

# Model 5190-F Temperature/Humidity Probe

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<input type="checkbox"/>	<b>NOT FAA APPROVED</b>

## User's Manual

Rev. C



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### **Latest Manual Version**

For the latest version of this manual, see the *Product Manuals* page under *Reference* on our web site at [www.allweatherinc.com/](http://www.allweatherinc.com/).



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- **Online** support is available by filling out a request at [www.allweatherinc.com/support/online-support/](http://www.allweatherinc.com/support/online-support/)
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## Revision History

Revision	Date	Summary of Changes
C	2017 Jan 12	Updated Section 3.2 to say return probe to AWI if it fails validation checks only if it is under warranty, removed AWOS warranty chapter.

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# 1. THEORY OF OPERATION

The Model 5190-F Temperature/Humidity Probe is designed for a variety of environmental monitoring applications, including All Weather Inc.'s Automated Weather Observing Systems (AWOS). The 5190-F operates with a DC supply voltage and has a low current draw. Relative humidity is measured with a thin-film capacitor sensor, and temperature is measured using a Pt100 RTD with an accuracy of  $\pm 0.1^{\circ}\text{C}$ . The signals from the sensors are converted into two linearized voltage output signals.

## 1.1 Power Supply

The 5190-F requires a voltage source in the range of 5–24 V DC, capable of providing 4 mA.

In the case of data logger applications, battery power can be conserved by energizing the probe for only 15 seconds during each measurement.

## 1.2 Output Signals

The 5190-F provides two linearized voltage signals as shown below.

Parameter	Output Voltage	Range
RH	0–1.0 V DC	0–100% RH
Temperature	0–1.0 V DC	-40°C to +60°C

*Note: Do not connect a load to the outputs with an impedance of less than 10 k $\Omega$ .*

## 1.3 Environmental Limits

### 1.3.1 Temperature Limits

The 5190-F was designed to operate from -40°C to +60°C.

### 1.3.2 Humidity Limits

The 5190-F can operate with the RH between 0 and 100%. Direct condensation does not damage the sensors. However, the humidity sensor will not provide correct readings when condensation is present, and neither of the sensors will operate if the sensor leads are short-circuited by condensation. The 5190-F provides a humidity output that is referenced to the saturated water vapor pressure above liquid water. With this reference, the maximum humidity reading at temperatures below freezing are as follows.

Maximum RH	Temperature	Maximum RH	Temperature
100%	0°C	81%	-20°C
95%	-5°C	78%	-25°C
91%	-10°C	75%	-30°C
87%	-15°C		

## **1.4 Temperature Compensation**

Practically every make of relative humidity sensor requires a compensation for the effect of temperature on the humidity output signal in order to measure accurately over a wide range of temperature conditions. In the specific case of an instrument using a capacitive sensor, compensation is required because the dielectric characteristics of both the water molecule and the hygroscopic polymer used in the sensor vary with temperature. The electronic circuit of the 5190-F uses data from the Pt100 temperature sensor to automatically compensate the effect of temperature on the accuracy of the humidity measurement.

## **1.5 Sensor Protection**

Always use the dust filter provided with the probe to protect the sensors. The standard wire mesh filter is sufficient for most applications. For applications that involve direct spraying of water and/or a lot of dust, use the optional foam filter.

## 2. INSTALLATION & CHECKOUT

### 2.1 Probe Location

Install the probe so that the local conditions at the sensors are typical of the environment to be measured.

In an outdoor environment:

- Use either a shield or a shelter to protect the probe and sensors from direct exposure to solar radiation and precipitation. Several shields are available from All Weather Inc., including the Model 8190 Motor Aspirated Radiation Shield (MARS).
- In an open field, install the probe at least 5 feet (1.5 m) above ground. Increase this distance if the ground surface is concrete or blacktop (such as above a roof).

### 2.2 Wiring Connections

The 5190-F is supplied with a 5-meter cable (about 16 ft) terminated with tinned ends. Some slack should be left in the cable to allow for a drip loop and to facilitate access to the probe for cleaning and replacement, otherwise any excess length may be trimmed. When a longer cable is required, consider using an extension cable for distances up to 30 m (100 ft).

Connect the wires as shown below.

Wire	Color	TB2 Terminal
Ground / –	Gray, Yellow, and Shield	4
Supply Voltage (+)	Green	3
RH	White	2
Temperature	Brown	1

*Note: Any other wires colors from the sensor should be covered and insulated so they do not make electrical contact.*

Check for wiring errors before powering the probe. Improper wiring may damage the probe.

*Note: Whenever possible, AWI recommends grounding the (-) side of the probe supply voltage.*

### 2.3 MARS Installation

If the Model 8190 Motor Aspirated Radiation Shield (MARS) is used with the 5190-F probe, refer to the 8190 MARS User's Manual (8190-001) for installation instructions.

*Note: In AWOS installations where a 5190-F is installed in a MARS, if the MARS fan fails, temperature and dew point will both be reported as missing.*

## 3. MAINTENANCE

### 3.1 Cleaning or Replacing the Dust Filter

The dust filter should be cleaned annually, depending on the conditions of measurement. Whenever possible, cleaning should be done without removing the filter from the probe. Clean the filter with a small brush to remove any debris that may have accumulated on the filter.

To replace the filter, unscrew the filter from the probe, replace the filter in the housing, and reinstall the filter assembly.

*Note: If you remove or replace the filter, make sure that the sensors do not get caught. The humidity sensor is sometimes mistaken for a “white paper tag”. Do not remove the probe! Before putting on a new dust filter, check the alignment of both sensors with the probe. The wires that connect the sensors to the probe are very thin and bend easily. If this happens, correct the alignment by holding the sensor very gently with a pair of small flat nosed pliers. Do not puncture the sensor with sharp pliers or tweezers or pull too hard on the sensor.*

### 3.2 Periodic Validation Check

Long-term stability of the humidity sensor is typically better than 1% RH per year. For maximum accuracy, the accuracy checks that are part of the triannual maintenance described below must be performed. Applications where the probe is exposed to significant pollution may require more frequent verification. Both the Pt100 RTD temperature sensor and associated electronics are very stable and should not require any calibration after the initial factory adjustment.

### 3.3 Periodic Maintenance (AWOS Installations)

#### 3.3.1 Equipment Required

The following equipment is required for periodic maintenance of the Model 5190-F.

- Psychrometer
- Psychrometric calculator (All Weather Inc. Model 5282-A)

All Weather Inc. sells many types of psychrometers, including the Model 5230 Assmann Psychrometer and the Model 5211 Sling Psychrometer. Contact All Weather Inc. for ordering information.

#### 3.3.2 Monthly Maintenance

Monthly maintenance of the Model 5190-F consists of checking the 8190 MARS and cleaning it if dust or debris is observed.

#### 3.3.3 Triannual Maintenance

Triannual maintenance of the Model 5190-F consists of performing the monthly maintenance tasks, cleaning the dust filter if dust or debris is observed, and checking the accuracy of the 5190-F against readings made using a psychrometer as explained below.

1. Position the psychrometer in close proximity to the intake of the motor aspirated radiation shield. Allow a minimum of 20 minutes for psychrometer conditioning before proceeding.



2. Prepare the psychrometer after the waiting period by wetting the wet bulb wick with distilled water.
3. Wind the psychrometer fan motor to provide constant aspiration (Assmann psychrometer only).
4. Begin taking measurements 1.5 minutes after the psychrometer starts running. Start recording the measurements once the temperature readings have stabilized — the maximum difference between successive measurements is less than 1°F (0.56° C). Record the psychrometer temperature, wet bulb temperature, 5190-F temperature, and 5190-F dew point temperature at 1-minute intervals.
5. Average all individual psychrometer temperature readings and 5190-F temperature readings that are within  $\pm 1^\circ\text{F}$  ( $\pm 0.56^\circ\text{C}$ ). Subtract the average psychrometer temperature from the 5190-F temperature. For AWOS installations, check the pass status on the data sheet if the result is within  $\pm 2^\circ\text{F}$  ( $\pm 1.1^\circ\text{C}$ ). If the probe fails validation, replace it. Return the failed probe to All Weather Inc. only if it is still under warranty.
6. Average all individual wet bulb temperature readings that are within  $\pm 0.5^\circ\text{F}$  ( $\pm 0.28^\circ\text{C}$ ) of each other. Calculate the dew point temperature from the average psychrometer temperature and the average wet bulb temperature using the psychrometric calculator. Subtract the calculated dew point temperature from the AWOS dew point temperature. Check the pass status if the result is within  $\pm 3^\circ\text{F}$  ( $\pm 1.7^\circ\text{C}$ ). If the probe fails validation, replace it. Return the failed probe to All Weather Inc. only if it is still under warranty.

### 3.3.4 Annual Maintenance

Annual maintenance consists of performing the monthly maintenance tasks and checking the accuracy of the 5190-F against readings made using a psychrometer according to the procedure prescribed for triannual maintenance above.

## 4. SPECIFICATIONS

Parameter	Specification
Humidity Sensor	Thin-Film Capacitor
Temperature Sensor	Pt100 RTD
Operating Temperature Limits	-40°C to +60°C
Humidity Output Signal (linear)	0–1.0 V DC = 0–100% RH
Temperature Output Signal (linear)	0–1.0 V DC = -40°C to +60°C
Minimum Load per Output	10 kΩ
Accuracy (at 23°C)	±1.5% RH ±0.1°C
First Signal After	2.3 s
Measurement Interval	0.7 s
Supply Voltage	5–24 V DC
Current Consumption	approx. 4 mA
Cable Length	5 m (16 ft), tinned ends
Sensor Protection	Wire mesh filter
Dimensions	208 mm × 15 mm diameter (8.19" × 0.59")
Weight	120 g (0.27 lb)

## 5. WARRANTY

Unless specified otherwise, All Weather Inc. (the Company) warrants its products to be free from defects in material and workmanship under normal use and service for one year from date of installation or a maximum of two years from date of shipment, subject to the following conditions:

- (a) The obligation of the Company under this warranty is limited to repairing or replacing items or parts which have been returned to the Company and which upon examination are disclosed, to the Company's satisfaction, to have been defective in material or workmanship at time of manufacture.
- (b) The claimant shall pay the cost of shipping any part or instrument to the Company. If the Company determines the part to be defective in material or workmanship, the Company shall prepay the cost of shipping the repaired instrument to the claimant. Under no circumstances will the Company reimburse claimant for cost incurred in removing and/or reinstalling replacement parts.
- (c) This warranty shall not apply to any Company products which have been subjected to misuse, negligence or accident.
- (d) This warranty and the Company's obligation thereunder is in lieu of all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, consequential damages and all other obligations or liabilities.

No other person or organization is authorized to give any other warranty or to assume any additional obligation on the Company's behalf, unless made in writing and signed by an authorized officer of the Company.



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5190-F-001  
Revision C  
January, 2017