

INSTALLATION/OPERATING INSTRUCTIONS

HEAT-TROL[®]

VALUE SERIES model 700

A Hydronic Reset Control for Direct Modulating Burners

Other HEAT-TROL models are available for single, multi-stage, or valve applications.

Another Precision Control from HEAT-TIMER Corporation

How the Model 700 operates...

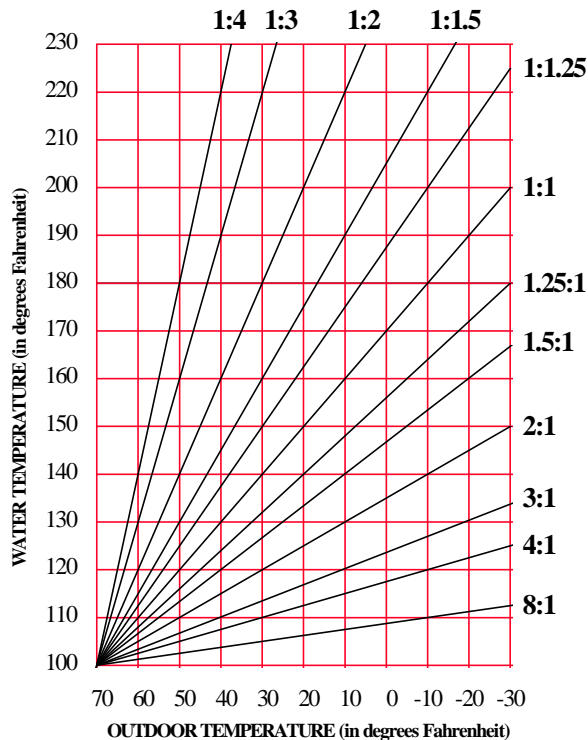
The **HEAT-TROL 700** establishes a building's ambient comfort by varying the temperature of the heating system's circulating hot water in response to changes in the outdoor temperature. In addition, it provides an outdoor temperature based circulator start/stop.

Two sensors are used, one to monitor the outdoor temperature, and one to monitor the temperature of the circulating hot water in the heating system. When the outdoor temperature falls to the system start point, the system circulator is energized 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 temperature then the system circulator is turned off.

Because of many physical characteristics, and the type of radiation, ie. baseboard or radiant, heat loss varies from building to building. For 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 installer fits a HEAT-TROL to a specific building by adjusting the "reset ratio" which is variable from 8:1 to 1:4. At a 2:1 "reset ratio" a 2-degree change in outdoor temperature will change the circulating hot water temperature by 1 degree; at a 1:3 ratio an outdoor change of 1 degree will change the water temperature by 3 degrees.



An optional clock can be inserted in the control to provide an automatic **SETBACK**. This lowers the hot water temperature for a designated period when the building is vacant or inactive. The control also features a **MORNING BOOST**, an automatically timed surge of heat which allows for a fast recovery from **SETBACK** conditions.

A HEAT-TROL can be used in conjunction with a room thermostat. For example, in a multi-zone application, thermostats can control the zone valves while the HEAT-TROL sets the water temperature.

INSTALLATION

1. Mount the control in a convenient location in the vicinity of the boiler, away from extreme heat or cold. Remove the cover by loosening the screw recessed at the center of the cover to reach the mounting holes on the back of the enclosure. Use the two key hole mounts at the top left and right which are visible through holes in the circuit board. Finally, the third mounting hole is at the bottom center of the control.

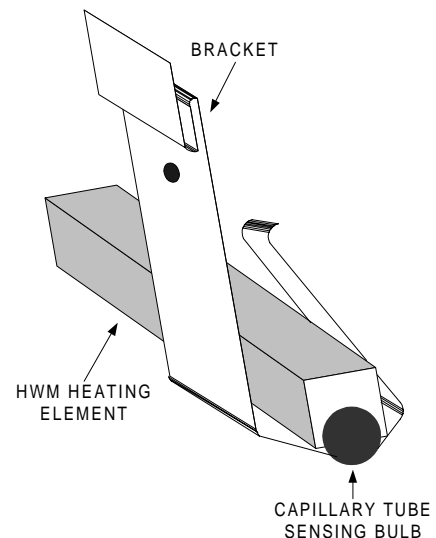
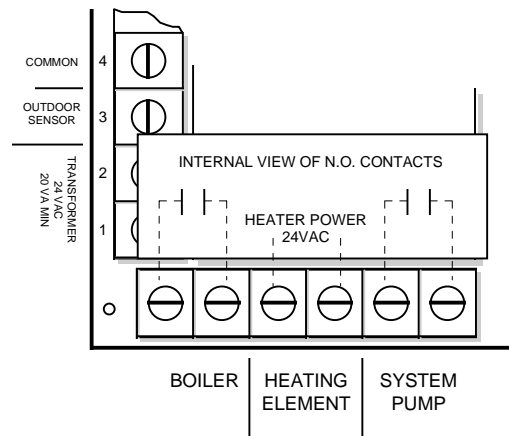
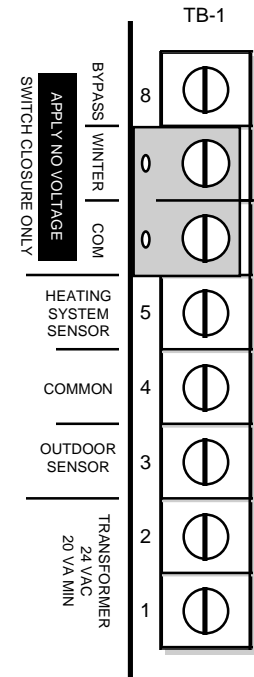
2. Install the heating system sensor in the hot water supply pipe to the building at least ten feet beyond the output of the valve. The preferred type of installation is in a 3/8" ID well, using heat conductive compound. Run the sensor wire to the control and connect the two conductors to terminals 4 and 5 (counting from the bottom) on terminal block TB-1.

3. Install the outdoor sensor in the shade (never in direct sunlight) on the north side of the building away from doors, windows and exhaust fans. Mount the sensor about 10 feet above ground level. Use the plastic clip provided so the sensor is mounted away from the building's surface and not touching it. Run the sensor wire to the control and connect the two conductors to terminals 3 and 4 on terminal Block TB-1.

To extend sensor wiring: Additional wire can be spliced to the sensor to extend to 500 feet. Avoid running wires in conduit with line voltage or telephone wiring.

4. Wire the power input to terminals 1 and 2 on terminal Block TB-1. The power input is 24VAC 60Hz. The transformer must be minimum 20VA.

5. Route boiler and pump wires through the "knock-out" hole on the very bottom of the enclosure. If the boiler or pump wires carry Class 1 voltages, then all other wiring must enter the enclosure through a different opening. Wire N.O. heating circulator pump contacts to pump starter. Wire N.O. boiler contacts in series with the boiler limit controls. Note: Each relay has an output rating of 3A resistive, 1/6 HP.

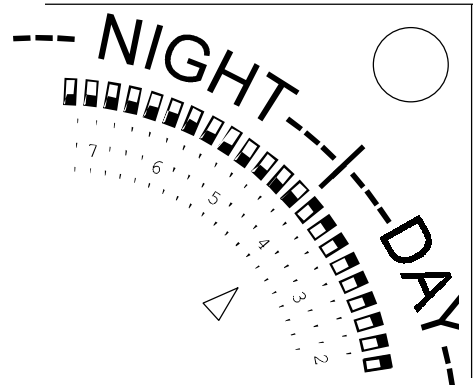


WARNING: The HEAT-TROL 700 is an operating control only. The boiler must have all safety and limit controls required by code. It is the responsibility of the installer to verify that all the safety and limits are working properly before the HEAT-TROL is installed.

6. Relocate the boiler capillary tube by following the capillary tube from the gas valve and finding the well in the header/manifold. Carefully pull the capillary tube sensing bulb from the well and feed it back to the gas valve. Slide the capillary tube sensing element into the HWM heating element as shown. Then clip or screw the HWM heating element bracket into a convenient location on the boiler jacket near the gas valve. Finally, bring the two wires from the HWM heating element to the two center screws of the HWM output as shown above.

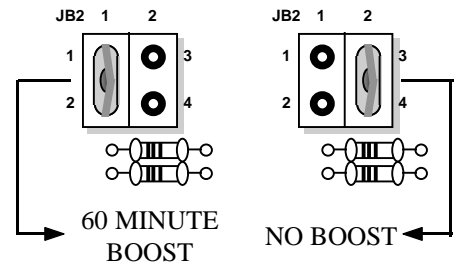
7. Set the gas valve temperature setting. The valve will have a range of selectable temperature settings. Dial in an 150°F setting.

8. Plug in the optional SETBACK clock. This fuel saving feature allows the Model 700 to maintain a lower level of heat during the night, or whenever the building is not being occupied. The lower level of heat is referred to as SETBACK, while the normally calculated water temperature is referred to as NORMAL (see graph on pg. 5).

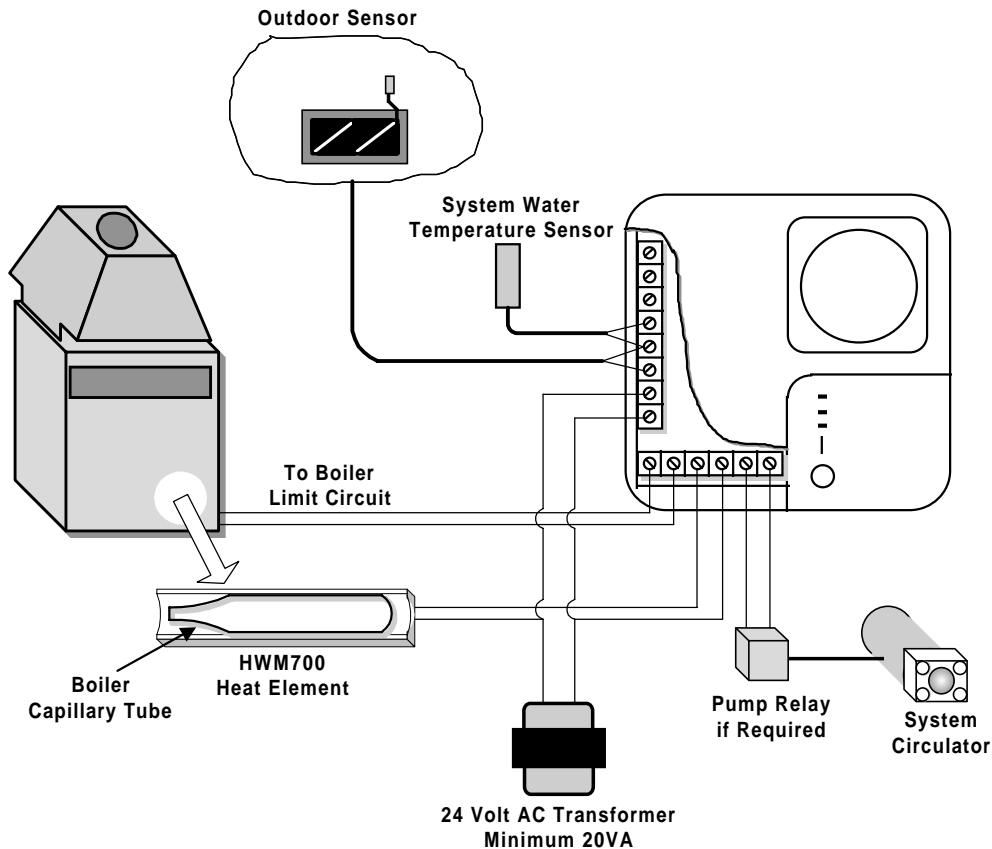


Set the time on the clock by rotating clockwise the minute hand in the center. Rotate the minute hand until the correct time on the outer dial is aligned with the triangular marker on the inner dial (at the two o'clock position). To set the NORMAL times, push the trippers to the outside of the dial. To set SETBACK times, push the trippers toward the center of the dial.

When SETBACK ends, a period of higher heat may be desired to quickly return the building to a comfortable level. This timed period of higher heat is called MORNING BOOST. To select the fixed 60 minute BOOST, it is necessary to install a jumper in block JB2 as shown. Block JB2 is located under the clock socket. During the BOOST period, the HEAT-TROL will hold 180°F water temperature or the value for the Maximum Water Temperature (see pg. 6) whichever is lower.



TYPICAL WIRING DIAGRAM



9. Using the indirect BYPASS function. This option should be used whenever it is desirable to increase the heat level from a remote location. The BYPASS function maintains 180°F or the Maximum Water Temperature (see pg. 6) whichever is lower. This is useful when there is an external call for more heat. When terminals COM (#6 on TB2) and BYPASS (#8 on TB2) are shorted together, the HEAT-TROL will enter the BYPASS mode.

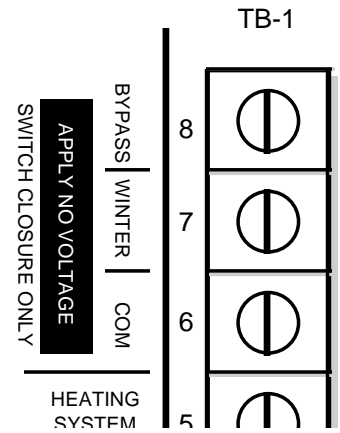
10. Installing a remote summer switch. This option should be used whenever it is desirable to turn the HEAT-TROL off from a remote location. It can be used with zone control valve end switches wired together in parallel, or with an existing room thermostat. Remove the factory installed metal jumper from the terminal strip and place one wire from the remote switch to the COM terminal (#6 on TB1). Then attach the other wire to the WINTER terminal (#7 on TB1). Whenever these terminals are shorted together, the HEAT-TROL will run normally. When these terminals are open, the HEAT-TROL will turn off the system circulator.

11. Set-up the knobs under the front cover. The position of these knobs will vary depending on the building and the heat levels required by the occupants. However, the following initial start-up settings, which are factory set, are appropriate for most installation. (For further description of these settings, see OPERATION - Adjusting the Water Temperature.)

- A. Adjust OFFSET to 0°F (12 o'clock position).
- B. Adjust RATIO knob to 1:1 (12 o'clock position).
- C. Adjust SETBACK to 20°F (12 o'clock position). Then enable the MORNING BOOST by placing the provided blue jumper on left hand block of JB2.

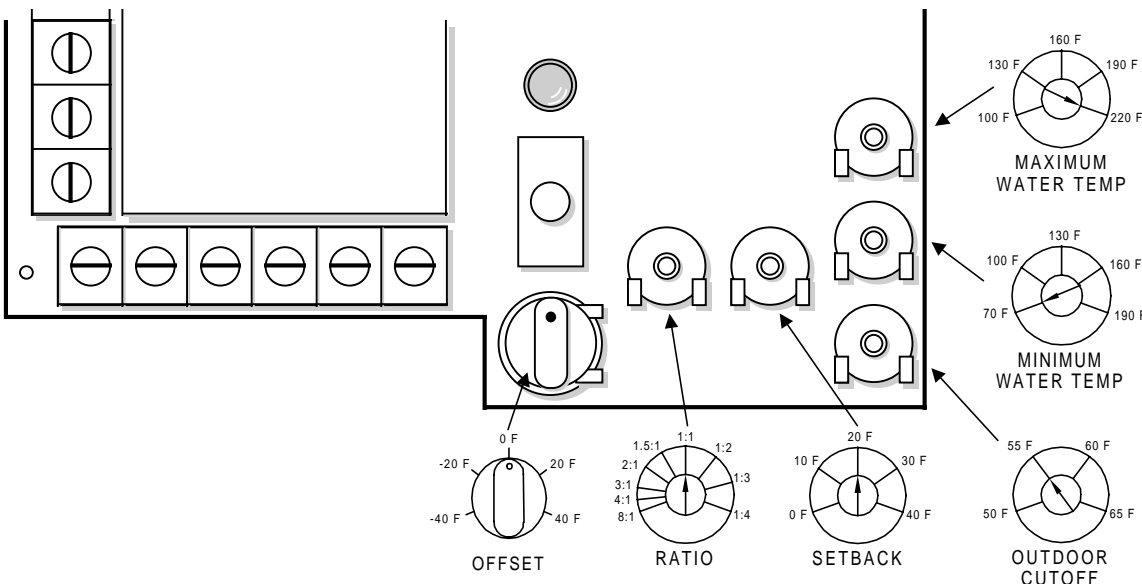
NOTE: Step C is not necessary if the optional clock is not installed.

- D. Adjust the OUTDOOR CUTOFF to 55°F (10 o'clock position).
- E. Adjust the MINIMUM WATER TEMPERATURE to the temperature recommended by the boiler manufacturer. If none is recommended, turn the knob fully counter-clockwise to 70°F (8 o'clock position).
- F. Adjust the MAXIMUM WATER TEMPERATURE to the highest value recommended for the system components. If none is recommended, turn the knob fully clockwise to 220°F (4 o'clock position).



CAUTION

Removing the factory installed WINTER to COM metal jumper will prevent the HWM from giving heat. Only remove the jumper if replacing it with dry contacts as described in 10.



OPERATION

Basically the operation of the HEAT-TROL 700 can be broken into two major categories. The first consists of initially adjusting the water temperature to match the specific needs of the building's occupants. Once the appropriate settings have been successfully determined, they will not need to be changed. The second category consists of day to day operations. These are very basic, and can all be done without removing the front cover.

ADJUSTING THE WATER TEMPERATURE

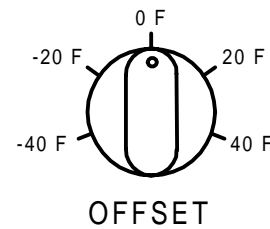
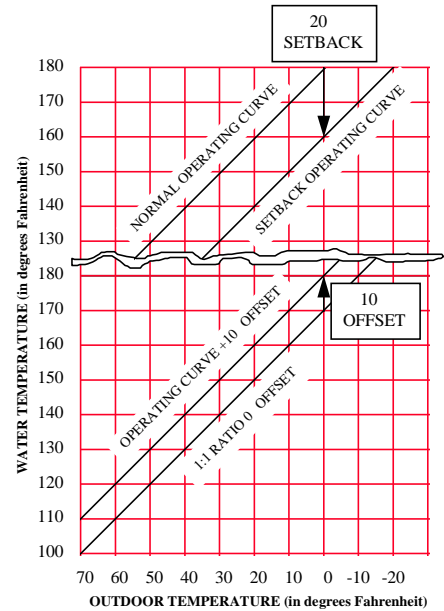
To adjust the water temperature for comfort, it is necessary to learn the function of each of the knobs under the front cover.

Heat Adjustment or Offset - the offset "fine tunes" the control's operation by shifting the reset ratio up or down (see side graph). This is the only knob that is accessible when the front cover is in place, since it will quickly cause the temperature of the water to be increased or decreased. If the building is too cold, simply rotate the offset knob an 1/8 turn clockwise. If the building is too warm, rotate the knob an 1/8 turn counter-clockwise. However, the offset knob adjustment should only be made when the outdoor weather is relatively mild. If a building is too hot or cold in really cold weather, adjust the reset ratio knob, described next. (NOTE: the offset knob has a range from -40° to 40° from fully counter-clockwise to fully clockwise, respectively. The 12 o'clock position represents an offset of 0°.)

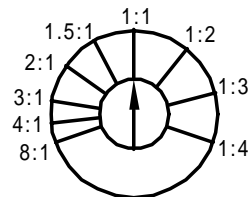
Reset Ratio - the reset ratio knob adjusts the amount of change of water temperature as compared to outdoor temperature (see graph on cover page). This knob should be adjusted when the weather turns cold. If the building is too cold, move the reset ratio knob clockwise one ratio. If the building is too warm in the cold weather, move the reset ratio knob counter-clockwise one ratio. After a change to the reset ratio, wait several days and evaluate the comfort level before making another change.

Setback - the setback feature is only used if the optional clock is installed. When the building is not occupied, or during the night when a lower heat level can be maintained, the setback lowers the normally calculated water temperature by the number of degrees indicated on the knob (see side graph). When the setback clock is being used, it is also necessary to determine if a MORNING BOOST period is desirable. The MORNING BOOST will begin as soon as the setback period is over, and can be selected for 0 or 60 minutes by using the jumper provided. During the boost period the water temperature will be held at 180°F or the value of the Maximum Water Temperature (see pg. 6) whichever is lower. The purpose of the MORNING BOOST is to allow a building to recover quickly from the cooler setback temperatures.

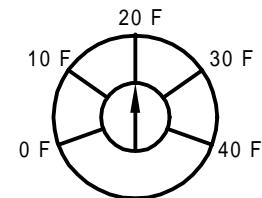
Therefore, the number of setback degrees depends on two factors. The first is how cool the setback temperatures should be. If the temperature is too cold at night, reduce the amount of setback by 5° (rotating counter-clockwise) to provide a more comfortable temperature. The second is how



OFFSET



RATIO



SETBACK

long it takes the building to recover from the setback temperatures. If the building is still too cold after an hour MORNING BOOST, then the amount of setback is too great. Once again, reduce the amount of setback by 5°. This will make the building less cold during the setback, so it will take less time to regain the normal comfort level.

Outdoor Cutoff - The outdoor cutoff selects the outdoor temperature at which the control will start providing heat. Above the selected temperature, the heating system will be off. Below the selected temperature, the pump will run continuously, and the water temperature will be based on the offset and reset ratio knobs.

Minimum Water Temperature - The minimum water temperature knob must be set to the boiler manufacturer's specification. If no minimum is specified, then for maximum fuel efficiency and comfort this knob should be turned all the way counter-clockwise to the minimum position. This will allow the HEAT-TROL to determine the water temperature which is comfortable.

Maximum Water Temperature - In radiant heat applications, it may be necessary to limit the temperature of the water going to the system. This may be done for comfort, or because the tubing or flooring may be damaged by high temperatures. Generally the maximum water temperature should be adjusted to the highest possible setting, allowing the HEAT-TROL to reset the water temperature up to that point.

WARNING: The HEAT-TROL is an operating control only. If excessive supply temperatures will cause system damage, separate limit controls must be installed.

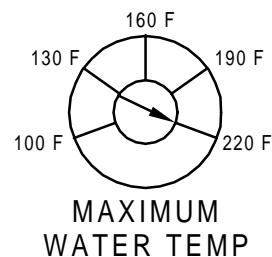
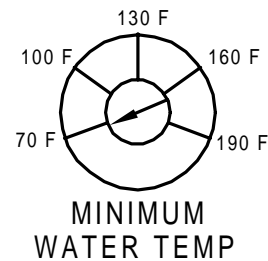
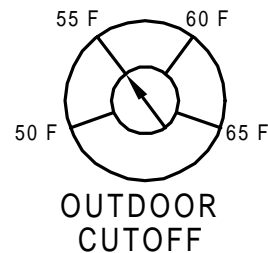
DAY TO DAY OPERATIONS




Flashing Green and/or Yellow lights - This indicates a problem with the sensors. See TROUBLESHOOTING (pg. 8) to find the source of the problem.




Green light/SETBACK - The green light will come on by itself when the control is in setback. This will happen when the optional clock is set to the SETBACK position (see #8 of INSTALLATION, pg. 3). If the building is cold, change the clock settings so the control is in the NORMAL mode.




Yellow light/BOOST/BYPASS - The yellow light will come on by itself when the system is maintaining 180°F or the Maximum Water Temperature (see above) whichever is lower. This will occur when the control is in BOOST or BYPASS. BOOST may occur after setback and lasts for 60 minutes (see Setback pg 5). BYPASS will occur for as long as the remote BYPASS terminals are shorted (see pg. 4). If the building is too warm during this period, give no BOOST after SETBACK, or remove the short from the remote terminals.

Red light/CALL FOR HEAT - The red light will be on whenever the system pump output is energized.



-  SETBACK
-  BOOST
-  CALL FOR HEAT

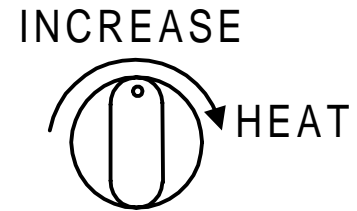
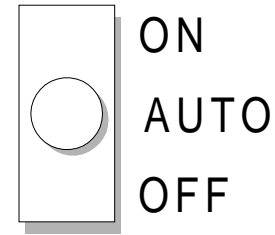
-  SETBACK
-  BOOST
-  CALL FOR HEAT

-  SETBACK
-  BOOST
-  CALL FOR HEAT

Using the ON - AUTO -OFF switch - This three position switch overrides the HEAT-TROL's temperature calculations for special situations. In the AUTO position, the control will calculate water temperature and run the system to maintain that temperature. In the ON position, the heating pump will run constantly and control will hold 180°F or the Maximum Water Temperature (see previous page) whichever is lower. In the OFF position, the heating pump will not run.

Note: In the ON and OFF position, the switch directly turns the system pump relay on or off. None of the normal functions of the HEAT-TROL have any effect.

Changing the Heat (Offset) Knob - The heat adjustment knob can quickly change the heat level in the building. Simply rotate the knob clockwise for more heat, and counter-clockwise for less heat. However, once the need for increased (or decreased) heat has ended, it is best to return the knob to its predetermined position (see Adjusting the Water Temperature, pg. 5).



TROUBLESHOOTING

Many of the problems encountered during normal operation can be solved by studying the status of the lights described in DAY to DAY OPERATIONS and checking the position of the ON-AUTO-OFF switch. However, some additional considerations are offered below:

No lights on, no heat, no pump - This may occur for any of the following reasons:

ON - AUTO - OFF switch is in the OFF position - Simply move the switch back to AUTO, and the control should resume normal operation.

Outdoor temperature above the Outdoor cutoff - If the outdoor temperature is higher than the outdoor cutoff, no heat will be given. Check the outdoor cutoff knob and see if the setting is appropriate.

Outdoor sensor is registering too high - If the outdoor sensor is in the sun or near a vent or window, it may be registering a higher temperature than the actual outdoor air temperature. (This can be accurately checked by following the instructions for Checking the Sensors, next page). If the HEAT-TROL registers it is warm outdoors, it will not deliver heat.

Control has been damaged or is not powered - To test this, simply move the ON-AUTO-OFF switch to the On position. The red light should turn on. If it does not, check the power to the control, it may be interrupted. If 24VAC is being delivered to the HEAT-TROL, then turn the power off and back on. If the red light turns on, check the HEAT-TROL is on its own transformer and isolate the control's power from any boiler or pump power. Finally, if the red light still does not light, the HEAT-TROL may be damaged. Contact the factory for additional support.

Green light flashing/Heating System Sensor Fault - this indicates a problem with the heating system sensor. Flashing green with long ONs and short OFFs means a short circuit. Flashing green with short ONs and long OFFs means an open circuit. Check the wiring to the sensor for breaks or damage. If there is no problem with the wire, go to Checking the Sensors.

Yellow light flashing/Outdoor Sensor Fault - this indicates a problem with the outdoor sensor. Flashing yellow with long ONs and short OFFs means a short circuit. Flashing yellow with short ONs and long OFFs means an open circuit. Check the wiring to the sensor for breaks or damage. If there is no problem with the wire, go to Checking the Sensors.

Checking the Sensors - Erratic heating problems may be caused by sensors that are not working correctly. To test a sensor, first remove the pair of wires from the terminal strip. Then take resistance reading across the detached sensor wires. The resistance of the sensor should correspond to the chart.

If the resistance measured at the sensor wires is significantly different from the chart value, then replace the sensor. Otherwise, the HEAT-TROL may have a problem. Contact the factory for further support.



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

For Technical Support or Additional Product Information
Contact:

Heat-Timer Corporation
20 New Dutch Lane
Fairfield, NJ 07004
Phone (973) 575-4004 Fax (973) 575-4052

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