

# Operation Instruction Manual

WSD-1503CPH

Programmable PID Temperature Controller with Dual Probe \*

Version 1.1

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May. 2013

## Introduction

Thank you for purchasing the Auber WS series temperature controller. We sincerely appreciate your decision and trust that our machine will meet your expectations in both the quality of the result and the value of our product. While we are delighted that you may be anxious to operate the controller for your project, a few minutes of your time reading through this manual will only serve to enhance your experience in the months and years ahead. In particular, we would urge you to read through the safety warnings below. Although this plug-and-play controller is very easy to operate, the process involves high temperature and high wattage appliances and your safety is paramount.



### SAFETY WARNINGS

- This controller is designed only to be used with devices that have limited power and their own thermal cut off protection, such as a thermostat or thermal fuse in case of controller failure.
- Do not place any objects on the top of controller surface which is used to vent excess heat during its operation.
- The maximum electric current this controller can handle is 15 ampere. For 120 volt AC in US and Canada, this limits the heater power to 1800 watts.
- Always place the sensor in the controlled subject when the controller is on. Before turning on the controller, please make sure the sensor is placed inside the container to be controlled. Leaving the sensor outside of the solution will form an open loop operation. If the sensor is left outside, controller will assume the temperature is low even if the controlled subject is already very hot. The controller will provide full power to the heater. It will not only overheat the controller, but also

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\* Patent pending

damage your appliance, and even cause a fire.

- This controller is designed to control the devices recommended by Auber Instruments only. Using it to control a not recommended device can be dangerous and cause fire. Auber Instruments is not liable for damages caused by misuse of the controller. If you are not sure the controller can be used, please contact Auber Instruments before use.
- If an abnormal display or noise is observed, turn the controller off, unplug the power cord and contact the manufacturer before using it again.
- Clean the controller only when it is cool and unplugged.
- Do not allow children to operate the controller.

## Operating Instructions

### 1. Description of the controller.

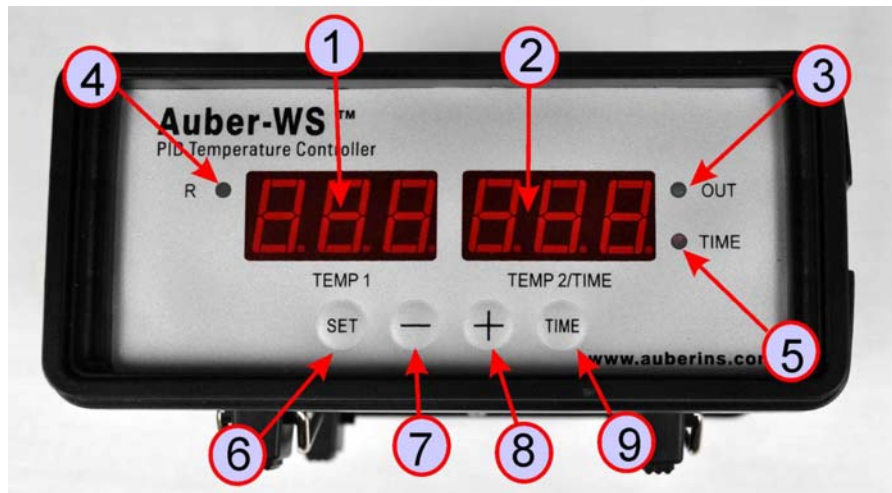


Figure 1. Front Panel

- 1) **TEMP1, Left window** - During normal operation, it displays the temperature values of probe 1. When high or low limit alarm of probe 1 is on, this window will flashing between the alarm type (AH1 or AL1) and the temperature. In the parameter setting mode, it displays the controller's system parameters.
- 2) **TEMP2/TIME, Right window** - During normal operation, it displays the temperature value of probe 2 (food internal temperature probe), or the time passed since the controller was powered up. When high limit alarm of probe 2 is on, this window will flashing between AH2 and the temperature. In the parameter setting mode, it displays the value of the parameter.
- 3) **Output status indicator** - This LED indicates the output status that should be synchronized with heater. When it is on (lit), the heater is powered. When it is off, the heater power is off. When it is flashing, it means the heater is on and off

intermittently to reduce the power output. It should be synchronized with the power light on the cooking device.

- 4) **Smoker generator control output status indicator.** When lit, the smoker generator control output is on. When off, the output is off.
- 5) **Timer status indicator** - When lit, right window shows the time passed since power up. When it is off, right window shows the current temperature detected by the probe 2.
- 6) **SET Key** - For showing current temperature settings, getting into parameters setting mode and confirming various actions taken.
- 7) **“-” Key** - To decrement displayed value when in controller is in the parameter setting mode. During normal operation, press it to cancel the alarm.
- 8) **“+” Key** - To increment displayed value when in controller is in the parameter setting mode. During normal operation, press it will change the left window from temperature to display which step the program is at.
- 9) **Time Key** - Change the display in right window between current timer and temperature values.

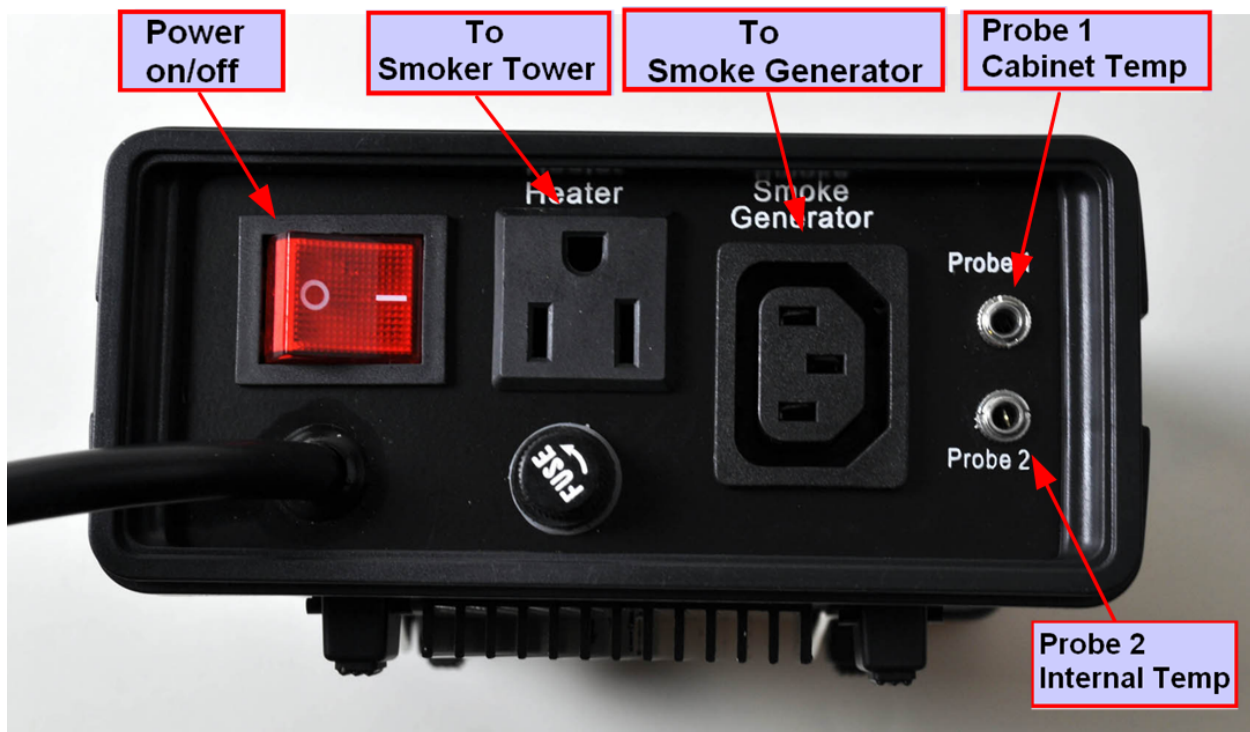


Figure 2. Back Panel

## 2. Connecting and operating the controller

Install the sensor.

(Note: If you ordered wall mount sensor instead of free hanging sensor, please see the separate instruction in the CD for its installation)

The controller is supplied with two probes. The one with short tip is for measuring the cabinet temperature. We name it probe 1. It needs to be plugged to the top sensor jack at the back of the controller. The long probe with a bend at the end is for the meat internal temperature measurement. It needs to be plugged to the bottom sensor jack at the back of the controller. The tip of the probes is dropped into the damper hole. Place a piece of tape on the top of the smoker tower to hold them in place. The tip of probe 1 should be placed close to the food but high enough so that it does not touch the food. (See Figure 3). The tip of probe 2 is to be inserted into the meat.

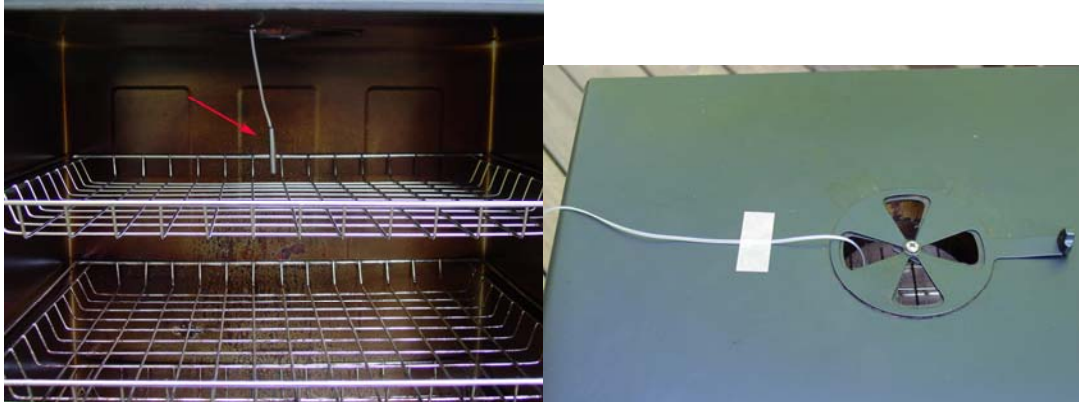


Figure 3. Sensor position. Left, the sensor should be placed close to the food but high enough so that it does not touch the food. Right, hold the sensor in place by a piece of tape.

If the smoker has a Temperature Heat Control Switch on the smoker tower, it should be set to the Hi position.

### **Power up the controller and the smoker.**

Connect the power cable of the controller directly to the wall outlet. And connect the controller output to the smoker tower with the power cord came with the Auber Controller. If the plug of power cord and the socket on the smoker tower do not match, you may go to find an appropriate power cord for it. You can connect the controller from the socket “smoker generator” to whatever device you want to perform on/off control as long as the device draws less than 3A current. The socket for the smoker generator is different from the one for the smoke tower to prevent users from plugging the devices to the wrong socket by mistake. It is a standard IEC C13 female connector. You need to a power cable with a IEC C14 male connector for your device. The power cable can be ordered as

optional equipment from Auber Instruments.

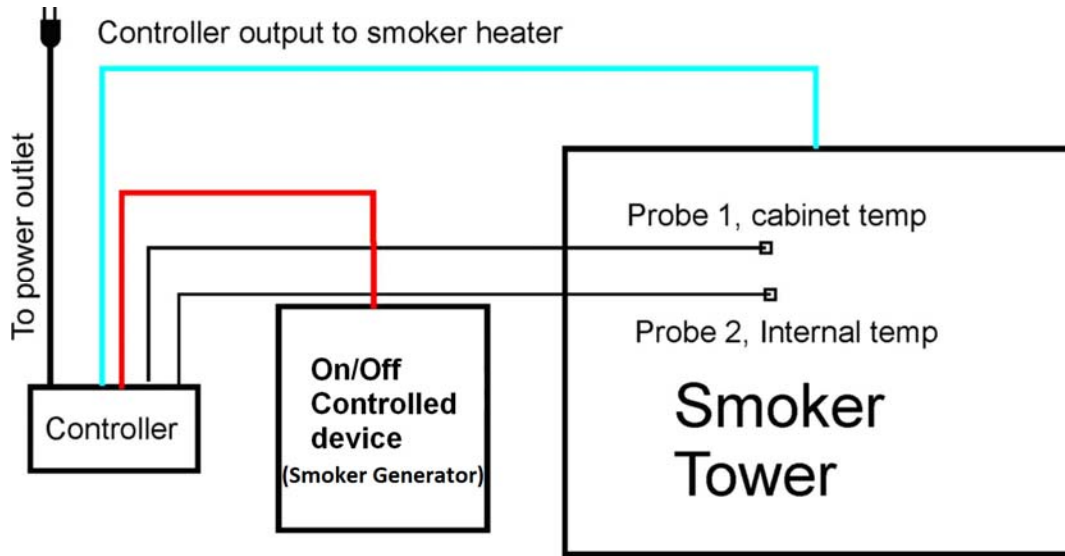


Figure 4. Connection for the smoker

### 3. Programming the smoking temperature profile.

A total of 6 steps can be programmed for this controller. Each step contains the set temperature (C0X) and an ending criteria setting (E0X), where “X” is the step number (e.g. Step 4 temperature is represented by C04 and step 4 ending criterion is represented by E04). The ending criterion determines how does controller finish the current step and start the next step. There are two options for the user, t and F. Set E0X to t if you want step X to be end by a preset time. Set E0X to “F” if you want step X to end by a preset temperature of the internal probe.

After you set E0X to “t”, you will be asked to set t0X for the time. Time is defined as the duration between the last step and the next step. Please make sure the time is long enough for the heater to heat up the smoker. If the time is set too short, the temperature may not be able to reach the current step temperature setting, before it jumps to the next step. The time unit is in hours with 0.1 hour resolution. Each 0.1 hour equals to 6 minutes.

If you set E0X to F, you will be asked to set F0X for the temperature of the internal probe. When all of the E0X are set to t, the controller can operate with only the probe 1 plugged in.

To program the temperature profile, press SET key once. The display will show C01 at the left window and temperature setting on the right window for step 1. Use “+” and “-” keys to change the setting. When finished, press the SET again to confirm the change. The display will show E01 on the left window and the ending criterion setting on the right

window. Use “+” and “-” keys to change the setting. When finished, press the SET again to confirm the change. The left window will display t01 or F01 depending whether t or F is selected for the E01. The right window will display the setting for t01 or F01. Use “+” and “-” keys to change the setting. When finished, press the SET again to confirm the change. The display will go the step 2 setting. It will repeat in the same way as the step 1. After you program enough step for the recipe, you can program rest of the steps of E0X to t and set t0X zero.

The temperature setting will not be changed if SET is not pressed (confirmed). After programming the necessary steps for cooking, you can finish programming by pressing the SET continuously until it passed T06 and display the current temperature. You can also leave the controller alone. The display will return to the normal display mode if no key is pressed within 15 seconds.

The initial program setting for the controller is listed in Table 1. This program will control the temperature of the cabinet at 120 °F for 2 hours. Then, change the temperature to 190 °F. It will stay at 190 °F until internal temperature of the meat reaches 160 °F. Then, the controller will drop the temperature to 130 °F for 30 hours, waiting you to pick the food. If you set C03=0 and t03=0, when meat internal temperature reaches 160 °F, the controller will shut off the heater, flashing END on both windows, and turn on the beeping alarm to notify you that cooking is finished.

Table 1. Initial program setting

Step #	Temp (F)	Step #	F or T	Step #	value
C01	120	E01	t	t01	2.0
C02	190	E02	F	F02	160
C03	130	E03	t	t03	30.0
C04	0	E04	t	t04	0.0
C05	0	E05	t	t05	0.0
C06	0	E06	t	t06	0.0

The smoker generator power is controlled by parameter R1 and R2 that can be accessed by code 166 (see section 7). The generator can be turned on for two steps. R1 is for the first step. R2 is for the second step. e.g. To turn on the smoker generator at step 1 and 3, set R1=1 and R2=3. If you only want to use one step, set either R1 or R2 to 0, and set the other one to the step you want to turn on the smoker generator. The initial setting for the controller is to turn on the generator at step 1 only.

#### 4. Check the current step and display the time

To check which step the program is at during cooking, press the “+” Key (8) once. The

left window will show the current step in the form of P0X on. e.g. It will display P03 if the controller is at step 3. The display will return to the temperature display automatically after 8 seconds. To check how long the controller has been running since powered up, press the **Time** key (9) once. The **Timer status indicator** will light. The right window will show the actual time passed since the controller was last powered up. Please note that this is the total time, not the time that has passed in the current step. Press Time key again will switch the display to the internal temperature.

## **5. Tuning the controller**

This controller contains two sets of system parameters that can be changed for different applications. This controller is shipped with the system parameters set for the Bradley Smoker. The user should not change these parameters if you want to control a Bradley Smoker. Otherwise, if you feel that performance is not ideal, you can try to manually tune the system or run the auto-tune again. For detailed information on how to tune the controller, please read the section 7 and 8 of the main manual.

## **6. Important consideration for better control results.**

The following is a list of things that could affect the result of temperature control.

a) The smoker and controller location. The smoker should not be placed directly in the sun. Direct sun light can heat the smoker to above 140 °F in the summer time, making controlling the temperature at 140 °F impossible. This is especially the problem for the black color smoker. The controller should be placed away from direct sun light also. Although the controller uses a high intensity LED display, it will still be difficult to read when sun light is directly shined to its surface. Users should also avoid exposing the controller to water and rain, which could damage the controller.

b) Low temperature control. The control result for temperatures below 125 °F will not be as accurate as for higher temperatures when the smoker generator is on. This is because there are two heaters in the smoker tower. One is the smoker heater controlled by the PID controller. The other is the heater from the generator that is not controlled. Our test shows that the heater in the generator itself can raise the temperature of the smoker tower by 60 °F (2 hours, in the shade with damper open). That means when the ambient temperature is at 70 °F, the smoker can be heat up to 130 °F in 2 hours by the heater of the generator (without using the heater in the smoker).

c) Damper position. Keeping the damper open will result in better temperature stability because more heat loss is created. This is important when the temperature is set below 140 °F. When the damper is closed, the temperature will take longer time to drop if it is overshoot during initial heat up. At higher temperature, closing the damper will not affect the performance much because the heat loss from the wall of the tower is increased.

Close the damper at high temperature will keep the moisture of the food.

d) Temperature uniformity of the smoker tower. Our test shows that when the all the shelves were empty, the temperature inside the smoker tower is fairly uniform except the back half of the lowest shelf that is close to the heater. User should avoid placing the sensor too close to the heater because it does not represent the temperature of the rest area. When the shelves are filled, temperature variation might depend on how the foods were placed. The bottom shelf can become hotter if more food is placed in it to block the hot air from going up.

e) Operating the controller when ambient temperature is below 32 °F (0 °C). The controller reading is only accurate for temperature  $\geq 32$  °F (0 °C). In addition, if the ambient temperature is below 14 °F (-10 °C), the controller will not function because it can't read the temperature correctly. In that case, user can warm the sensor by holding it with their hands. Once the sensor is above 14 °F (-10 °C), it will turn on the heater. Once the inside of the smoker is heated to above 32 °F, the controller will run by itself.

### 7. Program the smoker generator on step.

The smoker generator is controlled by the parameter R1 and R2. These two parameters determine which steps to turn on the smoker generator. The smoker generator will stay on only for the step it is programmed. It will turns off when program goes to the next step. e.g. When R1=2, and R2=4, the smoker generator will be on during step 2 and 4. R1=0 or R2=0 means that R1 or R2 will not do anything to the smoker. The smoker will not be turned on if both R1 and R2 are set to 0. R1 and R2 can be accessed through code 166 menu. For details, please read section 7 of the main manual.

### 8. Program the alarms.

The alarm setting can be accessed by code 188.

Table 2 shows the list of the parameters, their range and initial set value when left the factory.

Table 2. List of control parameters and its initial settings under code 188

Symbol	Description	Range	Initial
AH1	Probe 1 high limit alarm	0-200 °C, 0-392 °F	290
AL1	Probe 1 low limit alarm	0-200 °C, 0-392 °F	0
AH2	Probe 2 high limit alarm	0-200 °C, 0-392 °F	200
AST	Step finish alarm	On, OFF	ON

Detail of each parameter.

a) AH1, this is the high limit alarm for probe 1. User can set the temperature so that if the



system is out of control, the buzzer will be turned on. e.g. If AH1 set to 290, the buzzer will be on at 291 and off at 290. When the buzzer is on, the left widow will flashing between AH1 and the current temperature.

b) AL1 is the low limit alarm for probe 1. e.g. If AL1 is set to 100. The buzzer will be on when temperature drop to 100. It will be turned of when temperature rise to 101. This alarm is suppressed when first powered up. It will only function after the temperature has reached set point once. When the buzzer is on, the left widow will flashing between AL1 and the current temperature.

c) AH2 is the high limit alarm for the probe 2. If AH2 set to 190, the buzzer will be on at 191 and off at 190. When the buzzer is on, the right widow will flashing between AH2 and the current temperature. When smoking multiple piece of meat with different thickness, you can put the probe in the thinnest piece first. Set the alarm to the temperature when meat is ready. It will let you know when it is done. Then, you can move the probe to the second thinnest pieces and so on. To use this feature, you can set the ending criteria to time. If you set ending criteria to temperature, you need to set the ending temperature to be higher than the alarm temperature.

d) AST is the step ending alarm. When AST is turned on, the buzzer will beep 4 times when each step is finished. It is useful to notify the user the cooking step is finished. User can turn it off if no buzzer sound is wanted at the finish of each step.

**Note: All alarm can be cancelled during beeping by press the “-” key.**

For details on how to use code 188 to access these parameters, please read section 7 of the main manual.