SAVANNAH STOKER v3 TEMPERATURE CONTROLLER
FOR THE WOOD PELLET GRILL

Thank-you for purchasing the Savannah Stoker Pellet Grill Control System. The Savannah Stoker is a PID based artificial intelligent temperature controller that allows you to control your wood pellet grill or smoker with *"simplicity but infinite control"*.

FEATURES

- Set the desired cooking/smoking temperature from 160°- 550°F or the max temperature your grill can reach in 1° increments.
- Typical temperature swings are 5-10°F when cooking above 250°F and 10-15°F when smoking below 225°F.
- Hardwired permanent installed temperature sensor, compatible with the OEM temperature sensor.
- Grill cool-down cycle. The fan runs until the grill temperature drops below 130°F.
- 3 Speed Fan selectable by the user. High for cooking; Medium for Smoking, and Extra Low for cold smoking.
- Auger Bypass. Press a button and the auger runs 100% to get to grilling temperatures faster.
- Optional interface with the STOKER® Power Draft System from Rocks Bar-B-Que. Add the features of the STOKER like remote temperature control and monitoring from a computer or Smartphone or graph the cook with StokerLog running on a PC. Requires an optional cable. The STOKER is available from http://www.rocksbarbque.com.

SPECIFICATIONS

The Savannah Stoker is a direct replacement temperature controller for most Traeger Wood Pellet Grills but it will not fit in the Traeger Junior or the PTG. It will also control most smokers made by Blaz'n Grills Works Wood Pellet Grills, Royall Wood Pellet Grills (except the tailgater), Camp Chef Pellet Grill & Smoker and Smoke Daddy Pellet Pro. The Savannah Stoker maybe compatible with other wood pellet grills but may requiring modifications to the grill or wiring connectors.

Input type	Compatable with the OEM RTD and with K-Type Thermocouple hardwired to the back of the controller
Accuracy	0.75%Full scale or ±2.2 ℃ for K-Type thermocouple
Response Time	≤ 1.0s (when FILt=0)
Display Resolution	1°F
Control Modes	Automatic Control using PID based algorithims Manual Control STOKER® Control (optional interconnect cable required)
Fan Output	Zero crossing SSR, 85-240VAC/3A
Auger Output	Zero crossing SSR, 100-240VAC/3A
Igniter Output	Zero crossing SSR, 100-240VAC/10A
Power supply	100-240VAC 50-60Hz
Power consumption	300 Watts at startup, 60 Watts normal operation
Ambient temperature	0~50℃, 32~122ºF
Fuse	5x20mm 4A 250V Cooper Bussmann #S500-4-R or equal

WARNING Electrical Shock Risk!

Electrical power is present to the controller anytime the grill is connected to an AC Power Source. Before attempting to remove or install the controller the grill must be disconnected from the AC Power Source. Failure to do so could result in personal injury from electrical shock and/or damage to the controller. When not in use the grill should be disconnected from the AC Power Source. The controller should be protected from moisture at all times. It is highly recommended the grill be connected to a GFCI outlet or other protected circuit when in use.

WARRANTY

Sound Solutions, LLC, warrants to the original purchaser the controller will be free from defects in material and workmanship under normal use for a period of one (1) year from the date of original purchase. The temperature sensors and the STOKER® interface cable are warranted for a period of ninety (90) days.

The warranty shall not apply: (i) to any controller subjected to accident, misuse, neglect, water damage, alteration, acts of God, improper handling, improper transport, improper storage, improper use or application, improper installation, improper testing or unauthorized repair; or (ii) to cosmetic problems or defects that result from normal wear and tear under ordinary use and do not affect the performance or use of the product. If the controller develops a covered defect during the warranty period, Sound Solutions, LLC, will, at its option, either repair or replace the controller, the temperature sensor or the STOKER interface cable at no charge, provided that the controller and/or temperature sensor are returned to Sound Solutions, LLC, during the warranty period

To obtain warranty service contact Sound Solutions for an RMA # by phone: 1-252-746-3367 or email: savannahstoker@suddenlink.net
Return the component(s) along with a copy of the sales receipt to:

Sound Solutions, LLC
4205 Holly Street
Ayden, NC 28513

THE ABOVE STATED WARRANTY IS EXCLUSIVE AND REPLACES ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOUND SOLUTIONS, LLC WILL NOT BE HELD LIABLE FOR ANY OTHER DAMAGES OR LOSS INCLUDING INCIDENTAL OR CONSEQUENTIAL DAMAGES AND LOSS OF PROFITS OR REVENUES FROM WHATEVER CAUSE, INCLUDING BREACH OF WARRANTY OR NEGLIGENCE.

1. Installation

1.1 Required tools.
Medium Size #2 Phillips Head Screwdriver
Small/Narrow Flat Blade Screwdriver
A small towel

1.2 Unplug the grill from the power source.

WARNING Electrical Shock Risk!

Electrical power is present to the controller anytime the grill is connected to an AC Power Source. Before attempting to remove or install the controller it is important the controller is in the OFF position and disconnected from the AC Power Source. Failure to do so could result in personal injury from electrical shock and/or damage to the controller. When not in use the grill should be disconnected from the AC Power Source. It is highly recommended the grill be connected to a GFCI outlet or other protected circuit.

1.3 Assembly of the controller.

If you received the controller in the in our "Green Packing", you will have to attach the controller to the face plate and the wiring harness to the back of the controller.

1) Place a small towel on a flat surface to work over.
2) Remove the controller from the box.
3) Loosen the screws on the metal retainer clips on both ends until you can remove the metal retainer. The screws do not have to be completely removed.
4) Place the controller through the printed side of the faceplate.
5) Replace the retainer clips. The back side of the retainer clip slides in a grove on the controller. Tighten the screws, but not too tight.
6) On the back of the controller loosen the screws at terminals #10, #12, #13, #15, and #16. Each terminal is labeled including with the matching wire color.
Slide the spade connectors under the terminal clips making sure to match the corresponding wire color. Tighten the terminal screws to secure the wires.
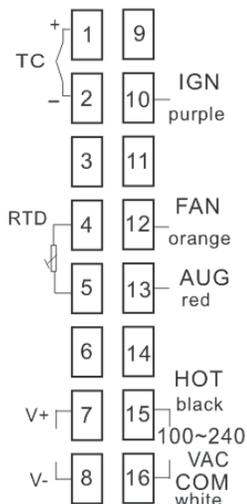
CAUTION

If the wires are not connected to the correct terminals the controller will not work properly and could damage the controller when powered up.

The wiring must NOT interfere with the draft fan or the auger cooling fan.

The controller will not work correctly if Remote Temperature Detector (RTD) is not properly connected.

Figure1.
Terminal Labels

1.4 Removing the existing controller.
Your process may vary. The following is for most Traegers.

1) Remove the two screws holding the controller to the pellet hopper saving the screws for use later.
2) Gently pull the controller away from the hopper while sliding it slightly to the right. Rotate the left side toward you so the circuit board (PCB) can clear the hopper opening.
3) Once the PCB is clear, pull apart (disconnect) the 4 wiring connectors by reaching up from bottom side of the hopper with one hand and through the opening with the other.
4) If the controller has 2 white wires connected to the back, remove them using the narrow screwdriver. The 2 white wires run to the Remote Temperature Detector (RTD) located in the cooking chamber.

You can use the existing RTD or install the RTD included with the SSv3. If using the existing RTD go to step 1.6.

1.5 To remove the existing Remote Temperature Detector (RTD).
1) Remove the grill grate and drip tray to provide access to the left side of the grill.
2) Remove the RTD, by removing the screw and lock nut located to the left of the RTD.
3) Pull the RTD up and feed the wires through the hole in the side of the grill and the end rail until the wires are removed.

1.6 Installing a new RTD.
1) Uncoil the wires to the sensor.
2) Tread the wires through the second hole in the end rail (same hole the RTD was in) and then through the hole in the left end of the grill about 1" below the end rail and above the drip tray support.
3) Continue feeding the wires downward between the pellet hopper and the grill body, then up and out the controller cutout.
4) Secure the sensor mounting bracket to the left end rail with the enclosed machine screw.
5) Connect the sensor wires to the back of the Savannah Stoker to **TERMINAL #4** and **TERMINAL # 5** marked **RTD** see Figure 1. Either wire can go to either **TERMINAL.** Make sure none of the insulation is under the terminal screws. Tighten the terminal screws to secure the wires.
6) Coil the sensor wires and secure together with a wire tie.

1.7 Installing the Savannah Stoker.
1) Place the wiring harness of the Savannah Stoker in the hopper opening. Reaching up from the bottom of the hopper, reconnect the wiring matching the correct color coded connector.

RED = **AUGER MOTOR** (Small Fan Blade)
ORANGE = **DRAFT FAN** (Large Fan Blade)
PURPLE = **IGNITER** (Fiberglass Insulation)
BLACK = **POWER** (Black/White Wires)

2) Place the controller in the hopper opening and re-install the top and bottom faceplate screws and tighten.
3) Working from under the hopper, secure the temperature sensor wires and the controller wires with wire ties to the underside of the hopper so the wires do not interfere with the auger fan of the draft fan.

2. Quick Start Guide

Yep, instead of reading the rest of the manual you're in a hurry to fire up the smoker and see what the Savannah Stoker can do. Right? Well, for everyone just like you this Quick Start Guide was prepared. So, what are you waiting for! Time to smoke something even it's just air. (air=empty grill)

2.1 Start-up.
NOTE: Refer to your smoker's owner manual for recommended start-up and safety procedures. Always start with a clean smoker for best results.

1) Plug the smoker to a GFCI protected AC outlet, it's a safety thing. The Stand-by indicator will illuminate RED indicating power is present at the controller.
2) Press the Power KEY ⏻ . The Stand-by indicator will go OFF. Both displays on the controller will flash, then the top display (PV) will show the current temperature inside the cooking chamber. The bottom display (SV) is the desired cooking temperature. You can read more about (PV) & (SV) in the column to the right, ….. later right?
3) The AUG and IGN indicator lights will be ON.
4) After several minutes the pellets will start to smolder and whitish-gray smoke will billow out then change color to that thin blueish smoke. You've seen this before.
5) When the cooking chamber reaches 130°+ the IGN indicator will go OFF, so did the Igniter.
6) Notice the AUG indicator cycling ON and OFF? If not now, it will, just keep watching. ON, the auger running. OFF, it's not.
7) When the smoker has heated up, cook something. It's better to cook food than air. Besides, while you're just sitting and watching the controller's displays and smelling the smoke for the next hour you could cook some sausage for tomorrow's breakfast.

2.2 Setting the Cooking/Smoking Temperature (SV).
Recommended start-up temperature is 225° to preheat the grill, but any start-up temperature can be set between 160° - 550°F in one (1°) degree increments. To change the Setpoint Value (SV) press/release the ▼ or ▲ KEY. The decimal point on the lower right corner of the display will start to flash. Press the ▼ or ▲ KEY to change SV until the desired temperature is displayed. The decimal point will stop flashing after no KEY is pressed for 3 seconds. You can press the **A/M KEY** to move the flashing decimal point to the desired digit that needs to change. Then press the ▼ or ▲ KEY to change SV starting from that digit.

2.3 Shut down.
1) Set the temperature (SV) to 225° or your future desired start-up temperature.
2) If you changed the FAN speed to medium or low, reset the **FanS** value to 3. (If you changed the speed you have read most of the manual.)
3) Press the POWER KEY ⏻ . The top display will flash "HOT" and the FAN indicator will blink until the cooking chamber temperature drops below 120° (the value of **Fant**)
4) The controller will power-off and the Stand-by indicator will illuminate RED indicating power is present at the controller.
5) Disconnect the power source.
6) Store the grill & cover. The controller should be protected from the elements. Water damage is not covered under the warranty.

3. The Front Panel

3.1 Understanding the Front Panel.
The numbers in the circle before each feature refers to Figure 2.

① **Stand by indicator:** Light is on when the controller is connected to a power source but not running. When the controller is running the light will go off and the displays will be on.
② **PV display:** The temperature inside the cooking chamber; commonly referred to as Process Variable or Process Value (PV).
③ **SV display:** When in normal operation mode this is the target temperature; it is commonly referred to as Setpoint Value (SV). When in display mode 2, it indicates the mode the controller is in (Automatic or Manual) and the output value (%).
④ **FAN indicator**: Light blinks when in "Cool Down".
⑤ **IGN indicator:** Light is on when the IGNITER is on.
⑥ **A/M indicator:** Light is on when the controller is in MANUAL MODE.
⑦ **AUG indicator:** Light is on anytime the AUGER is running.
⑧ **A/M KEY:** Automatic/Manual function KEY; Data shift KEY
⑨ **Decrement KEY ▼**: Decreases numeric value of the SV display.
⑩ **Increment KEY ▲**: Increases numeric value of the SV display.
⑪ **SET KEY:** Pressed momentarily, the controller switches the lower display (SV) between setpoint value and percentage of output. When pressed and held for two seconds the controller will enter the parameter setting mode.
⑫ **AUG KEY**: When engaged, the auger runs continuously.
⑬ **Power KEY ⏻** : When the controller is off and the Stand by indicator is RED, press the Power KEY to start the controller. When the controller is ON, pressing the Power KEY will start the "Cool Down" cycle. See 4.1.

Figure 2. Front Panel

4. Basic Operations

4.1 Turning the Controller On/Off

To turn the Controller ON:
Connect the smoker to a GFCI protected AC outlet. The Stand-by indicator will illuminate RED indicating power is present at the controller. Press the Power KEY ⏻ . The Stand-by indicator will go OFF. Both displays on the controller will flash. The top display (PV) will show the current temperature inside the cooking chamber. The bottom display (SV) is the desired cooking temperature.

To turn the Controller OFF:
Press the POWER KEY ⏻ , the controller will start the "COOL DOWN" cycle. The top display will flash "HOT" and the fan light will blink until the cooking chamber temperature drops below 120° (the value of Fant). The controller will power-off and the Stand-by indicator will illuminate RED indicating power is present at the controller.

4.2 Changing the Cooking Temperature, the Setpoint Value (SV)

Recommended start-up temperature is 225° to preheat the grill, but any start-up temperature can be set between 160° - 550°F in one (1°) degree increments. To change the Setpoint Value (SV) press/release the ▼ or ▲ KEY. The decimal point on the lower right corner of the display will start to flash. Press the ▼ or ▲ KEY to change SV until the desired temperature is displayed. The decimal point will stop flashing after no KEY is pressed for 3 seconds. You can press the **A/M KEY** to move the flashing decimal point to the desired digit that needs to change. Then press the ▼ or ▲ KEY to change SV starting from that digit.

4.3 Display Modes:
The controller has **3 Display Modes**.

Display Mode 1.
When the controller first turns ON it will be in **Display Mode 1.** This is the most used Display Mode. The (PV) display shows the temperature inside to cooking chamber. The (SV) display shows the target temperature of the cooking chamber.

Display Mode 2.
It you want to watch the controller in action place the controller in Display Mode 2. When in Display Mode 1, press/release the **SET KEY** to enter **Display Mode 2**. The (PV) display shows the temperature inside the cooking chamber. The (SV) display changes to show the auger's output as a % of the cycle time (t). Example: If the (SV) display is "A 60", the "60" indicates the Auger is running 60% of the cycle time. This value may change at the start of each cycle. The "A" in the display indicates the controller is in the "Automatic Control Mode".
Pressing the **A/M KEY** will switch the controller to "Manual Control Mode". When in Manual Control Mode, the first digit to the left will change to an "M" to indicate Manual Control Mode. Refer to the Section 5.1 Control Modes on the use of "Manual Control Mode"

Display Mode 3.
When in **Display Mode 1**, press/hold the **SET KEY** for 2 seconds to enter **Display Mode 3.** Display Mode 3 is where the values of the various operation parameters can be manually changed. The (PV) display shows the parameter name, the (SV) display is the current value. Use ▲ and ▼ to modify the current value. Press/release the SET KEY to advance to the next parameter. After the last parameter is displayed, press/release the SET KEY to exit Display Mode 3.

4.4 Using the Auger Bypass Feature.

Press/release the **AUG KEY** to run the Auger continuously bypassing the Control Modes. The (SV) display will flash "ACC" and the last set temperature when the Auger Bypass feature is being used. Press/release again to return to normal operation. The Auger Bypass feature is typically used for high temp grilling or to raise the grill's temperature more quickly than Automatic Mode.

⚠️ **Caution: When using Auger Bypass Mode the cooking chamber, drip tray, and the grease drain system should be clean. Cooking at high temperatures increases the risk of having a grease fire. Never leave the grill unattended. Always return the auger to normal operation before turning off the grill.**

4.5 Changing the Fan Speed

Place the controller in Display Mode 3.
Press/release the SET key to page to parameter **FanS**.
Use the ▲ and ▼ keys to modify the current value.
3 is normal fan speed, 2 is medium fan speed and 1 is slow fan speed. Medium Fan Speed is great to use when smoking below 225° or when using the STOKER below 250°. Limit the use of the low fan speed for cold smokin'.On low fan speed the risk of losing fire is greatly increased.
Note: Always return the Fan Speed to normal for cool down.

This space is provided for your notes:

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5. Control Modes

**The controller operates in 3 different Control Modes:
AUTOMATIC, MANUAL, and STOKER Control.**

5.1 Automatic Mode

Automatic Control Mode is the normal operational mode of the controller. In Automatic Mode the controller maintains the desired cooking/smoking temperature typically within 5-10°F when cooking above 225°F and 10-15°F when smoking below 200°F. Every grill and cooking environment is different so your results may vary.

How it works, if you really want to know.

The controller measures the temperature of the sensor in the grill, compares it to the target temperature, and then runs the auger a percentage of the cycle time (t) to maintain the target temperature. The controller uses "PID control Software" to determine the auger runtime %. The controller also runs the auger a minimum amount each cycle time to maintain the fire much like a pilot light.

Cycle Time Defined.

Cycle time is a time period (in seconds) the controller uses to calculate the auger's runtime. Example: When the cycle time parameter is set to t=20, and the controller has determined the output for the next cycle should be 25%, the auger will run for 5 seconds at the start of the next cycle and will be off for the remaining 15 seconds of the cycle. The default cycle time is 20 seconds.

What the heck is "PID"?

A PID controller is a control loop feedback mechanism widely used in automated processes like the cruise control on your car. The PID controller algorithm involves three separate constant parameters: the Proportional, the Integral and Derivative values, denoted P, I, and D. Simply put, these values can be interpreted in terms of temperature: "P" depends on the present "error", "I" on the accumulation of past "errors", and "D" is a prediction of future "errors", based on current rate of change over a period of time. The weighted sum of the PID values is used to calculate the adjustment to the process to minimize the "error". This adjustment is made at the start of each cycle time. **Refer to 6.3.3 for information about the PID parameters.**

5.2 Manual Mode.

Manual Mode allows the user to manually adjust the auger runtime as a percentage of the cycle time (t). To activate Manual Control Mode from Automatic Control Mode, press the Set KEY once to enter in Display Mode 2. Then press the A/M KEY. The A/M indicator light will come on. The upper display shows the measured value (PV) and the lower display shows the output % value. The first digit to the left will be an "A" when in Automatic Control Mode or to "M" to indicate Manual Control Mode. The value is the % of the cycle time (t) the auger is running. Example: If t=20 which is a 20 second cycle time and the output value is 20%, the auger runs 4 seconds (20% of 20 seconds) at the start of the cycle and then off 16 seconds. In Manual Mode pressing the ▼ or ▲ KEYs will lower or raise the auger runtime %. Note: Manual mode will be running the last output value when the controller was in Automatic Mode. The runtime % cannot be set lower than the OutL parameter value.

5.3 STOKER Control Mode

If you own the STOKER® Power Draft System from Rocks Bar-B-Que www.rocksbarbque.com you already know it's capabilities like food and grill temperature monitoring; accurate temperature control of a wood or charcoal smoker; web browser interface to access and remotely control the STOKER from any Smartphone or computer; and several third party programs and apps to make it even easier. You could use all of these features with a pellet grill except temperature control. But the game changes with the Savannah Stoker; just connect it to the Stoker with the optional interface cable to add remote temperature control of your pellet grill. The interconnection cable is available from Sound Solutions, LLC. Contact information is in the Warranty Section on Page 1.

NOTE: It is not the intent of this manual to provide instructions on the use or setup of the STOKER. The instructions below describe how to properly connect the STOKER to the Savannah Stoker.

How it Works:

On a wood/charcoal smoker the STOKER measures the temperature of the pit with a sensor, compares the reading to the target temperature, and then cycles a "Blower" attached to one of the bottom drafts of the smoker to maintain the temperature. To use the STOKER to control a Pellet Grill the STOKER has to be adapted to control the Auger in a similar way it controls the "Blower". This is where the Savannah Stoker comes in.

Let's get started!

1) Start your grill as you normally do. Preheat to the desired cooking/smoking temperature for at least 15 minutes.

2) While the grill is preheating plug the STOKER's Pit Sensor into the STOKER. Clip the Pit Sensor next to the Savannah Stoker's temperature sensor. Once the STOKER is running and the grill has preheated you can connect the Interface Cable.

3) Connecting the Interface Cable:
   a) Turn OFF the STOKER.
   b) Plug the Interface Cable into one of the STOKER's device input ports.
   c) Turn ON the STOKER.

4) Assigning the Interface Cable to the correct Pit Sensor.
   The STOKER needs to know which "Sensor" to use with the interface cable. The STOKER recognizes the Interface Cable as a "Blower". Refer to the STOKER Users Manual Ver. 2.7 p16-17.
   a) From the Main Menu of the STOKER, press the ↑↓ buttons to Scroll until "Temp Control" is in the bottom display.
   b) Press the Sel button to choose the Temp Control option.
   c) Press Sel again to scan the sensors.
   d) Scroll through the sensor(s) until the name of your Pit Sensor in the Pellet Grill is displayed.
   e) Press Sel to enter the Temperature Sensor Settings Menu.
   f) Scroll until "Blower" is displayed.
   g) Press Sel to display the Blower menu.
   h) Press the Sel button to display the available Blowers.
   i) Scroll thru the Blowers until the desired "Blower" is displayed. The interface cable will be a serial number until you rename it.
   j) Press Sel. An * appears next to the name to indicate the Blower is assigned to the Senor.
   k) Press ⊓⬦ to return to the previous menu.
   l) Set the Target Temperature in the STOKER.

STOKER Control Mode, continued from page 5

5) **Setting up the Savannah Stoker**
   a) Connect the interface cable to the Savannah Stoker. Refer to the instructions that came with the cable.
   b) On the Savannah Stoker lower the target temperature (SV) to 180°;
   c) Alternately, if you do not want to change the set temperature, place the Savannah Stoker in Manual Mode (See 5.2) and lower the output value to 17.
   d) Observe the grills temperature on the Savannah Stoker (PV). If the temperature is constantly descending below the Target Temperature the interface cable has not been properly assigned to the Pit Sensor as a Blower. Repeat Step 4 above.

Congratulations! Your STOKER is now controlling your pellet grill. Go ahead; give it a try from your easy chair, your neighbor's house, the grocery store, or work. Access from the internet requires your STOKER to be setup with an accessible IP address. Refer to the documentation for the STOKER found on www.rocksbarbque.com

6) **Returning control to the Savannah Stoker:**
   a) Turn off the STOKER.
   b) Unplug the interface cable,
   c) If the FAN is on low, return the FAN to normal speed.
   d) Set the desired temperature on the Savannah Stoker
   e) If in Manual Mode press A/M KEY to return to Automatic Mode

TIPS:
We recommend not running the STOKER below 200°F.
When the Target Temperature is below 250°F, better temperature control can be achieved with the FAN on medium speed.

⚠ **CAUTION: If the temperature of the grill is constantly dropping below the Target Temperature then the cause is most likely due to the interface cable not being properly assigned to the Pit Sensor as a Blower. Repeat Step 4 above.**

Precautions should be taken in the event that a grease fire occurs when the grill is unattended maintaining a safe distance from combustible materials at all times.

NOTES: Do not be concerned if the temperature readings of the STOKER and the Savannah Stoker do not match because the characteristics of the sensors are different. Support documentation for the STOKER® Power Draft System is available from Rock's Bar-B-Que. www.rocksbarbque.com.

StokerLog is a PC Application written by Amir Majidimehr that can be used as an alternate to the STOKER's web browser interface. StokerLog adds many features: Learns the characteristics of your barbecue; Chart and save your cook data; Set alarms on your computer; Ramp temperatures up/down by time or food temperature; and more. The author posts on the Virtual Weber Bulletin Board http://tvwbb.com in the Automatic Temperature Control Systems area. Discussion and download information is found there.

StokeMaster and BBQ Monitor are iPhone Apps used to monitor and make changes to the STOKER.

6. Operational Parameters

6.1 Operational Parameters.
The Savannah Stoker has various operational parameters. The default values will control most pellet grills with satisfactory results. In some instants the values may need to be changed to achieve better results. Some users may also want to tweak the parameters. One example is changing the cycle time when smoking at 180°. Increasing the cycle time (t) will produce more smoke but will also increase temperature swings. Other parameters the user needs to access: "AT" to start Auto-Tune, "OutL" to change the auger's minimum runtime; OutH to change the maximum auger runtime; and FanS to change the fan speed.

6.2 Changing Parameter Values.
When in Display Mode 1, press/hold the SET KEY for 2 seconds to enter Display Mode 3. Display Mode 3 is where the values of the various operation parameters can be manually changed. The (PV) display shows the parameter name, the (SV) display is the current value. Use ▲ and ▼ to modify the current value. Press/release the SET KEY to advance to the next parameter. After the last parameter is displayed, press/release the SET KEY to exit Display Mode 3. All of the new parameter values are automatically stored.

6.3 Operational Parameters Defined.
Figure 3 below shows the system Operational Parameters in order as they appear when paging through them as outlined above (6.2). Beside each parameters name is a brief Description, Setting Range, Initial Setting value, and Remarks. There is no retrieval of the default values once changed. If you need to restore the default values they have to be reset manually.

NAME	Description	Setting Range	Initial Setting	Remarks
IGN	Ignitor OFF temp	100-200 °C or °F	130	See 6.3.1
Hy	Hysteresis Band	0~50.0 °C or °F	5	
At	Auto tuning	0~3	3	See 6.3.2
I	Integral	0~9999 Seconds	140	See 6.3.3
P	Proportional	1~9999 °	25	
d	Derivative	0~2000 Seconds	35	
t	Cycle time	2~125 Seconds	20	See 6.3.4
Sn	Input type	Pt, K	Pt	See 6.3.5
Pb	Sensor Calibration Offset	-50+50 °C or °F	0	See 6.3.6
OutL	Output low limit	0~100 %	17	See 6.3.7
OutH	Output high limit	0~100 %	80	
C-F	Temp Display	C, F	F	See 6.3.8
FAnS	Fan Speed	1,2,3	3	See 6.3.9
Fant	Fan off Temperature	100-150	120	See 6.3.10

Figure 3.
Operational Parameters

Operational Parameters Defined, continued from page 6

6.3.1 "IGN" and "HY" Control the Igniter's ON/OFF Temperatures
The parameters IGN and HY are used together to control the igniter's functions.

IGN parameter: The Igniter's ON temperature.
HY parameter: The Hysteresis Band is used to protect the igniter from cycling ON/OFF to rapidly.

How it works:
    When smoker starts from cold, the Igniter will be on. As the pellets light and the temperature inside the cooking chamber rises the Igniter will go OFF when temperature inside the cooking chamber reaches **IGN + HY**. If the fire goes out due to an un-intentional reason, the temperature will drop. The Igniter will turn back ON when temperature drops to below the IGN setting and will go off again when the temperature reaches IGN + HY.

6.3.2 "At" Auto-Tune
Parameter **"AT"** is used to start the Auto-tune process.

At=1   Sets Auto-Tune in delayed start. The Auto-tune process is delayed until the A/M KEY is pressed. This is the preferred method to start auto-tune.
At=2   Auto-tune will start in 10 seconds.
At=3   Normal controller operation. After auto-tune is complete the controller automatically sets the value to 3.

When to Run Auto-tune:
    In most cases the controller is very adaptive and works well with the default parameter values for P,I,D, but every grill and cooking conditions are different. If temperature swings at 250°F are consistently greater than 10-15° then running Auto-tune may improve the controller's performance by determining new values for the PID parameters.

Preferred Method to Start Auto-tune:
1) Write down you current values for I, P, and D for future reference.
2) Set the target temperature (SV) in the 250° to 275°F range.
3) Let the grill's temperature stabilize for 20-30 minutes.
4) Set At=1
5) Start Auto-tune by pressing the "A/M" KEY when the temperature reading (PV) is <u>above</u> the target temperature but is <u>descending.</u>
6) The "At" symbol will blink in the lower display (SV) during the Auto-tune process.
7) If you need to stop the Auto-tuning process, press and hold the "A/M" KEY for about 2 seconds until the "At" symbol stops blinking in the lower display window.

During the Auto-tune process the controller will execute 2-3 cycles. The microprocessor in the controller will analyze the period, amplitude, and waveform of the temperature oscillations and calculate the optimal PID control parameter values. When Auto-tune is complete the controller will return to performing accurate artificial intelligence control using the new values.

If the Auto-tune results are not satisfactory, you can manually fine-tune the PID constants for improved performance. Or perform auto tune again. Sometimes the controller will get better parameters.

6.3.3 PID Control Parameters Explained.
Please note the controller uses an enhanced version of PID control algorithms. Tuning of the controller is different than traditional PID controllers. The parameters are explained below.

Before adjusting any of the PID parameters, we recommend running Auto-tune as outlined in section 6.3.2. Before making adjustments to the PID parameters always write down your current settings. After making changes let the grill stabilize for 30-45 minutes and evaluate the results. What works best at 250° may not give the same result @180°. Keep good notes.

Proportional Band "P"
    The unit is in degrees.
    This parameter controls the output of the controller based on the difference between the measured and set temperatures. The larger the "P" value means the weaker the action (lower gain). For example, if P=20, the proportional band is 20 degrees. When the PV reading is 20 degrees or more below the set point (SV), the controller will have 100% output (or the value of OutH, see 6.3.7). When the temperature is 10 degrees below the set point, the output is 50%. When the temperature is equal to the setting, the controller will have 0% output (assuming integral and derivative functions are turned off). This constant also affects both integral and derivative action. Smaller P values will make both integral and derivative action stronger.
    Typical values for "P" would be in the range of 20-40°F
    If you change from Fahrenheit to Celsius, divide "P" by 1.8.
    When changing "P" use small steps of 1 or 2.

Integral time "I"
    The unit is in seconds.
    This parameter controls the output of controller based on the difference between the measured and set temperature integrated with time. Integral action is used to eliminate temperature offset (both above and below set point, SV). A larger number means slower action. e. g. assuming the difference between the measured and set temperature is 10 degrees and remains unchanged, the output will increase continuously with time until it reaches 100%. When the temperature fluctuates more than 15° (when above 250°) an increase of the integral time may be needed. Decrease if the controller is taking too long to eliminate the temperature offset.
    When I=0, the system becomes a PD controller.
    Typical values for "I" would be in the range of 80-300 seconds, but the recommend setting for "I" is 4 times the value of "D", I=Dx4.
    If you change "D" also change "I"

Derivative time "D"
    The unit is in seconds.
    Derivative action contributes to the output power based on the rate of temperature change. Derivative action can be used to minimize the temperature overshoot by responding to the rate of change. The larger the number, the faster the action will be, e.g. when the cooking chamber door is opened, the temperature will drop at very high rate. The derivative action will change the controller output based on the rate of change rather than the net amount of change. This will allow the controller to act sooner.
    Increases to "D" will decrease overshoot, and improve settling time,
    Typical values for "D" would be in the range of 20-75 seconds.
    When changing "D" use small steps of 2-3.
    If you change "D" also change "I" to 4 times the value of "D", I=Dx4.

Operational Parameters Defined, continued from page 7

6.3.4 "t" Cycle time

Cycle time **"t"** is a time period (in seconds) the controller uses to calculate the auger's runtime. This is also known as the duty cycle. Default is 20 seconds.

Example: If the cycle time parameter is set to **t=20**, and the controller has determined the output for the next cycle should be 25%, the auger will run for 5 seconds at the start of the next cycle and will be off for the remaining 15 seconds of the cycle.

Notes: The default value for the cycle time is 20 seconds. This gives the best performance for most stock configured grills. The controller also runs the auger a minimum amount each duty cycle to maintain the fire much like a pilot light. The minimum amount is controlled by parameter "**OutL**", and the maximum limit is controlled by parameter "**OutH**".

If the cycle time is less than 20 seconds the auger may not run long enough during each duty cycle to maintain the fire. Before lowering the value of either the cycle time or OutL, refer to section 6.4 "How to Determine the Lowest Stable OutL Value".

Larger cycle times typically give larger temperature swings except on large insulated cookers where a cycle time of 45 or 60 may have to be used.

6.3.5 "Sn" Sensor Input Selection

Sn is used to define the type of input sensor used.

Pt = The default value for the temperature sensor (PT1000 RTD) shipped with the controller and for the sensor used with the stock controller.
K = K-Type thermocouple.

6.3.6 "Pb" Sensor Calibration Offset

Pb is used to set an input offset to compensate the error produced by the sensor. Use this to calibrate the sensors PV reading.

6.3.7 "OutL" and "OutH" Auger Runtime Limits

OutL and **OutH** are runtime limits of the auger. The value is a percentage of the total cycle time, parameter "t".

OutL is the minimum % of the cycle time the auger will run at the start of each cycle. Default is 17%. A minimum run time is required to maintain the fire. See the top of the next column. Example: With a cycle time t=20, and **OutL**=17, the auger will run for 17% of the 20 second cycle time or 3.4 seconds.

OutH is the maximum % of the cycle time the auger will run.
Default is 100%. The high limit is used to help reduce temperature overshoots that will occur at start-up, after the cooking chamber door is opened, and after the target temperature is increased. The default value works well with most grills. On small grills better performance is achieved with a lower value of 70 or 80.

⚠️ **CAUTION:**
A pellet grill requires a minimum amount of fuel feed per cycle time to maintain the fire.

If **OutL** is too low the fire will go out; too high and the smoking temperature will be too hot on very hot days. The default value will give satisfactory results with most stock pellet grills. If you need to change the **OutL** value refer section 6.4.

6.3.8 "C-F" Selecting Fahrenheit or Celsius

Parameter **C-F** is used to change between Celsius and Fahrenheit.
F= Fahrenheit (default)
C= Celsius
If changing to Celsius, Change the value of "P", See Section 6.3.3

6.3.9 "FAnS" Fan Speed

FAns is used to change the fan speed.

3= Normal fan speed

2= Medium Fan Speed

1= Low Fan Speed. (not recommend except for cold smoking)

6.3.10 "Fant" Fan Shut Off Temperature

The unit is degree. When the controller is turned off, the fan will continue to run until the cooking chambers temperature is cools down to the temperature set by **Fant**. For example, if the **Fant** is set to 130, the display will flash between "Hot" and "current smoker temperature", until the smoker temperature drops to below 130 degree.

6.4 How to Determine the Lowest Stable Value for OutL.

1) Start the grill normally. Set the target temperature to 225°F. Let the temperature stabilize for 20-30 minutes.
2) Change the parameter values of: t=20 and OutL = 10.
3) Change the controller to Manual mode. See section 5.2
4) Press the ▼ or ▲ KEYS to set the value in the lower display to 17.
5) The grill's temp will slowly lower until it stabilizes. This could take 30-45 minutes or longer. If the grill's temperature (PV) drops below 160° raise the output value by 2.
6) After the temperature becomes stable; take the average temperature; then, do one of the following.
   a) If the average is between 170-180°, do nothing.
      You have a found the stable value for OutL.
      Enter the lower display value as the OutL parameter value.
   b) If above 180° lower ▼ the SV value by 1, retest
   c) If above 190° lower ▼ the SV value by 2, retest
   d) If below 170° raise ▲ the SV value by 1, retest
   e) If below 160° raise ▲ the SV value by 2, retest