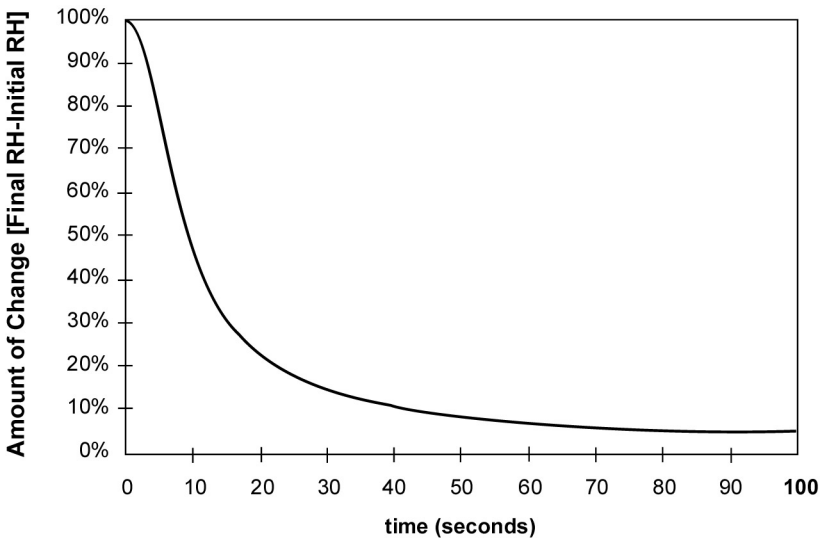
When measuring RH, the 220B probe will exhibit the typical response to changing humidity shown below.

Positive Change in RH



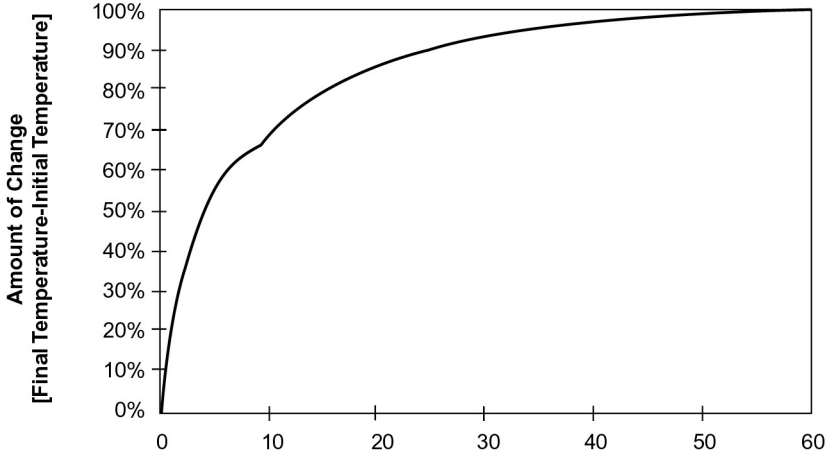
For example: the initial reading is 10% RH, and the final reading is 80% RH, the probe will read 10% RH (0% of amount of change) in 0 seconds, 24% RH (20% of amount of change) in 5 seconds, 54% RH (63% of amount of change) in 10 seconds, 77% RH (95% of amount of change) in 60 seconds.

Negative Change in RH

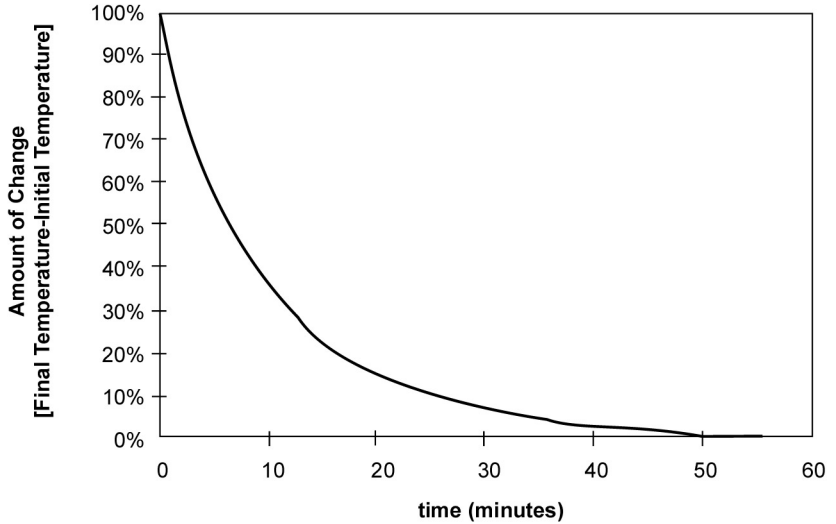


For temperature changes, the 220B typically reacts as shown below:

Positive Change in Temperature



Negative Change in Temperature



Performance Check

Performance of the Model 220B probe should be checked every 12 months. If the probe is used in dirty or toxic environmental conditions, calibration should be checked more often. However, if a calibration check is performed by the user, the following points should be considered:

1. All instructions in both the probe and meter manuals are to be followed.
2. Saturated salt solutions are an effective means of evaluating the performance of the humidity sensor. Each type of salt has its own properties and constraints on usage. Be familiar with the properties and proper procedures for using salt baths. Refer to ASTM E104-85 for some of these details. Humidity and temperature equilibrium must be established for comparison to a standard or reference. Humidity equilibrium will depend upon the head space of the container used. A larger head space will require a longer stabilization period after the container is opened for insertion of the 220B probe. Although the temperature measurement is not used in the calculation of relative humidity, temperature does have an effect on the RH produced by salt baths.
3. Verification of the temperature calibration should be performed in an air stream with stable temperature. Care must be taken when verifying the temperature calibration. Be familiar with the temperature standard and the characteristics of the air stream to be used.

Troubleshooting & Maintenance

Troubleshooting

Symptom	Possible Causes and Corrective Actions
MEASUREMENT IS ERRATIC	Probe is being exposed to local source of heat or cold. Probe has not been given sufficient time to reach thermal equilibrium.
ERRONEOUS READINGS	Probe may be out of calibration. Return for calibration. See Instructions for Return. Probe tip sensing element is broken. Probe must be returned for repair.
METER INDICATES THAT THERE IS NOT A PROBE CONNECTED.	Probe is not attached to meter. Attach probe. Probe connection is loose. Make sure locking ring is tight. Cable may be damaged. Check cable and connector.

Maintenance

The Model 220B probe is manufactured with solid state components. However, periodic maintenance consisting of a calibration check should be made every 12 months. The probe should also be checked for signs of physical damage.

Cleaning

Probe 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 the cylindrical housing or allow liquids to enter it. Dry the housing after cleaning.

Probe Tip

It is recommended that the sensor surfaces **not** be touched. Do **not** try to remove deposits or particles.

Chemical Environments

Do **not** use humidity probe in the following chemical environments:

Acetaldehyde	Ethyl acetate
Acetone	MEK
Acetic acid	Methyl chloride
Aniline	Nitrobenzene
Benzaldehyde	Oleum
Chlorobenzene	Perchloroethylene
Chloroform	Phenol
Chlorosulphonic acid	Propane
Cresols	Pyridine
Cyclohexanone	Sulphurous acid
Dichlorobenzene	Tetrahydrofurane
Dichloroethane	Toluene
Dimethylformamide	

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

APPENDIX A: Theory of Operation

General

There are two sensors located at the probe tip (See Figure 1). The smaller square sensor is a platinum element used to measure temperature. The larger sensor measures relative humidity. The operating principle for humidity is based on the properties of a hygroscopic material, used as the dielectric component of a capacitor. A change in ambient humidity results in a variation of capacitance.

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 in the cylindrical probe housing. See the block diagram of the probe, Figure 2.

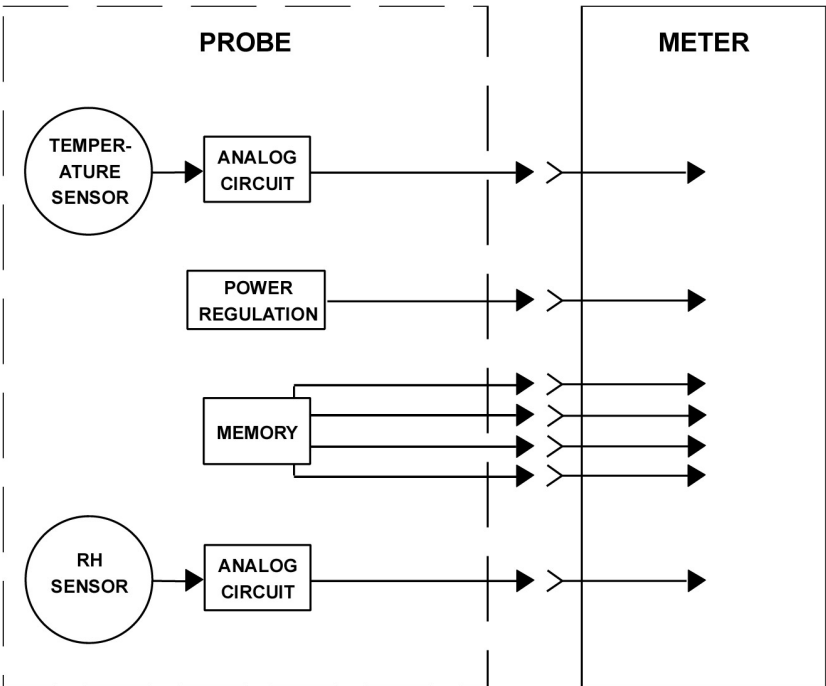


Figure 2: 220B Probe Block Diagram

Humidity Sensor

The humidity sensor acts as a capacitor and uses a special hygroscopic polymer as its dielectric. Depending on the humidity of the environment to be measured, a quantity of water proportional to the humidity of the environment is absorbed by the dielectric. When even a small amount of water penetrates the polymer, it causes a variation of capacitance. The relative humidity displayed on the meter, from 0 to 100%, is directly proportional to this variation of capacitance.

Temperature Sensor

The temperature sensor is made of platinum and changes resistance proportionally with temperature.

Memory

Probe identification, factory and user calibration constants, last set of measurement 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 performed digitally.

Power Regulation Circuit

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

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 _____

Instructions for Return

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.

Service/Calibration

Contact the Service Department at TSI if you require factory service of your Alnor instrument. The Service Department will provide you with the cost of service or calibration, Return Material Authorization (RMA) number, and shipping instructions.

Your service includes a Certificate of Traceability to National Institute of Standards and Technology (NIST, formerly NBS) with data (states instrument compared with factory standard traceable to NIST and lists of calibration data, i.e., "Standards reads..." and "This instrument reads...").

Obtain a Purchase Order from your Purchasing Department showing instrument model number and cost of service and/or calibration. 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. Mark the outside of the shipping container with the RMA Control number.

Forward the instrument prepaid. See back cover for factory addresses.

Ownership/Calibration Log

Equipment Log

Date of Purchase _____

Calibration Record _____

- | | | |
|-----------|-----------|-----------|
| 1. _____ | 2. _____ | 3. _____ |
| 4. _____ | 5. _____ | 6. _____ |
| 7. _____ | 8. _____ | 9. _____ |
| 10. _____ | 11. _____ | 12. _____ |

Notes: _____

220B Hygrometer Probe Specifications

Measuring Range	
Temperature	32 to 140°F (0 to 60°C)
Relative Humidity	0 to 100%
Operating Range	32 to 140°F (0 to 60°C)
Accuracy	
Temperature °F [°C]	± (0.4% of reading + 1°F), [0.7°C]
Humidity	± 2% from 10 to 96% RH @ 77°F (25°C) ± 2.5% from 10 to 90% RH @ 68° to 86°F (20 to 30°C)
Storage Temperature	-40°F to 150°F (-40 to 65°C)
Dimensions	10.3" (260 mm) length x 0.9" (23 mm) diameter Cable length approximately 60" (1.5 m)
Weight	7 oz (200 g)
Probe Connector	12-pin circular screw-lock
Compatible Instruments	The 220B may be used with all versions of the Alnor APM150, CompuFlow 8575, GGA75 and those APM360 meters using a round 12-pin probe connector.



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