



INSTRUCTION MANUAL

AirTherm SMT Heater/Humidity Controller

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ABOUT THIS MANUAL

The following symbols are used in this guide:



This symbol indicates a CAUTION. Cautions warn against actions that can cause damage to equipment. Please read these carefully.



This symbol indicates a WARNING. Warnings alert you to actions that can cause personal injury or pose a physical threat. Please read these carefully.

NOTES and TIPS contain helpful information.



Fig. 1—The AirTherm SMT can control both temperature and humidity in an enclosed environment.

INTRODUCTION

The **AirTherm SMT** is a CE compliant, computer-controlled heating and humidification system designed to be used with microscopes that are built into a chamber that is usually acrylic (insulated). Humidification of the enclosed system reduces evaporation from cell culture dishes. The computer-controlled structure uses a proprietary control algorithm to maintain a tightly controlled environment.

With **AirTherm SMT**, the temperature of the sample and optics can be controlled within 0.2°C. The humidity level (%) can be controlled at slightly below the dew point of the inner walls of the chamber to prevent condensation that might damage the microscope optics. During operation, air is drawn out of the chamber through the flexible hose, heated by the **AirTherm SMT** heater, humidified and re-circulated to the chamber by the return hose.

The system is typically used in a closed loop configuration (Fig. 2).

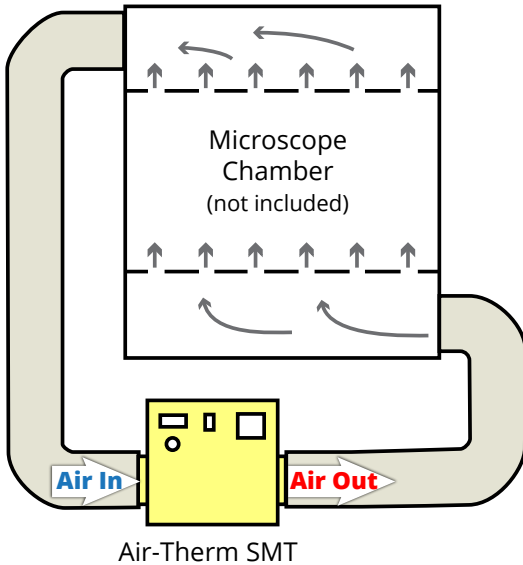


Fig. 2—A typical AirTherm SMT installation places the heated air inflow at the bottom and the cold air return at the top of the microscope chamber.

Cautions and Warnings



WARNING: DO NOT USE THE AIRTHERM SMT IN AN OXYGEN ENHANCED ENVIRONMENT.



CAUTION: Avoid blocking the airflow. Although a built-in thermal cutoff switch is designed to reduce the hazard, a fan failure or obstruction in the airflow has the potential for overheating the system and damaging the instrument or even causing a fire.



CAUTION: Keep the **AirTherm SMT** dry. For example, avoid condensation in a high humidity environment. Make sure the air outlet of the **AirTherm SMT** is connected to the humidifier. Connecting the humidifier to the air inlet to the humidifier will damage the **AirTherm SMT**.



CAUTION: Do NOT insert any object into the air in or air out ports of the **AirTherm SMT**.

Parts List

After unpacking, verify that there is no visible damage to the instrument. Verify that all items are included:

- (1) **AirTherm SMT**
- (1) power cord
- (1) 2 gallon daily output humidifier (optional)
- (2) **15590** Clear, coil-reinforced heater hose pieces, 4.5'
- (4) **13208** Hose clamps
- (1) **98727** Temperature sensor
- (1) **98728** Humidity sensor (optional)
- (1) Instruction Manual

Unpacking

Upon receipt of this instrument, make a thorough inspection of the contents and check for possible damage. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. Please read the section entitled "Claims and Returns" on page 29 of this manual. Please call WPI Customer Service if any parts are missing.

Returns: Do not return any goods to WPI without obtaining prior approval (RMA # required) and instructions from WPI's Returns Department. Goods returned (unauthorized) by collect freight may be refused. If a return shipment is necessary, use the original container. If the original container is not available, use a suitable substitute that is rigid and of adequate size. Wrap the instrument in paper or plastic surrounded with at least 100mm (four inches) of shock absorbing material. Please read the section entitled "Claims and Returns" of this manual.

INSTRUMENT DESCRIPTION

Front Panel

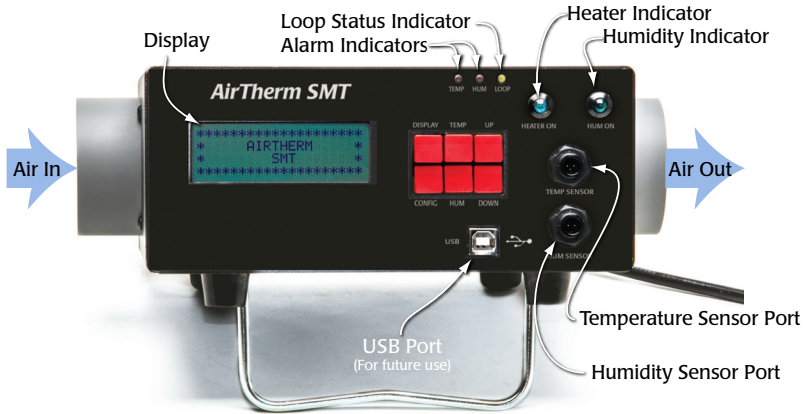


Fig. 3—The streamline design of the AirTherm SMT give you quick access to setup parameters and display options.

Display– The main display shows the temperature and the humidity in the control environment.

Display and Configuration Buttons–

Display: Press this button to toggle between display modes–the main display (temperature and humidity), the temperature only display, and the humidity only display.

Config: This button toggles through a list of configuration parameters like setpoints and alarms.

Temp: To modify the temperature setpoint or to enable/disable the heater, press this button.

Hum: To modify the humidity setpoint or to enable/disable the humidifier, press this button.

Up/Down: These two buttons are used to adjust configuration parameters.

Alarm Indicators– The red LEDs illuminate to indicate an alarm state.

Temp: This red LED illuminates when the temperature falls outside the high and low alarm limits set using the configuration menu.

Hum: This red LED illuminates when the humidity level falls more than $\pm 0.5\%$ outside the high and low alarm limits set using the configuration menu.

Loop Status Indicator–This yellow heartbeat LED blinks continuously to indicate that the unit is operational and the control loops are running.

Heater Indicator—This green LED illuminates when the heater is engaged and running.

Humidity Indicator— This green LED illuminates when power is sent to the humidifier.

Temperature Sensor Input—The RTD temperature sensor plugs into this port.

Sensor (not shown)—The sensor is shielded and grounded with a stainless steel sleeve. The sensor can be directly inserted near sites that involve electric recording without introducing any interference from the heating unit. It can be safely placed in water, but it will ground the system unless an electrically insulated coating is applied. If an electrically insulated coating is necessary, we recommend using silicone or epoxy to coat the stainless steel portion of the sensor. The coating should not be applied unless it is necessary, since it will slow the response time.

Humidity Sensor Port—The humidity sensor plugs into this port.

Humidity Sensor (not shown)—The sensor is not included. The sensor should be shielded from bright light. Do NOT expose the sensor to condensing environments. Exposure to condensing environments will cause the sensor output to indicate 0% relative humidity.

USB Port—This port is reserved for future developments.

Back Panel



Fig. 4—The master power switch, BNC analog output connectors, ground connection and humidifier supply voltage are located on the back panel.

Power—The **Power Switch** on the back panel controls the main power for the fan, heater and microprocessor controllers. The power cord plugs into the **Power Cord** port. Both 110 V or 220 V versions of the unit are available.

Power Out (Humidifier)—The humidity power cord connects to this circular, panel mount, 4 pin connector on the back panel of the **AirTherm SMT**. This connection is either 110 V or 220 V, depending on the power coming into the **AirTherm**.

Analog Outputs (Temperature and Humidity)—These BNC outputs are used to connect the **AirTherm SMT** with a data acquisition system (Lab-Trax, or other recording device). The temperature output is scaled at 0.065 V/°C. (37°C = 2.405 V). The humidity output is scaled at 0.04 V/%. (50% = 2.00 V).

Ground Connection—The chassis can be grounded through this port using a

grounding wire with a banana plug.

Humidifier

The humidifier uses ultrasonic sound waves to turn water into a fine mist. This has the advantage of being very efficient and easy to control. The drawback is that particles dissolved in the water can end up floating around in the air after the mist evaporates.



CAUTION: Make sure the humidifier is clean before each use and only use distilled water in order to keep dust from being deposited inside the chamber.

Air temperature drops as water mist from the humidifier evaporates. Conversely, relative humidity drops as air temperature rises. As a result, humidity and temperature control compete when both are increased simultaneously. Therefore, humidity regulation in the **AirTherm SMT** is automatically deactivated when the temperature is more than one degree from the setpoint. If the temperature setpoint is 37°C, the humidity controller operates when the temperature is between 36 and 38°C.

Basic System Setup

1. Clean the humidifier and fill it with distilled water.

NOTE: If distilled water is not used, contaminants in tap water may end up inside the microscope chamber.

2. Connect the humidifier to the plumbing connection where the humidity input ports come into the system. A PVC T-shaped tubing adapter in the hole on the top of the humidifier can be used for this purpose.
3. Connect tubing with the included clamps as shown in Fig. 2 on page 2. Make sure the air outlet of the **AirTherm SMT** connects to the humidifier before going on to the microscope chamber.



CAUTION: Connecting the humidifier to the air inlet of the **AirTherm SMT** will damage the **AirTherm SMT**.

4. Connect the humidifier power cable to the humidity control outlet on the back panel of the **AirTherm SMT**. Line up the pins, push the plug into the humidity control port, and rotate the outer collar of the plug clockwise until the cable locks in place.
5. Connect the humidity sensor to the humidity sensor input port on the front of the **AirTherm SMT**. Line up the pins, push the plug into place and screw the collar finger tight.
6. Connect the temperature sensor to the temperature sensor input port on the front panel of the **AirTherm SMT**.
7. Place the sensors inside the microscope chamber.

OPERATING INSTRUCTIONS

Basic Use of the AirTherm SMT

1. Setup the system as described in “Basic System Setup” on page 6.
2. Position the temperature sensor and humidity sensor at the location where the temperature and humidity will be controlled.
3. Turn the **AirTherm SMT** power switch on. It is located on the back panel.
4. Adjust the temperature setpoint to the desired target value. See “Adjusting Temperature Setpoint” on page 8.
5. Adjust the humidity setpoint to the desired target value. See “Adjusting Humidity Setpoint” on page 9.
6. Adjust the fan speed to control the air flow rate. See “Setting Fan Air Flow” on page 11. The airflow rate can be adjusted from 20–50 ft³/minute (CFM). For safety reasons, the fan flow rate cannot be set at less than 10%.

TIP: A lower flow rate offers a quiet operation and is suitable for most applications. However, the higher flow rate can generate more turbulence, so that the temperature in the chamber is more uniform. The higher air flow speeds up the heating process and makes it possible to heat larger chambers.



CAUTION: Avoid blocking the airflow. Although a built-in thermal cutoff switch is designed to reduce the hazard, a fan failure or obstruction in the airflow has the potential for overheating the system and damaging the instrument or even causing a fire.

7. By default the temperature setpoint is set at 37°C. If the temperature reading is below the setpoint, the heater turns on and the Heater On indicator begins to flash.
8. Allow the temperature to reach the setpoint and wait one hour.
9. Enable the humidifier. See “Enabling/Disabling Humidity Control” on page 9.

Changing the Display

Press the **Display** button to toggle between display modes—the main display (temperature and humidity), the temperature only display, and the humidity only display.



Fig. 5—Press the Display button to toggle between the three display screens.

NOTE: If the temperature sensor is not properly connected, “ERROR” appears on the Temperature display, and if the humidity sensor is improperly connected, “ERROR” appears on the Humidity display. “Disabled” appears under Humidity if the humidity control is disabled.

Adjusting Temperature Setpoint

1. Press the **Temp** button to display the current temperature setpoint (Fig. 6). The default setting is 37°C.



Fig. 6—Press TEMP to display the temperature setpoint.

2. Press the **Up** or **Down** button to modify the temperature setpoint.
3. Press the **Display** button to save your changes.

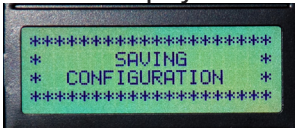


Fig. 7—When you press the Display button, the new configuration parameters are stored.

Enabling/Disabling Temperature Control

When necessary, you can disable the heater. For example, when you are setting up the system, you may want to have the fan running without heating the open environment.

1. Press the **Temp** button to display the current temperature setpoint (Fig. 8).



Fig. 8—(Left) The temperature display shows the current temperature setpoint.

Fig. 9—(Right) Press Config to display the temperature configuration parameters.

2. Press the **Config** button to access the temperature control menu. This menu allows you to enable/disable the temperature control and set the temperature setpoint. Press the **Config** button until Temperature Control appears (Fig. 8). The default setting is Enabled.
3. Press the **Up** or **Down** button to enable or disable the control.
4. Press the **Display** button to save your changes.

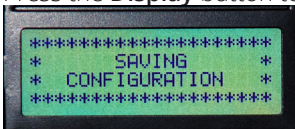


Fig. 10—When you press the Display button, the new configuration parameters are stored.

Adjusting Humidity Setpoint

1. Press the **Hum** button to display the current humidity setpoint (Fig. 9). The default setting is 50%.

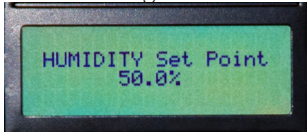


Fig. 11—(Right) Press HUM to display the humidity setpoint.

2. Press the **Up** or **Down** button to modify the humidity setpoint.
4. Press the **Display** button to save your changes.

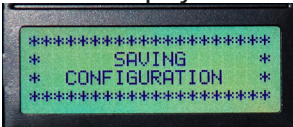


Fig. 12—When you press the Display button, the new configuration parameters are stored.

Enabling/Disabling Humidity Control

When necessary, you can disable the humidity control. For example, it is desirable to allow the temperature control to stabilize to the temperature setpoint before introducing humidity into the system.

1. Press the **Hum** button to display the current humidity setpoint (Fig. 11).



Fig. 13—(Left) The humidity display shows the current humidity setpoint.

Fig. 14—(Right) Press Config to display the humidity configuration parameters.

2. Press the **Config** button to access the humidity control menu. This menu allows you to enable/disable the humidity control and set the humidity setpoint. Press the **Config** button until Humidity Control appears (Fig. 13). The default setting is Enabled. On every power up, this setting reverts to Enabled.
3. Press the **Up** or **Down** button to enable or disable the control.
4. Press the **Display** button to save your changes.

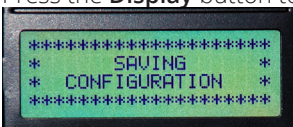


Fig. 15—When you press the Display button, the new configuration parameters are stored.

Adjusting Configuration Parameters

The Configuration menu lets you set the high and low temperature alarm, the high and low humidity alarms, and the fan air flow setpoint. Additionally, you can enable or disable the alarms (temperature and humidity).

Setting Alarms

If the temperature (or humidity) in the control environment falls outside of the range set by the high and low alarm conditions, the **AirTherm SMT** beeps. By default the temperature alarms are set at 36°C and 38°C, and the humidity alarms are set at 49% and 51%.

1. If the home screen is not visible, press the **Display** button.

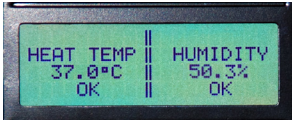


Fig. 16—The home screen shows the temperature and humidity inside the control environment.

2. Press the **Config** button until the desired alarm appears (Fig. 17). Options include Temperature High Alarm, Temperature Low Alarm, Humidity High Alarm and Humidity Low Alarm.

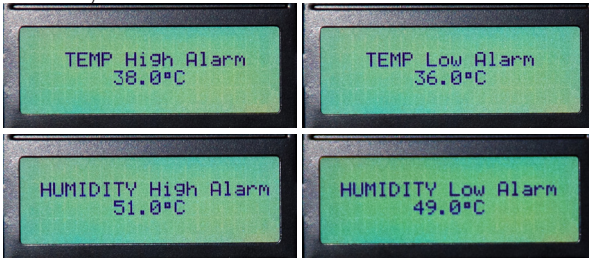


Fig. 17—Four alarm conditions can be defined from the configuration menu.

3. Press the **Up** or **Down** button to change the alarm value.
4. Press the **Display** button to save your changes.

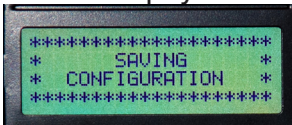


Fig. 18—When you press the Display button, the new configuration parameters are stored.

Setting Fan Air Flow

The default fan air flow speed setting is 50%. It can be adjusted up or down to move between 20–50 ft³/min. (CFM). For safety reasons, the fan cannot be set below 10%.

1. If the home screen is not visible, press the **Display** button.

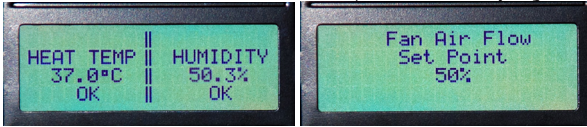


Fig. 19—(Left) The home screen shows the temperature and humidity inside the control environment.

Fig. 20—(Right) The fan air flow setpoint parameter displays.

2. Press the **Config** button until Fan Air Flow Set Point appears (Fig. 20).
3. Press the **Up** or **Down** button to change the alarm value.
4. Press the **Display** button to save your changes.

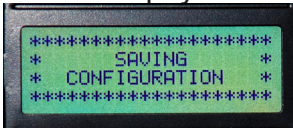


Fig. 21—When you press the Display button, the new configuration parameters are stored.

Enabling/Disabling Temperature Alarms

If audible alarms are unnecessary, you can disable them.

1. If the home screen is not visible, press the **Display** button.

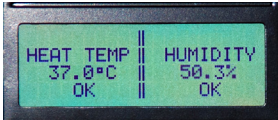


Fig. 22—The home screen shows the temperature and humidity inside the control environment.

2. Press the **Config** button until Temperature Alarm (Fig. 23) or Humidity Alarm (Fig. 24) appears. The default setting for both alarms is Disabled.

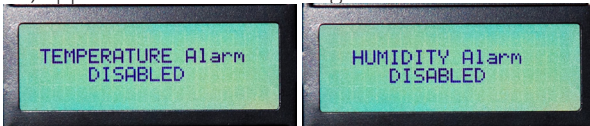


Fig. 23—(Left) The temperature alarm in the example is disabled.

Fig. 24—(Right) The humidity alarm in the example is disabled.

3. Press the **Up** or **Down** button to toggle the status between enabled and disabled.

4. Press the **Display** button to save your changes.

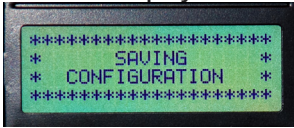


Fig. 25—When you press the Display button, the new configuration parameters are stored.

Analog Outputs

The analog outputs are located on the back panel.

Temperature Read-out

The top BNC connector on the back panel of the **AirTherm SMT** is an analog output for the temperature read-out. The temperature output is scaled at 0.065 V/°C. (37°C = 2.405 V).

Humidity Read-out

The bottom BNC connector on the back panel of the **AirTherm SMT** is an analog output for the humidity read-out. The humidity output is scaled at 0.04 V/%. (50% = 2.00 V).

MAINTENANCE

Preventing Condensation on Microscope Chamber Walls

Chambers designed for microscope temperature regulation are not as well insulated as incubation systems. Because the inside of the chamber can be significantly warmer than room temperature, condensation can form inside the chamber when the humidity is too high. This condensation can cause damage to the microscope and equipment inside the chamber. To prevent this, start by setting the relative humidity to 40%. Gradually increase the humidity until condensation begins to form. Then, reduce the humidity setpoint by 10%.

NOTE: Since relative humidity changes by about 5% per degree Celsius in high humidity environments, the setpoint should be reduced even further if there is significant drop in the laboratory temperature at night.

The microscope warms up much slower than air. Allow the microscope to warm up to the temperature setpoint for at least one hour before starting humidity control. This prevents condensation from forming on the optics.

Changing a Fuse

1. Turn the main power switch off (I).
2. Unplug the power cord from the power cord socket on the back of the **Air-Therm** (Fig. 26).

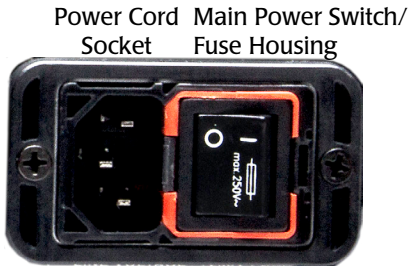


Fig. 26—Unplug the power cord to access the fuse housing release.

3. Insert a small flat blade screwdriver under the orange lip on the left side of the main power switch/fuse housing (Fig. 27). Gently pry upwards until the power switch slides out.



Fig. 27—(Left) Insert the screw driver under the fuse housing lip and pry the housing open.

Fig. 28—(Right) The fuse housing slides out.

4. Pull the fuse housing out of its socket (Fig. 29).



Fig. 29—Remove the fuse housing to access the fuses.

5. Remove the bad fuse.
6. Replace the bad fuse with another 5x20 mm metric fuse, 4 A, 250 V (2.5 A for the 230 V unit).
7. Position the power switch/fuse housing and slide it back into its socket until it snaps into place.
8. Reinstall the power cord.
9. Turn the power switch on to verify that the **Air-Therm** has power again.

ACCESSORIES

Part Number	Description
3301	European power cord
3302	UK power cord
3006	US power cord
13208	Hose clamps
13972	4A Fuse
14088	Australian power cord
15590	Clear hose, 2.5" diameter, 4.5'
98727	Temperature probe
98728	Humidity probe

Optional Accessories

Part Number	Description
FD35-100	Fluorodish Sterile Culture Dish, clear wall, 35mm, 23mm well, box of 100
FD35PDL-100	Fluorodish Sterile Culture Dish, Poly-D-Lysine coated, clear wall, 35mm, 23mm well, box of 100
FD3510-100	Fluorodish Sterile Culture Dish, clear wall, 35mm, 10mm well, low sidewall, box of 100
FD5040-100	Fluorodish Sterile Culture Dish, clear wall, 50mm, 35mm well, box of 100

TROUBLESHOOTING

Issue	Possible Cause	Solution
No power	Fuse is blown.	Check the fuse. See “Changing a Fuse” on page 13. The fuse is a 5x20 mm metric fuse. 4 A 250 V (for 120 V unit), 2.5 A (for 230 V unit).
	Power cord is improperly connected	Verify that the power cord is securely connected and plugged into a live wall socket.
No heat	The heater is disabled	See “Enabling/Disabling Temperature Control” on page 8.
No fan	If the power is on and the fan is not running, the airflow may be inhibited.	Check for an obstruction to the fan. This typically occurs in the air in port. If no obstruction can be found, return the unit for servicing.
Chamber heats inconsistently	The air hose is blocked.	Unplug the air out hose and verify that air is flowing through the system. If no air is flowing, locate and remove the blockage.
Chamber never reaches setpoint	The chamber is too large or not insulated well enough.	Reduce the chamber size or insulate it.
	The probe is improperly located.	Check the position of the temperature probe.
Humidity control fails	The humidifier is out of water.	Turn off power to the system. Add water to the humidifier reservoir. See the humidifier manual for instructions.
	The humidifier power switch is off.	Set the humidifier power switch to one of the two on settings.
	Humidity control is not enabled.	Humidity control should not be enabled until the system reaches the temperature setpoint. See “Enabling/Disabling Humidity Control” on page 9.

NOTE: If you have a problem/issue that falls outside the definitions of this troubleshooting section, contact the WPI Technical Support team at 941.371.1003 or technicalsupport@wpiinc.com.

SPECIFICATIONS

This instrument conforms to the following specifications:

Air Flow Rate	20–50 CFM (0.55–1.4 m ³ /minute)
Control Temperature Range	Ambient to 45°C
Temperature Resolution	0.1°C
Temperature Accuracy	0.2°C
Analog Output For Chart Re-corder	
Temperature output scaled at	0.5°C resolution (0-10 V represents 1–100°C)
Humidity output scaled at	0.04 V/%. (50% = 2.00 V)
Heating Volume....	Min. volume 1.5 CF (42.5 L) to less than 50 CF (1400 L), re-circulating
Temperature Sensor Type	Platinum RTD 1000 \square
AirTherm SMT Fuse (120 V SMT)	4 A, Slow 5x20 mm metric
(230 V SMT)	2.5 A, Slow, 5x20 mm metric
Humidity Control Range	Ambient–90%
Humidity Resolution	0.1%
Humidity Accuracy	5%
Humidity Repeatability	0.5%
Humidifier Type	Ultrasonic
Humidifier Tank Capacity	0.5 gallons
Humidifier Daily Output	2 gallons
AirTherm SMT Power	450 W, 95–135 V or 220–240 V, 50/60 Hz
AirTherm SMT Dimensions	9¼ x 8¼ x 3½" (23.5 x 21 x 9 cm)
Firmware Revision	2.0

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DECLARATION OF CONFORMITY



WORLD PRECISION INSTRUMENTS, LLC.
Telephone: (941) 371-1003 Fax: (941) 377-5428
e-mail wpi@wpiinc.com

DECLARATION OF CONFORMITY CE

We: World Precision Instruments, Inc.
175 Sarasota Center Boulevard
Sarasota, FL 34240-9258, USA

as the manufacturer/distributor of the apparatus listed, declare under sole responsibility that the product(s):

AIRTHERM-SMT-2

To which this declaration relates is/are in conformity with the following standards or other normative documents:

Low Voltage Directive (Safety) 2014/35/EU:

- EN 61010-1:2010+A1:2019

EMC Directive 2014/30/EU:

- EN IEC 61326-1:2021
- EN IEC 61326-2-3:2021
- EN IEC 61000-3-2:2019+A1:2021
- EN IEC 61000-3-3:2013+A2:2021

Issued On: December 9, 2022



*Cory Boyes / Director of Design and
Development*

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Mr Andrew Waldes
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Pfungstweide 16, 61169 Friedberg, Germany

WARRANTY

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of 30 days* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within ten (10) days after receipt of shipment. Claims for lost shipments must be made within thirty (30) days of receipt of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim is settled. In some instances, photographic documentation may be required. Some items are time-sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container

Do not return any goods to us without obtaining prior approval and instructions from our Returns Department. Goods returned (unauthorized) by collect freight may be refused. Goods accepted for restocking will be exchanged or credited to your WPI account. Goods returned which were ordered by customers in error are subject to a 25% restocking charge. Equipment which was built as a special order cannot be returned.

Repairs

Contact our Customer Service Department for assistance in the repair of apparatus. Do not return goods until instructions have been received. Returned items must be securely packed to prevent further damage in transit. The Customer is responsible for paying shipping expenses, including adequate insurance on all items returned for repairs. Identification of the item(s) by model number, name, as well as complete description of the difficulties experienced should be written on the repair purchase order and on a tag attached to the item.

** Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.*



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