

HEAT-TIMER

INSTALLATION/OPERATING INSTRUCTIONS

HEAT-TROL Elite Series HWE-Single Stage

How Water Reset Control with Set Back For Single Stage Boiler with Heating and DHW Pumps

HOW THE HWE-SINGLE STAGE OPERATES...

The HWE-Single Stage (HWE-SS) establishes ambient comfort by varying the temperature of the heating system's circulating hot water in response to changes in the outdoor temperature. In addition, it provides an outdoor temperature based start/stop, heating system pump control, and domestic hot water (DHW) pump control.

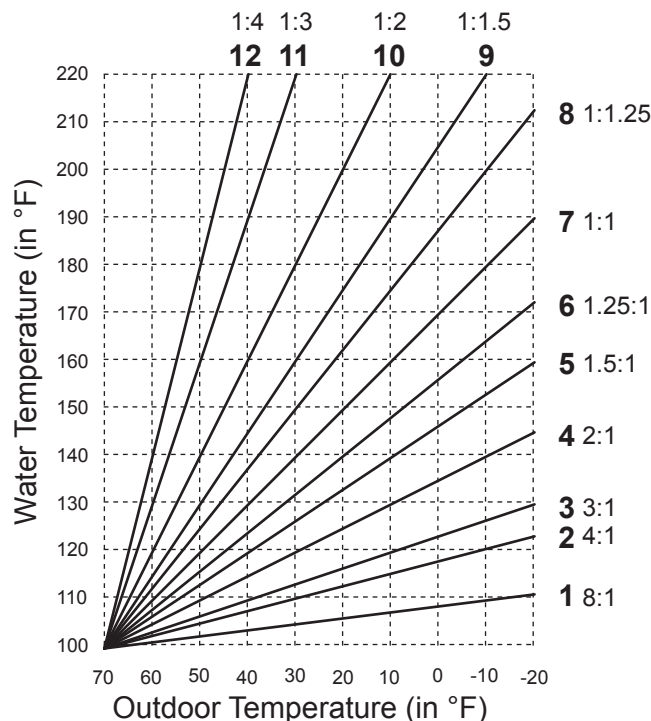
Two sensors are used, one to monitor the outdoor temperature, and one to monitor the circulating hot water temperature in the heating system. When the outdoor temperature falls to the outdoor cutoff setting, the heating system is activated and the hot water temperature is increased proportionally to meet the need for more heat. Should it get warmer outdoors, the hot water temperature is automatically lowered by the control. If the outdoor temperature continues to rise to the outdoor cutoff setting then the heating system is turned off.

Because of many physical characteristics, and the type of radiation, ie. baseboard or radiant, heat loss varies. In one building, a 1-degree temperature change outdoors may require a change of 1 degree in heating water temperature; for another it may require a change of 2, 3, or even 4 degrees in order to gain the desired comfort level. This is known as the Reset Ratio. The middle chart shows the wide range of Reset Ratios available for the HWE-SS.

The installer fits the HWE-SS to a specific building by adjust-

ing the Reset Ratio curve. With a curve of 4 (2:1 reset ratio) a 2-degree change in outdoor temperature will change the circulating hot water temperature by 1 degree; at an 11 curve (1:3 reset ratio) an outdoor change of 1 degree will change the water temperature by 3 degrees. Most buildings with baseboard radiation require a curve of 6, 7, or 8. Radiant heat applications usually require a lower curve.

An optional external thermostat or Set Back control input can be connected to the HWE-SS. This input can be connected to a new or existing thermostat or switch to shut the heating system down when the thermostat is satisfied. When set to Set Back mode this input will switch the heating system to a lower setting determined by the Set Back setting.



Reset Ratio Curves

An optional domestic hot water input is provided for systems where an indirect tank provides DHW. During a DHW call, the HWE-SS will maintain a constant set point of 200°F regardless of outdoor temperature or the status of the optional external thermostat. The DHW pump will be enabled whenever there is a call for DHW. The heating system pump can be programmed to turn off during the first hour of a DHW call. This allows the DHW tank to be satisfied quickly.

Digital displays of the sensor temperatures and all control settings allow rapid verification of operating status and precise adjustment of the HWE-SS.

INSTALLATION

Mounting the Controller

- The HWE-SS is designed to mount on a standard 1900 (4"x4") electrical box (not supplied).
- If panel mounting, or if additional room is needed for wiring, an extension skirt is available.
- Locate the HWE-SS in a convenient location near the boiler to be controlled.
- Mount the HWE-SS away from excessive heat or cold. Ambient operating temperature is from 20 to 120°F.
- After completing all the wiring connections (see below) use the two screws provided to mount the HWE-SS to the 1900 box.

Install the Heating system sensor

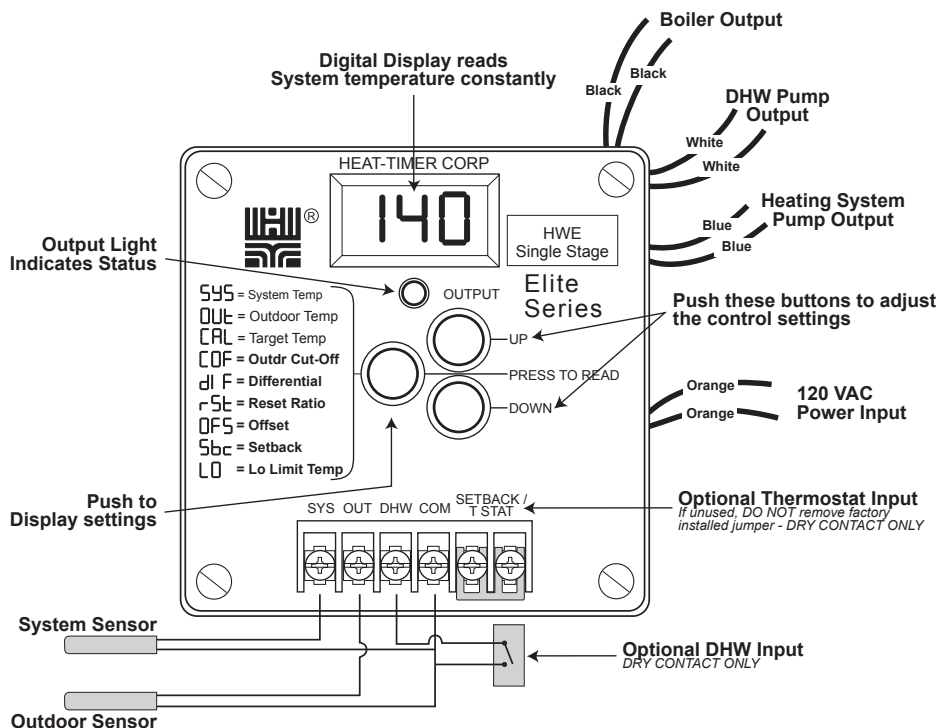
- The HWE-SS heating system sensor is designed to be installed in a 3/8" ID well.
- Locate the sensor in the common header, where it will register the output of the boiler and before any takeoffs.
- The sensor wires can be extended up to 500' by splicing with 18 gauge shielded wire.
- Do not run sensor wire in conduit with line voltage.
- The sensor has no polarity. Connect either sensor wire to the front terminal marked SYS.
- Connect the other sensor wire and the shield to the front terminal marked Com.

Install the outdoor sensor

- Locate the outdoor sensor in the shade on the north side of the building.
- Be sure the location is away from doors, windows, exhaust fans, vents, or other possible heat sources.
- The sensor should be mounted at least 4 inches away from the building wall and approximately 10 feet above ground level.
- The sensor wires can be extended up to 500' by splicing with 18 gauge shielded wire.
- Do not run sensor wire in conduit with line voltage.
- The sensor has no polarity. Connect either sensor wire to the front terminal marked OUT.
- Connect the other sensor wire and the shield to the front terminal marked COM.

Wiring the power inputs

- Attach 120VAC line voltage to the two orange wires extending from the back of the HWE-SS.
- If possible, provide a dedicated circuit breaker for the HWE-SS. Never connect the HWE-SS on a circuit breaker connected to high inductance devices such as relays, contactors, pumps, fans, or motors.
- Use wire nuts, or wrap the connections with electrical tape.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 wiring.
- Heat-Timer recommends connecting power to its controls through a surge suppressor.
- **Connect power to the HWE-SS through a power switch mounted near the control.**



Wiring the SETBACK/ T STAT input

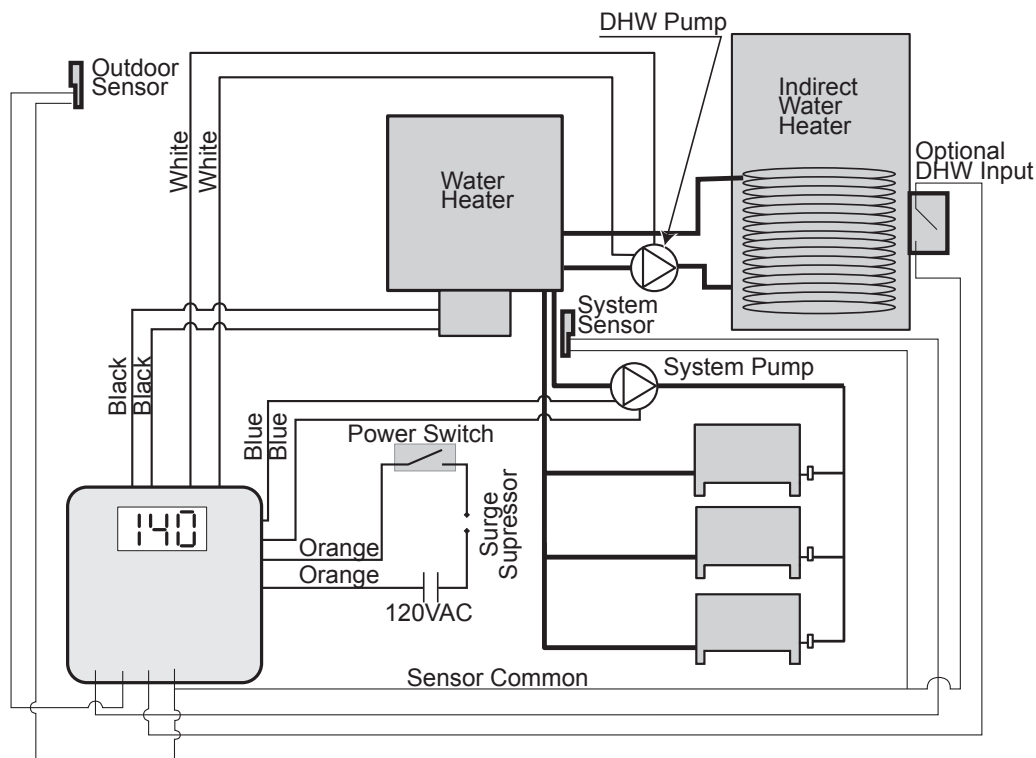
- If the T STAT input terminals are open, the HWE-SS will not energize the Boiler (except on a DHW call) or the Heating System Pump outputs.
- The HWE-SS is shipped with a jumper across the T STAT terminals. DO NOT remove this jumper unless you replace it with a dry contact switch which closes when heat is required in the building. This type of contact is usually provided by a thermostat.
- When the T STAT terminals are opened, the Boiler output will immediately open to disable the boiler. If there is an active Heating System Pump output, it will remain energized for three minutes to remove heat from the boiler, and then also turn off.
- The T STAT signal must be a dry contact only. No voltage can be placed across the T STAT terminals.
- Bring the two wires from the dry contact to the front terminals marked T STAT.

Wiring DHW input

- If the DHW to COM terminals are connected, the HWE-SS will operate in DHW mode. The control will hold a 200°F set point, the DHW Pump output will be active, and the Heating System Pump can be selected to turn off. This allows an indirect DHW tank to heat up quickly.
- The red OUTPUT light will flash when the HWE-SS is in the DHW mode.
- The DHW signal is normally provided by an aquastat in the DHW tank.
- The DHW signal must be a dry contact only. No voltage can be placed between the DHW and COM terminals.
- Bring the two wires from the dry contact to the front terminals marked DHW and COM.

Wiring the OUTPUTS

- The output wires provide a dry contact closure only. They do not source any power.
- Each pair of same colored wires, Black, White, and Blue are connected internally to a N.O. relay which is rated at 8 Amp max.
- The total of all outputs must not exceed 15A.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 wiring.
- Wire the Black pair of wires in series with the boiler's limit circuit or thermostat wire terminals (TT) as shown below.
- Connect the Blue pair of wires to the Heating System Pump starter as shown below.
- Connect the White pair of wires to the DHW Pump starter as shown at the bottom of the page.



WARNING

This Heat-Timer control is strictly an operating control; it should never be used as a primary limit or safety control. All equipment must have its own certified limit and safety controls required by local codes. The installer must verify proper operation and correct any safety problems prior to the installation of this Heat-Timer control.

INITIAL CONTROL START-UP

- Whenever the HWE-SS is powered up, it will display the software version number and then the current operating modes. Each display will remain on the screen approximately 5 seconds. If the operating modes are correct, there is no need to make any adjustments.
- Once the operating modes have been set for a particular application, they will be retained in memory.
- Note that if you do change an operating mode, you will need to reset all the settings (shown in Display Chart, opposite page).
- An operating mode can only be changed when it is being displayed in the start-up sequence. To restart the sequence it is necessary to remove power to the HWE-SS and then power it again.
- Set the operating parameters as described in sequence below:

°F or °C - Fahrenheit or Celsius Temperature Operation

Default is °F

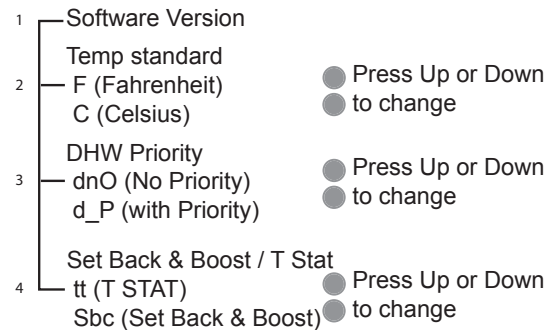
- If the display shows °F then the HWE-SS will operate in Fahrenheit degrees.
- If the display shows °C then the HWE-SS will operate in Celsius degrees.
- To change the temperature operation, hold down the center button while pushing either the *UP* or *DOWN* button to toggle between the displays of °F and °C.
- When the correct temperature operation is selected, release the buttons and wait approximately 5 seconds.

dnO or d_P - DHW Selection

Default is dnO

- If the display shows dnO then the HWE-SS will operate with NO DHW Priority. This means the status of the Heating System Pump will not change when there is a DHW call. If the Heating System Pump was not running, based on the outdoor temperature and T STAT input, the Heating System Pump will remain off. If the Heating System Pump was running, it will continue to run, and 200°F water will be circulated through the heating loop.
- If the display shows d_P then the Heating System Pump will be disabled for the first hour of a DHW call. This allows the DHW tank to be satisfied more quickly. If the DHW is not satisfied after an hour, the Heating System Pump will resume its normal operation based on the outdoor temperature and T STAT input.
- To change the DHW Priority selection, hold down the center button while pushing either the *UP* or *DOWN* button to toggle between the displays of no priority (dnO) and priority (d_P).
- When the correct priority mode is selected, release the buttons and wait approximately 5 seconds.

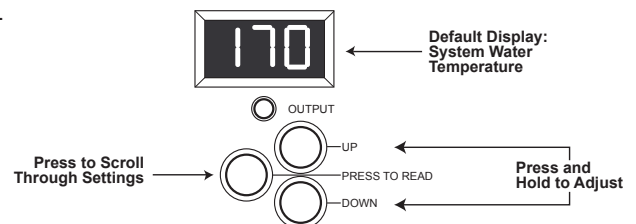
SETTINGS ON STARTUP



DEFAULT Settings

Settings shown in instructions have been selected by Heat-Timer and will provide proper operation for many installations.

- The HWE-SS comes equipped with default settings which are a good starting point for most installations. You can reset the control back to default manufacturing setting by pressing both buttons the *PRESS TO READ* with either the *UP* or *DOWN*.
- After the start-up routine has completed, the display will show the system water temperature.
- To display the other settings (see chart on opposite page), repeatedly press the center *PRESS TO READ* button.
- A setting can only be adjusted when it is being displayed.
- Use the *UP* and *DOWN* buttons to adjust the setting.
- The display will always revert back to the actual system water temperature after 30 seconds.



OPERATION

DISPLAY SETTINGS

Calculated water temperature

Center button pressed once

- This is the water temperature the HWE-SS will control the boiler to hold. It is based on outdoor temperature, Offset, Reset Ratio, and Set Back values. This value Can Not be changed by pressing the UP or DOWN button.
- The Calculated water temperature can not be less than the Lo Limit Temp setting.
- If either sensor is reading a fault condition, the Boiler and Heating System Pump outputs will immediately be energized. The Calculated display will show ON to indicate this condition.
- If the outdoor temperature is above the Outdoor Starter setting, the HWE-SS will not activate the heating system. The Calculated display will show OFF to indicate this condition.
- The HWE-SS will control the boiler to hold the heating system temperature around the Calculated temperature.
- The Calculated temperature is the average temperature the HWE-SS will maintain. The system temperature can be expected to fluctuate above and below the Calculated value. The size of the fluctuation depends on the Differential (see pg. 6) and on the heating load.
- If Set Back is activated selected on initial setup and an external control energized the SETBACK / T STAT terminals, the Calculated water temperature is changed to reflect the reduction in Calculated water temperature by the Set Back amount. The system will switch back to normal operation when the terminals are deenergized.

DISPLAY CHART AND ADJUSTMENTS

Press Center Button	Display	Press and hold either UP or DOWN button to adjust the valve
Once ♦	SYS Default	The HWE-SS returns to the default display of system water temperature as measured by the System Sensor. If the sensor is not connected, the display will show OPN. If shorted, it will show SHT.
Twice ♦	OUT Outdoor	The temperature value measured by the Outdoor Sensor. If the sensor is not connected, the display will show OPN. If shorted, it will show SHT.
3 Times ♦	CAL Calculated	This is the water temperature the HWE-SS will control boilers to hold. It is based on the outdoor temperature, Reset Ratio, and the Offset value. If OFF is shown, there is no call for heat (although there may be a call for DHW, which is indicated by red OUTPUT LED flashing.)
4 Times	COF Outdoor Cut-Off	When the outdoor temperature falls below the Outdoor Cutoff setting, the HWE-SS will give heat. When the outdoor temperature is above the Outdoor Cutoff, the Calculated value will be OFF and no stages will be activated. The Outdoor Cutoff is adjustable from 40 to 100°F. Manufacturing default is 65°F.
5 Times	DIFF Differential	The Differential controls boiler cycling. When there is a call for heat, the boiler will be activated until the Calculated temperature is reached. The boiler will then turn off and stay off until the system water temperature falls through the number of degrees set by the Differential. The Differential is adjustable from 2 to 25°F. Manufacturing default is 5°F.
6 Times	RSR Reset Ratio	The Reset Ratio controls the amount of heat which enters the heating system based on the outdoor temperature. A higher numbered Reset Ratio will result in a higher Calculated water temperature. See the chart on the first page for the reset curves. If the application has radiant heat, a lower numbered Reset Ratio curve should be selected. The Reset Ratio is adjustable from 1 to 12. Manufacturing default is 7.
7 Times	OFFS Offset	The Offset moves the Reset Ratio curves vertically up or down. For example, changing the offset from 0 to -10 will decrease the water temperature 10° regardless of outdoor temperature or the Reset Ratio curve selected. The Offset is adjustable from -40 to 40°F. Manufacturing default is 0°F.
8 Times	SBC Set Back/Boost	The Set Back function only works when SB is selected initially when setting the control. It allows an external control wired to terminals marked SETBACK/T STAT to turn boiler water temperature down to the calculated water temperature less the Set Back setting. When the terminals are energized, Set Back takes effect. The Set Back is adjustable from 0°F to 30°F. Manufacturing default is 10°F.
9 Times	LO Min. Water Temp.	This is the lowest temperature heating water the HWE-SS will circulate through the heating system. It should be set according to the boiler manufacturer's specification. The Minimum Water Temperature is adjustable from 70°F to 170°F. Manufacturing default is 120°F.

♦ The actual sensor readings are displayed and can not be adjusted with the UP and DOWN buttons.

Outdoor Cutoff **Default is 65°F** Center button pressed four times

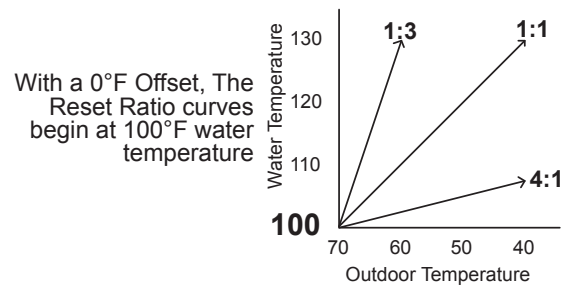
- The Outdoor Cutoff sets at what outdoor temperature the HWE-SS will activate the heating system.
- When the outdoor temperature is above the Outdoor Cutoff setting, the HWE-SS will not give heat. The Calculated water temperature will read OFF.
- The Outdoor Cutoff has a built in 2°F differential.
- When the outdoor temperature drops below the Outdoor Cutoff setting minus the 2°F differential, the HWE-SS will compute the Calculated water temperature and control the boiler to hold that temperature.
- If the building is too cold before the heating system is activated, raise the Outdoor Cutoff temperature.

Differential **Default is 5°F** Center button pressed five times

- The Differential controls the cycling of the boiler. On a call for heat, the boiler will remain activated until the Calculated water temperature is reached. The boiler will then be turned off and will not be reactivated until the system temperature falls through the Differential.
- For example, if the Calculated water temperature is 150°F, then the boiler will run until the system temperature reaches 150°F. The HWE-SS will then turn the boiler off and leave it off until the water temperature falls through the default 5°F Differential. So, at 145°F the boiler will be reactivated.
- Setting a larger Differential will allow the boiler to run for longer periods, which can prolong boiler life. However, a large Differential may cause noticeable changes in ambient temperature as the system water temperature fluctuates. Consult the boiler manufacturer for a range of recommended Differential settings.

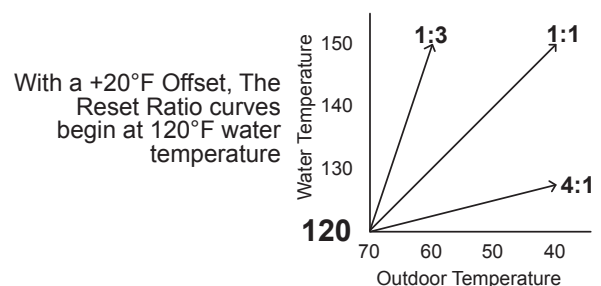
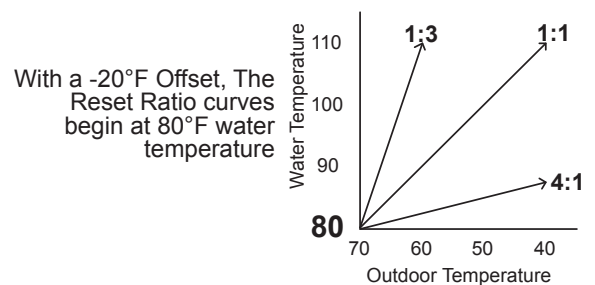
Reset Ratio **Default is 7** Center button pressed six times *◆ This is a good starting point for baseboard radiation. Radiant installation should start lower.*

- The Reset Ratio controls how much heat will be input to the system based on outdoor temperature. The Reset Ratios are shown as Outdoor Temperature:Water Temperature.
- A 1:1 Reset Ratio signifies for each degree it gets colder outside, the Calculated water temperature will rise 1 degree.
- The other Reset Ratios are shown on the first page.
- The Reset Ratio curves start at 70°F. At 70°F the HWE-SS will require 100°F water. Note that 70°F is not the outdoor temperature where the HWE-SS will begin giving heat. That point is determined by the Outdoor Cutoff. Also note the 100°F starting point can be changed by adjusting the Offset as described below.
- For new installations with standard baseboard heating, begin with a Reset Ratio curve of 7.
- For new installations with radiant heat, begin with a Reset Ratio curve of 2 or 3. (Refer to Tubing Design for desired curve selection.)
- Adjust the Reset Ratio curves in cold weather. If the ambient indoor temperatures are cold in the cold weather, pick the next higher Reset Ratio (that is, go from 7 to 8). If the ambient building temperatures are warm in the cold weather, pick the next lower Reset Ratio.
- After adjusting the Reset Ratio curve, wait at least 24 hours before making another adjustment.



Offset **Default is 0°F** Center button pressed seven times

- The Offset value moves the starting point of the Reset Ratio curves.
- Therefore, any change made to the Offset will immediately change the value of the Calculated water temperature by the same amount (unless the new value is below Lo Limit Temp). For example, if the Calculated water temperature were 150°F based on the specific outdoor temperature and Reset Ratio, then increasing the Offset from 0°F to 10°F would increase the Calculated water temperature to 160°F.
- In a new installation, start with an Offset value of 0°.
- Adjust the Offset value in mild weather. If the ambient indoor temperatures are warm in the warm weather, decrease the Offset. If the ambient building temperatures are cold in the mild weather, increase the Offset.
- The rule of thumb for baseboard radiation is to change the Offset by 4° for every degree you wish to change the ambient temperature. For radiant heat applications, change the Offset by 1° or 2° for every degree you wish to change the building temperature.



Set Back / Boost **Default is 10°F** **Center button pressed eight times**

- When the Set Back mode is chosen and contact terminals between SETBACK/T STAT are closed, normally by using a timer or other controls, the Calculated water temperature is lowered by an amount set by the Set Back *Sbc*. When contact terminals are opened, the newly Calculated water temperature will be boosted higher by the amount set by the Set Back *Sbc* for 1 hour. The normal Calculated water temperature will resume after the boost hour duration.

Lo Limit Temp **Default is 140°F** **Center button pressed nine times**

- The Lo Limit Temp value is the minimum water temperature the HWE-SS will circulate.
- When there is a call for heat (based on the outdoor temperature and the T STAT input), the HWE-SS will compute the temperature of the water to circulate based on the outdoor temperature, Reset Ratio, and Offset, as described in the previous sections.
- After this, the HWE-SS will compare the newly computed water temperature to the Lo Limit Temp. The HWE-SS will use either the computed value or the Lo Limit Temp value, whichever is HIGHER.
- The Lo Limit Temp should be set to the minimum water temperature recommended by the boiler's manufacturer.

CAUTION

Set the Lo Limit Temp to the minimum water temperature specified by the boiler's manufacturer. Failure to do so may shorten the life of the boiler.

OUTPUT LIGHT DISPLAY

- The red LED marked OUTPUT indicates the current heating mode of the HWE-SS.
- OUTPUT OFF - None of the outputs, Boiler, Heating System Pump, or DHW Pump, are active.
- OUTPUT FLASHING - There is a call for DHW. During a DHW call, the boiler will hold 200°F, the DHW Pump output will be active. The Heating System Pump may or may not be active depending on the DHW Priority settings and the length of the DHW call.
- OUTPUT ON - There is a call for heat. The Heating System Pump will be active, the Boiler output will be controlled to hold the Calculated Water Temperature, and the DHW Pump will be off.

SETBACK & BOOST / T STAT INPUT

- When the SETBACK/T STAT terminals are closed and the initial operating mode was set to *tt* (T STAT) the control will energize the Heating System Pump and the boiler, if it was not already on, until Calculated Water temperature is reached, then it will shut the Heating System Pump and Boiler off. When terminals are open the HWE-SS will not energize the Heating System Pump and will only energize the Boiler output on a DHW call.
- When the SETBACK/T STAT terminals are closed and the initial operating mode was set to *Sb* (Set Back / Boost) the control will energize the Heating System Pump and the boiler, if it was not already on, until Calculated Water temperature plus the *Sbc* (Set Back / Boost) setting is reached. When terminal are open the HWE-SS will energize the Heating System Pump and Boiler when Boiler Water Temperature is less than the Calculated Temperature less the *Sbc* (Set Back / Boost).
- The HWE-SS comes equipped with a factory installed jumper across the SETBACK/T STAT terminals. DO NOT remove this jumper unless it is being replaced by a dry contact switch.
- The SETBACK/T STAT input would typically be provided by a thermostat or a timer. When the thermostat is satisfied, no heat is required. When the thermostat calls for heat, the HWE-SS will activate the Heating System Pump and the boiler will hold the Calculated temperature.
- This input can also be used as a remote stop/start for the HWE-SS.
- When the SETBACK/T STAT terminals are first opened, the Boiler output will immediately turn off. However, the Heating System Pump output will continue to run on for 3 minutes to remove heat from the boiler.

HEATING SYSTEM PUMP OPERATION

- The Heating System Pump output is design to continuously circulate the heating water whenever heat is required.
- The Heating System Pump relay will energize whenever the outdoor temperature is below the Outdoor Cutoff temperature and the T STAT input is closed.
- When either the outdoor temperature rises above the Outdoor Cutoff, or the T STAT input is opened, the Heating System Pump will run on for 3 more minutes. This removes heat from the boiler.
- If the Heating System Pump output has not been activated for 7 days (as might occur in the summer), the relay will be energized for 15 seconds to exercise the pump.

DHW PUMP OPERATION

- The DHW Pump output is designed to continuously circulate 200°F boiler water through a domestic tank when there is a DHW call (connected across the DHW and COM terminals).
- When the DHW is satisfied, the DHW Pump will run on for 3 more minutes. This removes heat from the boiler and circulates it through the DHW tank.

TROUBLESHOOTING

No Display or Display of 888

Check the power to the HWE-SS. The HWE-SS requires 120VAC power to the orange wires. Turn the power off and back on to restore the display.

System or Outdoor Display shows OPN

Check that the wires from the sensor are continuous to the HWE-SS. Then follow the procedure for Incorrect Temperature Display.

System or Outdoor Display shows SHT

The HWE-SS sees a short across the input terminals. Remove the wires from the input terminals. The display should change to read OPN. If it doesn't, the HWE-SS may be damaged.

System or Outdoor Display shows an Incorrect Temperature

Remove the wires from the input terminals. The display should change to read OPN. If it doesn't, the HWE-SS may be damaged. Take an ohm reading across the detached sensor wires. The ohm reading should correspond to the chart at right. If it doesn't, the sensor may be damaged.

No Heat - No Outputs - Output Light OFF

Check the outdoor temperature and Outdoor Cutoff readings. If the outdoor temperature is above the Outdoor Cutoff, the HWE-SS will not give heat. Then check the T STAT terminals. If the T STAT terminals are not jumped together, the HWE-SS will not give heat.

No Heat - No Outputs - Output Light ON

Remove any connections to the Blue wires for the Heating System Pump. Test for continuity across the pair of Blue wires. If the wires are continuous, the HWE-SS is calling for the Heating System Pump to run. Check the pump to determine why it is not circulating.

No Heat - Heating System Pump Running - Output Light ON

Check that the displayed System water temperature is below the Calculated water temperature minus the Differential. If not, wait until the System temperature falls, and then the boiler should fire. Otherwise, remove all connections from the Black pair of wires for boiler control. Check for continuity across the pair of Black wires. If the wires are continuous, the HWE-SS is calling for the boiler to run. Check the boiler to determine why it is not firing.

No Heat - Output Light FLASHING

The HWE-SS is registering a call for DHW. If the DHW Priority (d_P) is set, the Heating System Pump will not run during the first hour of a DHW call. Generally the DHW will be satisfied before a drop in ambient temperature is noticeable. If the DHW load is large, change the Priority setting to none (dnO), this will allow the Heating System Pump to circulate heating water while the DHW tank is being satisfied.

Cold DHW - Output Light FLASHING

Check if the System water temperature display is approximately 200°F. If it is cooler, remove any connections across the Black pair of boiler wires. If the Black wires are continuous, then the HWE-SS is calling for the boiler to run. Check the boiler to determine why it is not firing. If the System Water temperature is hot, remove any connections to the pair of White wires for the DHW pump. Check for continuity across the pair of White wires. If the wires are continuous, the HWE-SS is calling for the pump to circulate. Check the pump to determine why it is not circulating.

TEMPERATURE (in degrees ° F)	Value (in Ohms)
0	42683
10	31215
20	23089
25	19939
30	17264
35	14985
40	13040
45	11374
50	9944
55	8714
60	7653
70	5941
80	4649
90	3667
100	2914
110	2332
120	1879
130	1524
140	1243
150	1021
160	842
170	699
180	583
190	489
200	412

CAUTION

When connecting power to the HWE-SS control, Heat-Timer recommends a surge suppressor to protect the control.