



INSTALLATION & OPERATION
MANUAL

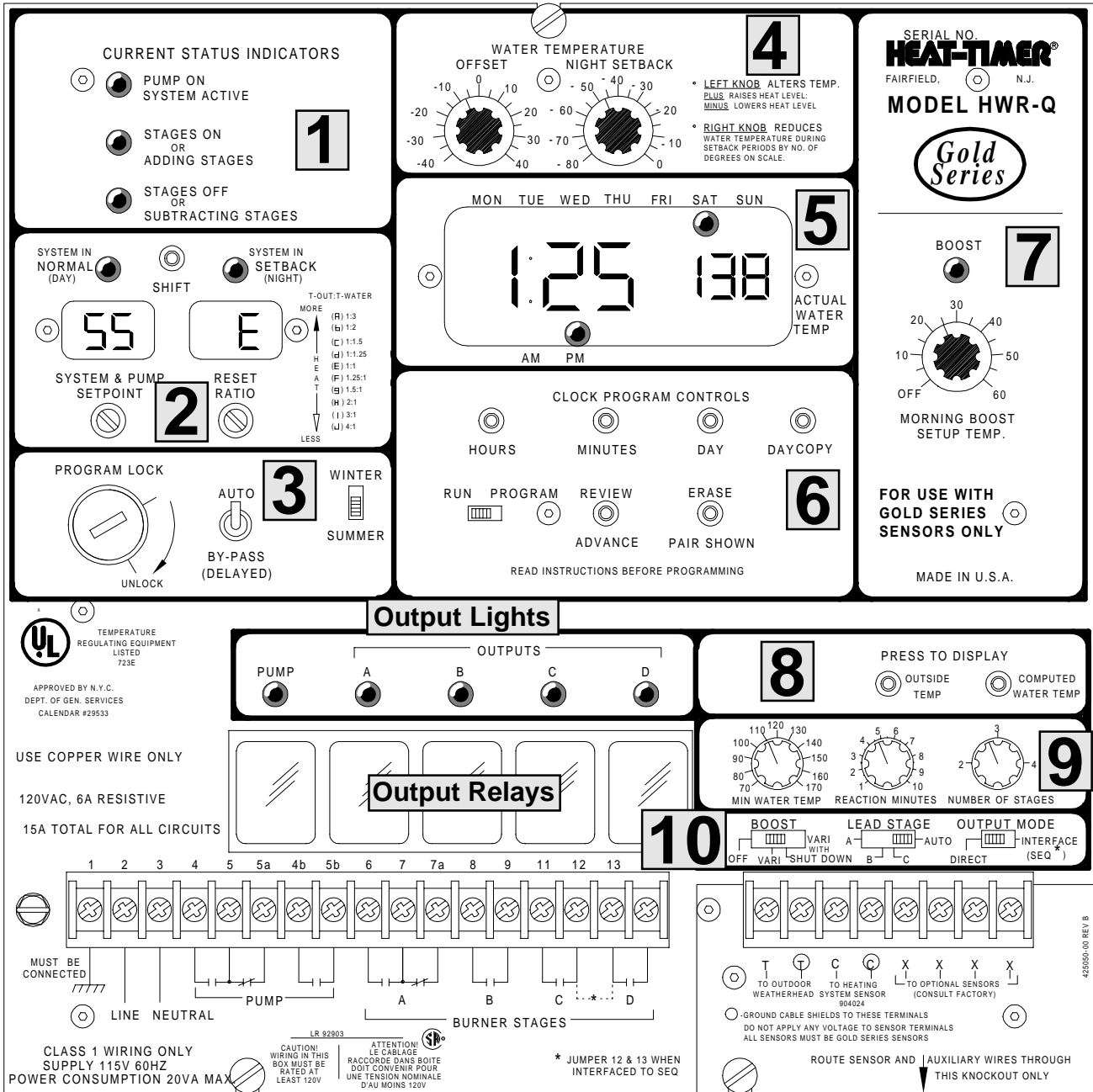


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THIS HEAT-TIMER MODEL HWR-Q HAS BEEN APPROVED BY UNDERWRITERS LABORATORIES E-60760(M) AND THE CANADIAN STANDARDS ASSOC. THIS MODEL IS APPROVED FOR INSTALLATION AND OPERATION IN THE CITY OF NEW YORK BY THE DIVISION OF PUBLIC STRUCTURES. THE CALENDAR NUMBER APPROVAL IS 29533.

HT #059137 REV A



Functions

To help simplify these instructions, sections of the control panel are keyed and referred to in the text by the above numbers

Control Panel

Functions

1

CURRENT STATUS INDICATORS

- ***Indicator lights*** show status of heating system at all times.

2

SYSTEM & PUMP SET POINT and RESET RATIO

- ***Digital display*** of system and pump sensor set point
- ***Digital display*** of reset ratio adjustment 1:3 to 4:1 (Outdoor:Water)
- ***SHIFT*** manual switch to change NORMAL (DAY) to SETBACK (NIGHT) and reverse.
- ***RED LIGHT*** to show when unit is in ***NORMAL (DAY)*** mode.
- ***RED LIGHT*** to show when unit is in ***SETBACK (NIGHT)*** mode.

3

PROGRAM LOCK , BY- PASS SWITCH and WINTER / SUMMER SWITCH

- ***KEY*** locks program, outside set point, and reset ratio setting
- ***BY-PASS SWITCH*** puts unit in ***AUTO*** mode or ***BY-PASS***.
- ***WINTER / SUMMER SWITCH*** auto / heat-off switch.

4

WATER TEMPERATURE ADJUSTMENT

- ***OFFSET*** fine tunes the reset ratio adjustments.
- ***NIGHT SETBACK*** lowers ambient temperatures during the SETBACK (NIGHT) mode.

5

CLOCK & OUTDOOR TEMPERATURE DISPLAY

- ***Clock*** displays ***PRESENT TIME*** while the unit is in AUTO mode.
- ***RED LIGHT*** indicates ***AM or PM***.
- ***RED LIGHT*** indicates the ***day of the week***.
- ***ACTUAL WATER TEMP*** displays current heating water temperature.

6

CLOCK PROGRAM CONTROLS

- Used to program 7-day clock for NORMAL (DAY) and SETBACK (NIGHT) heat levels.

7

BOOST

- ***RED LIGHT*** indicates unit is in ***BOOST*** and ***BOOST*** adjustment curve knob.

8

PRESS TO DISPLAY

- ***OUTSIDE TEMPERATURE*** displays temperature of the outdoor sensor.
- ***COMPUTED WATER TEMPERATURE*** displays temperature HWR-Q will maintain.

9

MIN WATER TEMP, REACTION MINUTES, and NUMBER OF STAGES

- ***MINIMUM WATER TEMPERATURE*** adjustment.
- ***REACTION MINUTES*** adjustment to prevent boiler short cycling.
- ***NUMBER OF STAGES*** adjustment for HWR-Q controlling stages directly.

10

BOOST, LEAD STAGE, and OUTPUT MODE

- ***BOOST*** switch to select type of morning Boost and shutdown.
- ***LEAD STAGE*** selection for HWR-Q controlling stages directly.
- ***OUTPUT MODE*** switch to between direct operation, or output to SEQ-8 output panel.

Control Panel

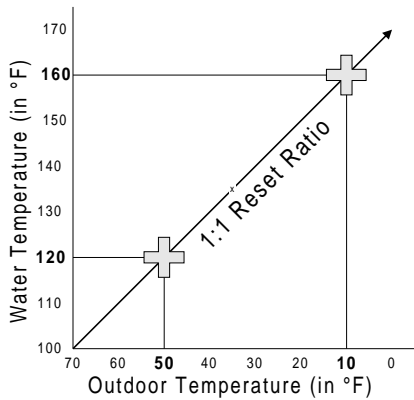
Understanding the "Gold Series" Model HWR-Q

The Model HWR-Q controls a hot water heating system to provide a building with comfortable and even heat levels. The HWR-Q varies the temperature of the circulating heating water in response to changes in the outdoor temperature. The heating water temperature is controlled by staging up to four on/off boilers (or 2 lo/hi fire boilers) directly, or by staging up to eight on/off (or 4 lo/hi fire boilers) with an output panel (SEQ-4 or SEQ-8).

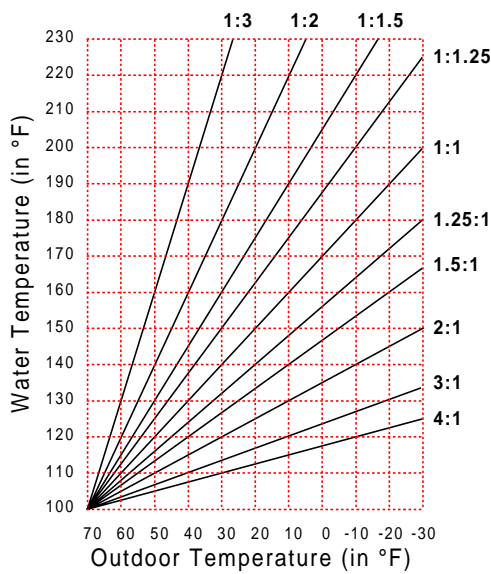
The HWR-Q also controls the system circulating pump with an adjustable outdoor cutoff. When the outdoor temperature is warm, the pump is off and no heating water is circulated through the system. When the outdoor temperature drops, the pump is activated and the heating water circulates through the system. The temperature of the heating water is controlled by the Reset Ratio and changes with outdoor temperature.

The Reset Ratio Concept

When a building is being heated, heat escapes through the walls, doors, and windows to the colder outside air. The amount of heat that escapes depends on the outside temperature. The colder the outside temperature, the more heat escapes. If you can input heat into the building at the exact same rate that it is lost out of the building, then the building temperatures will remain constant. The Reset Ratio is an adjustment which allows you to achieve this equilibrium between heat input and heat loss.



The starting point for most systems is the 1:1 (Outdoor Air Temperature : Heating Water Temperature) ratio. This means that for every degree the outdoor temperature drops, the temperature of the heating water will increase one degree. The starting point of the curves is adjustable, but comes factory selected at 70°F Outdoor Temp. and 100°F Water Temp. For example with a 1:1 ratio, if the outdoor temperature is 50°F, this means the temperature has fallen 20° from the starting point of 70°F. Therefore, the heating water temperature will be increased 20° to 120°F.



Each building has different heat loss characteristics. A very well insulated building will not lose much heat to the outside air, and may need a Reset Ratio of 2:1 (Outdoor:Water). This means the outdoor temperature would have to drop 2 degrees to increase the water temperature 1 degree. On the other hand, a poorly insulated building with insufficient radiation may need a Reset Ratio of 1:2 (Outdoor:Water). This means that for each degree the

outdoor temperature dropped the water temperature will increase 2 degrees. The HWR-Q has a full range of Reset Ratios to match any buildings heat loss characteristics.

Computed and Actual Water Temperature

The HWR-Q constantly monitors outdoor temperature. When the outdoor temperature falls below an adjustable outdoor set point temperature, the HWR-Q activates the system pump and begins to calculate the Computed Water Temperature. The Computed Water Temperature is the temperature of the circulating system water the HWR-Q calculates based on outdoor temperature and the Reset Ratio curves. If the HWR-Q has been set up correctly, then by circulating water at the Computed Water Temperature, the amount of heat entering the building will equal the heat loss.

The HWR-Q also monitors the Actual Water Temperature. This value is constantly displayed on the small right-hand display on the panel. When the Actual Water Temperature is different from the Computed Water Temperature, the HWR-Q will turn a boiler stage on or off to regulate the circulating system water temperature.

Sequence of Operation

The HWR-Q checks outside temperature by means of a solid state sensor located on the exterior of the building. At the same time it monitors the water temperature of the building's heating system by means of a heating system sensor located on a common supply line.

Whenever the outdoor temperature falls below a set point, the system pump is activated and the HWR-Q regulates the heating system to hold the Computed Water temperature. As the outdoor temperature changes, the HWR-Q adjusts the actual water temperature to hold a constant or Normal (Day) heat level. The Normal heat level is for when occupants are present and active.

The HWR-Q can also hold a lower or Setback (Night) heat level. This lower level of heat is for when the building is unoccupied, or tenants are sleeping. The HWR-Q has the capability of programming up to 4 Normal and 4 Setback times for each day of the week. When the building comes out of Setback, there is an optional Boost setting to quickly bring the building up to comfortable temperatures.

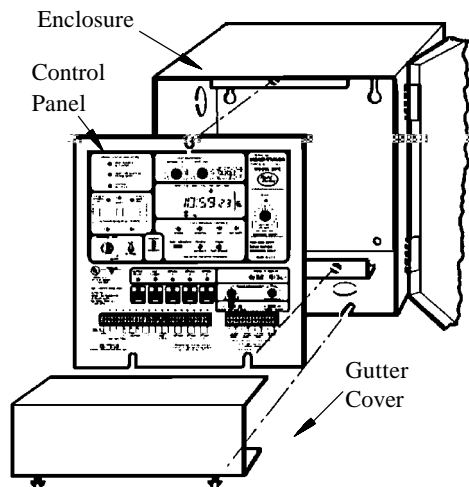
Getting the installation started

Installation of this control is simple if you follow the instructions carefully. The installation consists of four basic steps:

- Locating and mounting the control,
- Locating and mounting the sensors, both the outside sensor and the heating system sensor,
- Wiring the power, input and output lines,
- Creating an initial pilot program of settings.

Warning: *The Heat-Timer Model HWR-Q is strictly an operating control; under no circumstances should it be used as a primary limit or safety control. The boiler must have its own certified limit and safety controls as required by local codes. These are the responsibility of the installing contractor who must verify proper operation and correct any safety problems prior to starting the HWR-Q installation.*

First Step: Mount the Control



Locate an appropriate site

- Near the equipment to be controlled
- Away from excessively high or low temperatures
- At eye level, or where the displays are easily visible
- The surface must be strong enough to hold the weight of the control and the metal enclosure.
- Leave 12" of clearance under the enclosure to allow access to gutter cover screws.

If using an SEQ panel (to provide additional output stages) with the HWR-Q

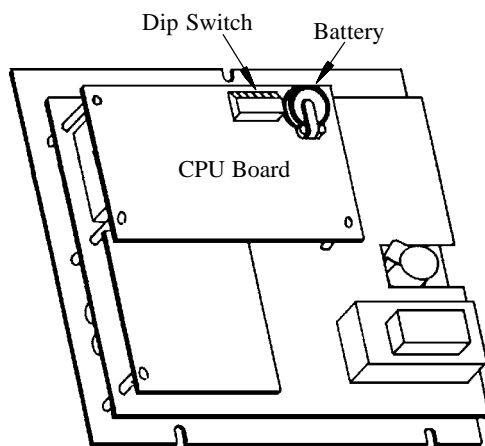
- Select a location wide enough to mount both enclosures 5" to 6" apart

Remove the HWR-Q from the yellow metal enclosure

- Take off the gutter cover by loosening the screws at its bottom
- Remove the top center screw holding the panel to the enclosure
- Loosen the two screws at the bottom of the enclosure
- Lift the panel from the enclosure

Screw the enclosure to the mounting surface through the holes provided.

On the rear of the panel:



Activate the battery

- Turn the HWR-Q panel over to reveal the piggyback circuit board (CPU board).
- Remove the insulating strip from the coin-type battery.

CAUTION: Do not activate the battery unless you plan to power the control at once. If the control is not powered, the battery will lose its charge in 100 days.

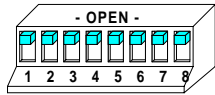
Set the dip switches (see chart next page)

- If the HWR-Q is controlling an SEQ-4 (HT #926525-00) or an SEQ-8 (HT #926523-00), then do not set any dip switches. All the switches should be in the OPEN position.
- Set dip switch number 7 for Shared Domestic Hot Water (DHW). The Shared DHW will prevent Stage A from being the lead stage. In addition, Stage A will always be the last stage turned on, and the first stage turned off. This allows Stage A to open a valve or activate a boiler which is piped to heat a DHW tank. If the DHW tank is not calling, and the

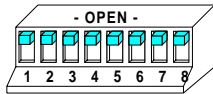
Installing Outdoor Sensor

DIP SWITCH CHART

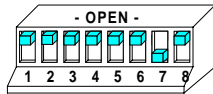
Interface to SEQ-4 or SEQ-8



Optional Shared DHW

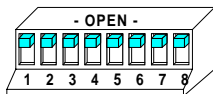


Normal Operation
Any stage can be the lead stage

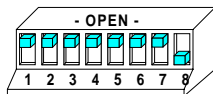


Shared DHW
Stage A is never lead, always last on, first off

Optional Lo/Hi Fire Operation



Normal Operation
Any stage can be the lead stage



Lo/Hi Fire
Only stages A and C can be the lead stage

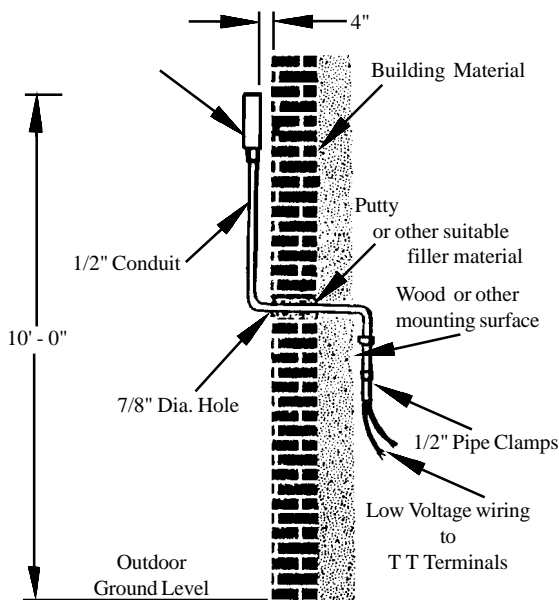
remaining heating stages (B, C, and D) are not sufficient to heat the water, then Stage A will be brought on for the heating system.

- Set dip switch number 8 for lo/hi fire boilers. With the lo/hi fire option, only stages A and C (the lo fire stages) will be able to be the lead stage.

Set the dip switch

- Locate the dip switch on the rear of the HWR-Q next to the battery
- Set the switches as shown below. The OPEN position is away from the circuit board, and the CLOSE position is down toward the circuit board

Second Step: Install the Sensors



Installing the outdoor sensor

- Only use the Heat-Timer Gold Series sensor included with the unit (#904025). If you are replacing an earlier model Heat-Timer, it is necessary to upgrade the sensor.
- Locate the sensor in the shade on the north side of the building. The sensor should never be in direct sunlight.
- 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' using shielded 2 conductor cable (Belden #8760 or equivalent). Do not ground the shield at the sensor.
- Do not run sensor wires in conduit with line voltage wiring.

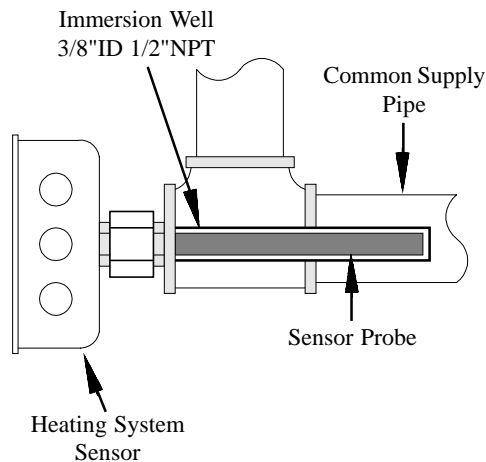
CAUTION: Determining the proper location for the outdoor sensor is very important. The HWR-Q will base the heat on the outdoor temperature information it receives from this location. If the sensor is in the sun, or covered with ice, its reading will be different from the actual outdoor temperature.

The Heating System Sensor (HSS) must be located where it will indicate the temperature of the water being *supplied* to the heating system.

Locating the HSS

- The sensor must be placed in the common supply header after all boiler connections but before any major takeoffs. Ideally, the sensor should be located approximately 10' past the boilers.
- The sensor must be located where it sees the output of all the boiler stages. If a boiler is piped so the sensor does not see the output of the boiler, the HWR-Q will not sequence the boilers correctly.

CAUTION: If the HSS can not sense the heating system water temperature being supplied to the building, the HWR-Q will not provide comfortable heat levels. Be sure the HSS is located on a main supply pipe which can not easily be isolated from the system.

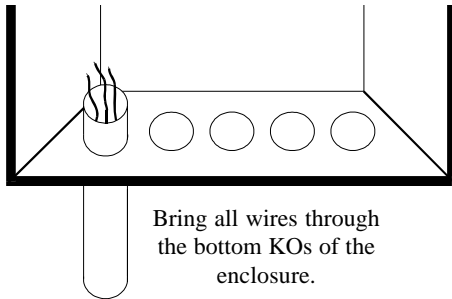


Installing the HSS

- Only use a Gold Series sensor. If you are replacing an earlier model Heat-Timer, it is necessary to upgrade the sensor.
- Install a 3/8\"ID 1/2\"NPT immersion well (Heat-Timer part #904011 or equivalent).
- Insert the sensor probe of the supplied immersion sensor (HT #904024) into the well, and screw the handy-box into the threaded top of the well.
- The sensor wires can be extended up to 500' using shielded 2 conductor cable (Belden #8760 or equivalent). Do not ground the shield at the sensor.
- Do not run sensor wires in conduit with line voltage wiring

Wiring the Output Terminals

Third Step: Wire the Power and Output Terminals



CAUTION: If using the HWR-Q alone (without the output panel SEQ-4 or SEQ-8) the factory installed jumper between terminals 12 and 13 must be removed.

Wire the power terminals

- Bring the power wires through the bottom **left** hand knock out of the enclosure. **Do not bring wires through sides or the top as this will interfere with servicing the control.**
- Attach 120V 60 Hz to terminals **2 LINE**, and **3 NEUTRAL**.
- Terminal **1**, ground, must be connected.
- Class 1 copper wire is required by UL.

Wire the heat circulation pump

- The **PUMP** contacts are dry contacts only. They do not source any power.
- Wire the Normally Open (N.O.) dry contacts, Terminals **4** and **5**, to the pump starter.
- Terminals **4b** and **5b** are separate N.O. dry contacts which will be continuous whenever Terminals **4** and **5** are continuous. They can be used to run a second pump, or any other output which should always be on when the outdoor temperature falls below the **SYSTEM & PUMP SETPOINT**.
- If you wish to lead lag two system pumps, and/or if you want to interlock a flow switch to activate a second pump if the primary system pump fails, use Heat-Timer SCP panel (HT #926541-00).

Wire the outputs

For up to 4 on/off boilers (without an SEQ-4 or SEQ-8)

- The HWR-Q outputs are dry contacts only. They do not source any power.
- Remove the factory installed jumper between terminals **12** and **13**
- Bring the boiler wires through a bottom left hand KO of the enclosure
- The Normally Open (NO) contacts for each boiler must be in series with the boiler limit circuits
- If the boilers need the secondary pumps to run on after the boiler is turned off, or need an interlock to combustion air, use Heat-Timer SCP panel (HT #926541-00).
- Attach the first boiler to the NO contacts marked **BURNER STAGE A** (terminals 6 & 7), the second boiler to **B** (8 & 9), the third boiler to **C** (11 & 12), and the fourth boiler to **D** (13 & 14).
- For wiring diagram, see pg. 36

For up to 2 lo/hi boilers (without an SEQ-4 or SEQ-8)

- The HWR-Q outputs are dry contacts only. They do not source any power.

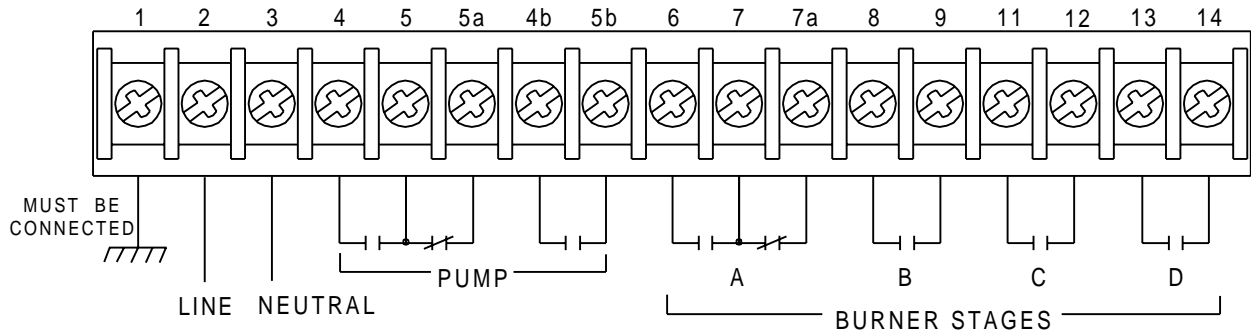
Wiring the Output Terminals

- Remove the factory installed jumper between terminals 12 and 13.
- Bring the boiler wires through the bottom left hand KO of the enclosure.
- If the boilers need the secondary pumps to run on after the boiler is turned off, or need an interlock to combustion air, use Heat-Timer SCP panel (HT #926541-00).
- The Normally Open (NO) contacts for each boiler must be in series with the boiler limit circuits
- Attach the lo stage of the first boiler to the NO contacts marked *BURNER STAGE A* (terminals 6 & 7), the hi stage to *B* (8 & 9)
- Attach the lo stage of the second boiler to the NO contacts marked *C* (terminals 11 & 12), the hi stage to *D* (13 & 14)
- For wiring diagram, see pg. 37

If attaching to an SEQ-4 or SEQ-8, see section *Installing a HWR-Q to a SEQ panel*, pg. 14.

CAUTION: Each relay is rated at 1 amp inductive, 6 amps resistive at 120V. The total output of all relays must not exceed 15A.

Warning: The HWR-Q 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 HWR-Q is installed.



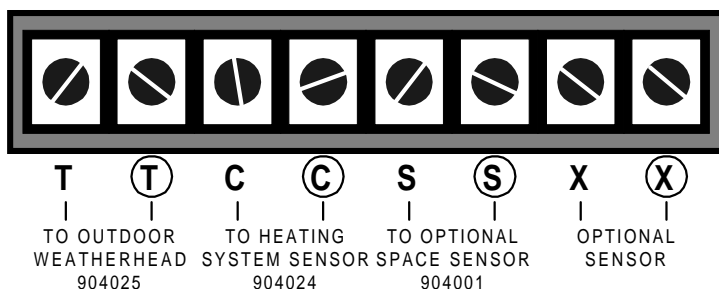
Fourth Step: Wire the Input Terminals

Wiring the outdoor sensor

- Bring outdoor sensor wires through the bottom **right** hand knock out in the enclosure (see pg. 8 on running the wires).
- Attach the sensor wires to the *T-T* terminals.
- Connect the shield to the right hand *T* terminal with a circle around it.

Wiring the heating system sensor (HSS)

- Bring HSS wires through the bottom **right** hand knock out in the enclosure (see pg. 9 on running the wires).
- Attach the sensor wires to the *C-C* terminals.
- Connect the shield to the right hand *C* terminal with a circle around it.



WARNING: Never apply external voltage to the input terminals. Permanent damage will occur, voiding the warranty.

Testing the Sensor Installation

Testing the sensors

- Power up the HWR-Q.
- The control will go through a countdown, and then the small rightmost three digit display marked *ACTUAL WATER TEMP* will show the temperature read by the heating system sensor.
- If the display reads OPN, SHT, or an incorrect temperature, see pg. 49 to determine the source of the problem.
- Press the button marked *OUTSIDE TEMP*. The small rightmost display will now show the temperature read by the outdoor sensor.
- If the display reads OPN, SHT, or an incorrect temperature, see pg. 49 to determine the source of the problem.

Final Step: Make these Initial Settings

Once the control is mounted and wired, set up an initial program. The list below acts as a check list and provides typical settings. The settings may have to be adjusted later based on actual building conditions.

The list numbers correspond to the detailed descriptions of each setting in the following section THE CONTROL SETTINGS.

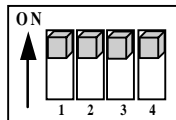
1. Set the *WINTER/SUMMER* switch to **WINTER**.
2. Adjust the *SYSTEM & PUMP SETPOINT* to **60°F** (Key must be unlocked).
3. Adjust the *RESET RATIO* to **E** (Key must be unlocked).
4. Adjust the *WATER TEMPERATURE OFFSET* knob to **0°** (12 o'clock position).
5. Turn the *WATER TEMPERATURE NIGHT SETBACK* knob to **-20°** (2 o'clock position).
6. Set the *AUTO/BYPASS* switch to the **AUTO** position.
7. Set the present time.*
8. Day/Night program is factory set for the Normal (Day) heat level from 6AM to 10PM, and the Setback (Night) heat level from 10PM to 6AM for the entire week.*
9. With stand-alone operation, the *OUTPUT MODE* switch must be set to **DIRECT**. With a SEQ-4 or SEQ-8 output panel, the switch must be set to **INTERFACE**.
10. Set the *NUMBER OF STAGES* to **2, 3** or **4** (not applicable with an SEQ panel).
11. Set the *LEAD STAGE SWITCH* to **AUTO**.
12. Set the *REACTION MINUTES* to **2** (9 o'clock position)..
13. Set the *MINIMUM WATER TEMPERATURE* knob to the boiler manufacturer's specifications.
14. Turn the *MORNING BOOST SETUP TEMP.* knob to **20°** (11 o'clock position). Switch the *BOOST* to **VARI**.

Optional SEQ Panels

15. Set *AUTO/OFF/INCREMENT* switch to **AUTO**.
16. Set *ON/AUTO/OFF* switches for all active boiler stages to **AUTO**. Be sure any SEQ output stages without relays or not connected to a boiler stage are **OFF**.

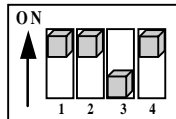
* To adjust, see the next section *CONTROL SETTINGS*

Installing a HWR-Q with an Optional SEQ panel



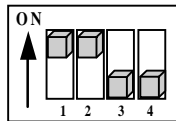
NORMAL HEATING

Adds stages as temp or psi falls below set point



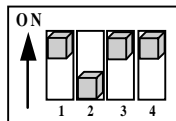
Lo/Lo/Hi/Hi HEATING

Only Lo stages are lead, stages are added as system falls below set point



Lo/Hi/Lo/Hi HEATING

Only Lo stages are lead, stages are added as system falls below set point



HEATING with DHW

Normal Heating with last stage used for Shared Domestic Hot Water

CAUTION: Any SEQ output stage not attached to a boiler stage must have the *On/Auto/Off* stage set to **Off**. Any stage over which the HWR-Q should have control must be set to **Auto**. Otherwise, the sequencing and lead stage rotation will not occur properly.

Mount the SEQ controller

- Select a location next to the HWR-Q
- Remove the panel from the enclosure as shown on pg. 7
- Screw the enclosure to the mounting surface using the holes provided

Locate the dip switches

- On the SEQ-4 the switches are on the front behind the 4"x4" cutout in the panel
- On the SEQ-8 the switches are on the rear of the panel. Turn the control over and the switches will be facing up toward you.

Set the dip switches

- The dip switches control how the boiler stages will be brought on
- Normal Heating is for On/Off boiler stages. The SEQ-4 can handle up to 4 On/Off stages, while the SEQ-8 can handle up to 8 stages.
- With Lo/Hi boilers, you can select to bring on all the Lo stages first (Lo/Lo/Hi/Hi), or you can select to bring on the Lo stage and then the Hi stage of each boiler (Lo/Hi/Lo/Hi). The SEQ-4 can handle two Lo/Hi boilers, and the SEQ-8 can handle four.
- The Shared Domestic Hot Water does not allow the last stage (stage *D* on an SEQ-4 or stage *8* on an SEQ-8) to be the lead stage. The last stage is always the last stage on when heat is required, and the first stage to be turned off.
- Set the dip switch by following the chart on the left.

Install the relays

- There should be one relay (HT #500031-00) for each stage.
- Put in the boiler stage relays in the positions shown below.
- Any SEQ output stage which you want to be part of the heating sequence must have its *On/Auto/Off* switch to **Auto**.
- Any SEQ output stage not attached to a boiler stage must have its *On/Auto/Off* switch to **Off**.

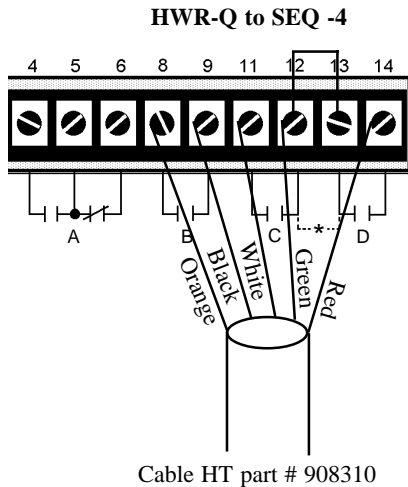
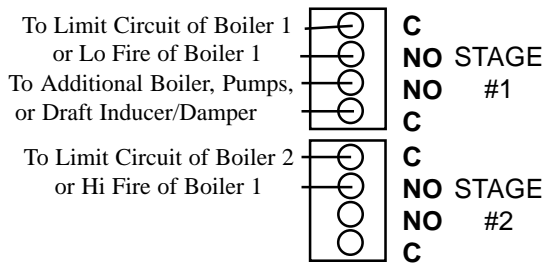
ON/OFF STAGES	Lo/Hi STAGES	SEQ-4	SEQ-8
BOILER 1	Lo BOILER 1	STAGE A	STAGE 1
BOILER 2	Hi BOILER 1	STAGE B	STAGE 2
BOILER 3	Lo BOILER 2	STAGE C	STAGE 3
BOILER 4	Hi BOILER 2	STAGE D	STAGE 4
BOILER 5	Lo BOILER 3		STAGE 5
BOILER 6	Hi BOILER 3		STAGE 6
BOILER 7	Lo BOILER 4		STAGE 7
BOILER 8	Hi BOILER 4		STAGE 8

Wire the power supply terminals

- Bring the power wires through the bottom left hand KO of the enclosure
- Attach 120V 60Hz to terminals LINE and NEUTRAL
- Power Ground must be connected
- Class 1 copper wire is required by UL

Wire the boiler stages (see wiring diagrams pgs. 39 and 40)

- The SEQ panel has two Normally Open (N.O.) pairs of contacts for each stage.
- Wire one pair of N.O. contacts in series with the limit circuits of the boiler.
- The second N.O. pair may be used to turn on any equipment which you want to start when each boiler fires. A typical example would be to turn on secondary pumps. If the boilers need the secondary pumps to run on after the boiler is turned off, use Heat-Timer SCP panel (HT #926541-00)
- If all the second pairs of contacts are wired in parallel, then equipment will start when any of the boiler stages is fired. A typical example of this application would be for a draft inducer/damper. If a combustion air interlock is required, use Heat-Timer SCP panel (HT #926541-00)
- If there are more than 8 On/Off boiler stages, (or more than 4 Lo/Hi boiler stages), then the second set of contacts can be used to turn on multiple boilers.



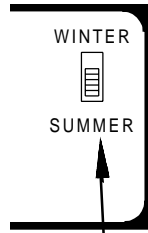
Wire the HWR-Q to the SEQ

- The factory installed jumper from terminal 12 to 13 of the HWR-Q must be in place.
- For an SEQ-4, use the cable provided (HT #908310) to connect the two panels. The cable gets connected to the HWR-Q as shown at left.
- For an SEQ-8, wire to the terminal block in the lower right hand side marked 8, 9, 11, 12, and 14. These wires connect to the same terminal numbers 8, 9, 11, 12, and 14 on the HWR-Q. In other words, wire terminal 8 of the SEQ-8 to terminal 8 on the HWR-Q. Then wire 9 to 9, 11 to 11, and so on. See wiring diagrams pgs. 39 and 40.

As you start up the control, learn each setting and how it operates

The start-up list on the previous page serves to get the HWR-Q up and running. To adjust the HWR-Q to run optimally in your system, additional adjustments will probably have to be made.

The following pages provide complete descriptions of the HWR-Q functions. All the settings are keyed by number to the list of Initial Settings for easy reference.



In the *SUMMER* position, the HWR-Q will not give heat

1. Winter/Summer switch

The HWR-Q will turn off the system pump and all stages when this switch is in *SUMMER*. When the switch is in the *WINTER* position, the HWR-Q will activate the system pump and begin heating whenever the outdoor temperature falls below the *SYSTEM & PUMP SETPOINT*.

Therefore, during the heating season, this switch must be in the *WINTER* position. When the heating season is over, it is a good practice to move the switch into the *SUMMER* position.

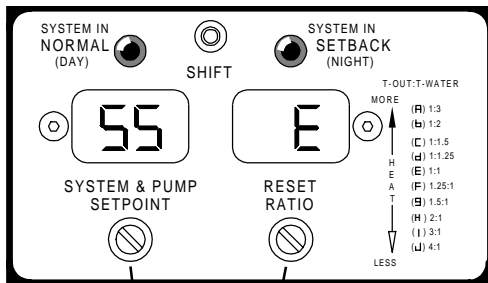
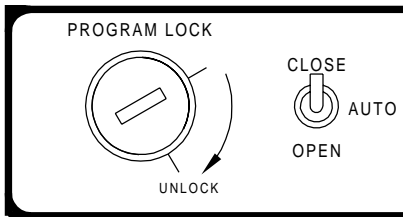
CAUTION: Do not turn the power off to the HWR-Q when the heating season is over. If you do so, the battery will run down and have to be replaced. Instead, switch to *SUMMER*.

2. System & Pump Setpoint

The *SYSTEM & PUMP SETPOINT* will determine when the HWR-Q turns on the system pump and begins heating the system water. When the outside temperature is above the Setpoint, the HWR-Q will turn off the system pump and all heating stages. When the outside temperature falls below the Setpoint, the HWR-Q will activate the pump and control the burner or valve to hold the calculated heating water system temperature.

To change the *SYSTEM & PUMP SETPOINT*, you must first unlock the *PROGRAM LOCK*. This is to prevent the settings from being changed by unauthorized users. Simply insert the program key and rotate it clockwise to the *UNLOCK* position. Then rotate the knob under the *SYSTEM & PUMP SETPOINT* until the desired temperature is displayed.

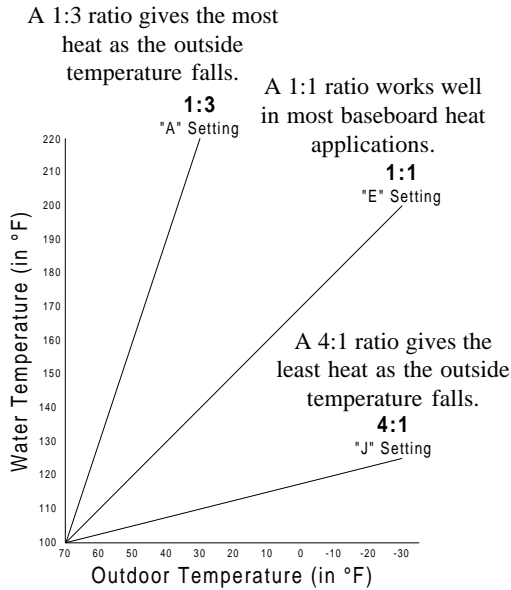
Turn key to UNLOCK to program set points



Knobs rotate to change Setpoint and Ratio settings on display

The *SYSTEM & PUMP SETPOINT* can be set from 30°F to 75°F. In addition, the Setpoint can be set to *ON* or *OFF*. In the *ON* position, the system pump will run regardless of the outside temperature and the stages will be active to hold the system water temperature. (Note: The lowest system water temperature the HWR-Q will circulate is 70°F. If the *SYSTEM & PUMP SETPOINT* is turned *ON*, the HWR-Q will circulate at least 70°F water even in the hottest of weather.) In the *OFF* position, the system pump and heating stages will always be off.

Reset Ratio

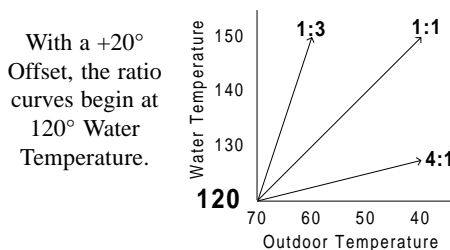
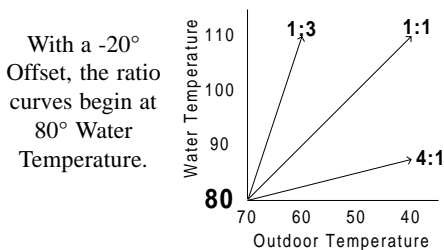
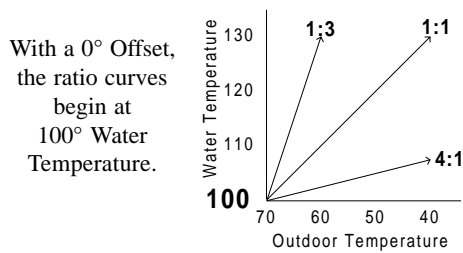


3. Reset Ratio

The *RESET RATIO* determines how the system water temperature will vary with outside temperature. With any of the ratios, the colder it becomes outside, the hotter the temperature of the system water. The ratios are adjustable from 1:3 (A) to 4:1 (J). To adjust the *RESET RATIOS*, you must first unlock the *PROGRAM LOCK* (see diagram pg. 17). Then rotate the knob until the desired letter setting is shown.

With a 1:3 (A) ratio, the system water temperature will increase rapidly as the outside temperature falls, hitting the maximum of 240°F at 24°F outside temperature. With a 4:1 (J) ratio, the system water temperature will increase slowly as the outside temperature falls. Even at -30°F, the system water will only be 125°F, and at 24°F outside, the system water will be 112°F. Such a low Reset Ratio might be used with radiant floor heating applications. (For a complete Reset Ratio chart see pg. 31.)

With most baseboard heating applications, a 1:1 (E) setting is a good place to start. With a 1:1 (E) ratio, for every degree the outside temperature falls, the system water temperature is increased one degree.



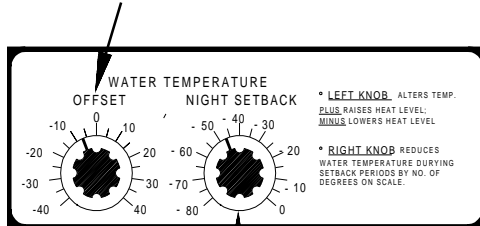
If required: **Adjust the *RESET RATIO* in cold weather.** If the ambient building temperatures are too cold in cold weather, change the ratio counterclockwise by one letter (ie. from E to D). If the building temperatures are too warm in cold weather, change the ratio clockwise by one letter (ie. from E to F).

4. Water Temperature Offset

The *WATER TEMPERATURE OFFSET* knob allows you to adjust the starting points of the Reset Ratio curves (see charts on left). This means that regardless of the outdoor temperature, or the Reset Ratio that has been selected, when the Offset knob is changed, that change is directly added or subtracted to the calculated water temperature. For instance, if the calculated water temperature were 130°F and the Offset knob were rotated from 0° to 10° (an increase of 10°), then the calculated water temperature would immediately change to 140°F.

The *WATER TEMPERATURE OFFSET* does not change the effect that outdoor temperature has on system water temperature. For instance, with a 1:1 Reset Ratio, the system water temperature will always increase one degree for each degree the outdoor

A -40° Offset gives the least amount of heat. A $+40^{\circ}$ Offset gives the most amount of heat. Adjust the Offset in mild weather.



A -80° Setback reduces the temperature of the circulating hot water by 80° during Night period. A 0° Setback does not reduce the water temperatures.

Sample Offset and Setback Calculations: Outside Temp: 30°F Ratio: 1:1

With 0° Offset and Day Settings
Target Water Temperature: 140°F

With -20° Offset and Day Settings
Target Water Temperature: 120°F

With $+20^{\circ}$ Offset and Day Settings
Target Water Temperature: 160°F

With 0° Offset and 20° Setback
Target Water Temperature: 120°F

With 0° Offset and 40° Setback
Target Water Temperature: 100°F

With -20° Offset and 20° Setback
Target Water Temperature: 100°F

With -20° Offset and 40° Setback
Target Water Temperature: 80°F

With $+20^{\circ}$ Offset and 20° Setback
Target Water Temperature: 140°F

With $+20^{\circ}$ Offset and 40° Setback
Target Water Temperature: 120°F

temperature drops. What the Offset does is add or subtract a constant temperature value.

If required: **Adjust the WATER TEMPERATURE OFFSET in mild weather.** If the ambient building temperatures are warm in the warm weather, decrease the Offset. If the ambient building temperatures are cold in the warm 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 building temperatures. For radiant heat applications, change the Offset by 1° or 2° for every degree you wish to change the building temperature.

To adjust the Offset simply rotate the knob *WATER TEMPERATURE OFFSET*. The knob is adjustable from -40° to $+40^{\circ}$. A minus Offset reduces the circulating water temperature, and a positive Offset increases the temperature. A good starting point is in the halfway position at 0° .

5. Water Temperature Night Setback

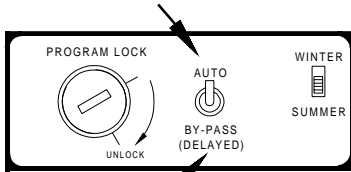
The HWR-Q has two heat levels. The *NORMAL (Day)* settings are for when a building is occupied and people are active. The *SETBACK (Night)* settings hold a lower ambient temperature, and are for when a building is unoccupied, or people are sleeping.

The *WATER TEMPERATURE NIGHT SETBACK* knob lowers the temperature of the circulating system water by the number of degrees indicated. In other words, the HWR-Q will first calculate the temperature of the circulating system water by using the outside temperature and Reset Ratio. Then the HWR-Q will add or subtract the value of the Offset knob. Finally, if the control is in Setback, the HWR-Q will subtract the value of the Setback knob. This final value is the temperature the HWR-Q will use for the circulating system water. This procedure will occur automatically.

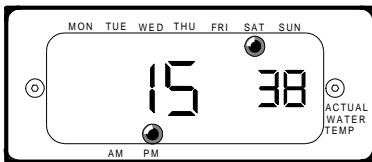
To adjust the amount of Setback rotate the knob *WATER TEMPERATURE NIGHT SETBACK*. The knob is adjustable from 0° (no night Setback) to 80° (the circulating water temperatures will be lowered 80° when the control enters the Setback mode.) For baseboard radiation, begin by setting the night Setback 4° for every degree you wish to decrease the ambient building temperatures. For example, if you wish the building to be 5° cooler during Setback, set the knob to -20° . For radiant applications, begin by setting the Setback 1° or 2° for every degree you wish to decrease the ambient building temperatures.

Auto/By-pass Switch

In *AUTO*, the HWR-Q will regulate the heating system.



In *BYPASS*, the pump and boiler stages will run on their limits and



Total hours and minutes on *BY-PASS* will be recorded and displayed. Shown is 15 hours and 38 minutes.

6. Auto/By-pass Switch

This switch must be in the *AUTO* position for the HWR-Q to regulate the system heat. Switch to *BY-PASS* to override the panel or to test boiler stages. When the HWR-Q is in *By-pass*, none of the normal functions will be executed. The display will change to read the total amount of time the control has been in *By-pass*. The large central display will show the number of hours in *By-pass*, and the smaller right hand display will show the number of minutes.

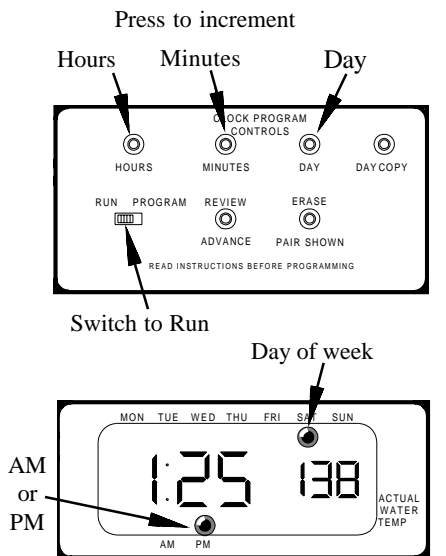
With Direct Boiler Operation: The HWR-Q will turn on Stages A, B, and C and they will run on their limits until the control is switched out of *BY-PASS*. (Stage D will also run on limits if the HWR-Q is fully functional). Stages A, B, and C will run in *BY-PASS* even if the HWR-Q has no display. The *By-pass* switch directly connects the Normally Open contacts 6 to 7, 8 to 9, and 11 to 12. Therefore, if stages are not coming on, test them by putting the control in *BY-PASS*. If the stages still do not come on, the problem is not with the HWR-Q panel.

With SEQ Panel: The HWR-Q will not add stages to the SEQ panel when it is switched to *BY-PASS*. Instead, use the individual stage switches on the SEQ panel to bring on boiler stages.

7. Setting the Present Time

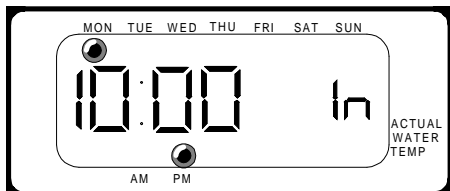
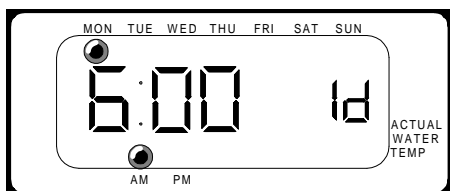
When an HWR-Q is first powered up, the central display will show *NONE*. This may also occur if the control has been turned off for an extended period of time and the battery has drained down. (See Winter/Summer switch pg. 17 on how to avoid this.) To set the present time, use the following procedure:

- Use the programming key to turn the *PROGRAM LOCK* switch to the *UNLOCK* position.
- Switch the *RUN/PROGRAM* switch to *RUN*. This will cause the display to show the present time and actual water temperature.
- Press the *HOURS* button until the correct hour and *AM* or *PM* is shown. It is very important to note the *AM* and *PM* lights directly under the central display. If the time is 4:35 PM, keep pressing the hours button until the hour shows 4 and the red *PM* light is lit.
- Press the *MINUTES* button until the correct number of minutes is shown.
- Press the *DAY* button until the correct day of week, *MON*, *TUE*, *WED*, *THU*, *FRI*, *SAT*, or *SUN* is lit.

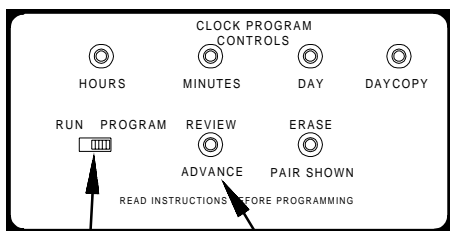


Time displayed is 1:25 PM on Saturday. The actual water temperature is 138°F.

8. Setting the Normal (Day) and Setback (Night) Program Schedules



The first Normal (day) setting for MON is 6:00 AM, the first Setback (night) setting for MON is 10:00 PM



Switch to Program

Press Review/Advance to move through the day/night program

The HWR-Q has two levels of control. The *NORMAL (DAY)* level is used when a building is occupied, and people are active. The *SETBACK (NIGHT)* level is used when a building is not occupied, or when people are sleeping.

The HWR-Q can have up to four Normal and four Setback periods for each individual day of the week. When in the programming mode, a Normal level is shown with the small right-hand display of **1d**, **2d**, **3d**, or **4d** and the Setback levels are shown by **1n**, **2n**, **3n**, and **4n**. If there is a time shown, then that is the time when that Normal (**d**) or Setback (**n**) heat level will begin. If the display shows *NONE*, that means that particular mode is not programmed.

Every time the HWR-Q updates the clock time, it checks the Normal/Setback program. If there is a matching Normal/Setback time programmed, it sets the heat level accordingly, otherwise the heat level is not changed. This means you do not have to program every day of the week. If an office building is unoccupied all weekend, simply set the last programmed **n** setting (8:00 **2n** PM for example) on *FRI*. Set all the *SAT* and *SUN* programs to *NONE* (using the *ERASE PAIR SHOWN* button). The control will stay in Setback until it reaches a **d** setting (6:00 **1d** AM for example) on *MON* morning.

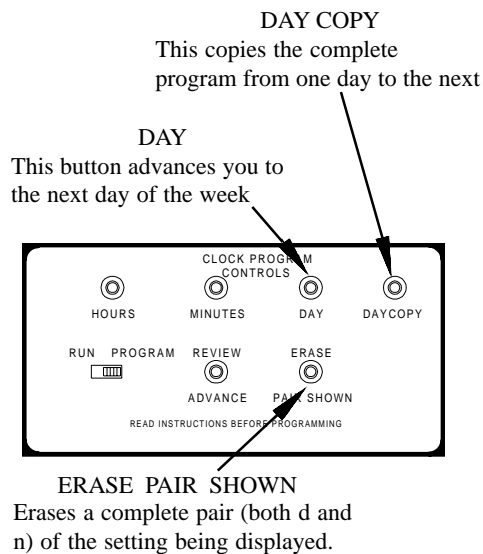
Use the following procedure to program the HWR-Q:

- Use the programming key to turn the *PROGRAM LOCK* switch clockwise to the *UNLOCK* position.
- Switch the *RUN/PROGRAM* switch to *PROGRAM*. This will cause the display to show the first program time. The factory default display will show **6:00 1d** and the *AM* light will be lit. The day of the week lights will show *MON*. This means the Normal heat level will begin on Monday at 6:00 AM.

- To adjust this time, push the *HOURS* and *MINUTES* buttons until the desired time is shown. For example, to change the time to **7:00 AM**, simply press the *HOURS* button once. Be sure the *AM* and *PM* lights below the time are correct.
- Now press the *REVIEW/ADVANCE* Button. If still set at the factory default

Review/Advance button	MON	TUE	WED	THU	FRI	SAT	SUN
1d	6:00AM	6:00AM	6:00AM	6:00AM	6:00AM	6:00AM	6:00AM
1n	10:00PM	10:00PM	10:00PM	10:00PM	10:00PM	10:00PM	10:00PM
2d	NONE	NONE	NONE	NONE	NONE	NONE	NONE
2n	NONE	NONE	NONE	NONE	NONE	NONE	NONE
3d	NONE	NONE	NONE	NONE	NONE	NONE	NONE
3n	NONE	NONE	NONE	NONE	NONE	NONE	NONE
4d	NONE	NONE	NONE	NONE	NONE	NONE	NONE
4n	NONE	NONE	NONE	NONE	NONE	NONE	NONE

Output Mode

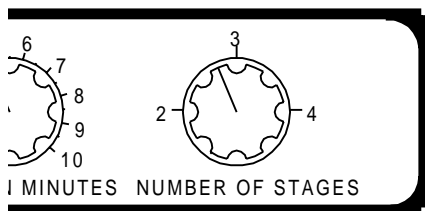
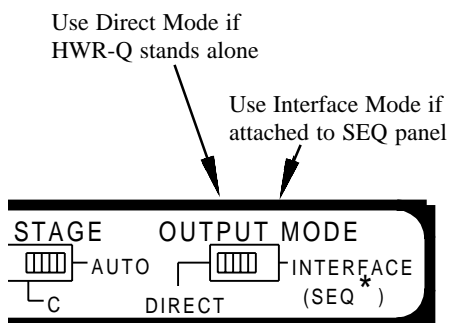


- times, the display will change to **10:00 1n** and the **PM** and **MON** light will be lit. This means the Setback heat level will begin on Monday at 10:00 PM.
- Adjust the time with the **HOURS** and **MINUTES** buttons.
- Continue to press the **REVIEW/ADVANCE** button. The small display will change to **2d, 2n, 3d, 3n, 4d, and 4n**. Set any of these by pressing the **HOURS** and **MINUTES** buttons.
- To advance on to the next day at any point, press the **DAY** button. This will move you on to the **1d** for the next day of the week.
- To clear any of the programmed times simply press the **ERASE PAIR SHOWN** button. This will clear the pair (a matching **d** and **n** for that day) to **NONE**.
- To save time, you can copy one day's program to the next. If you have set up **MON** as you like it, press the **DAY** button until **TUE** is lit. Then press the **DAY COPY** button. Tuesday will now have the same program as Monday.
- When you are finished programming, be sure to move the **RUN/PROGRAM** switch back to the **RUN** position.

9. Output Mode

When the **OUTPUT MODE** switch is in the **DIRECT** position the HWR-Q controls up to four on/off boilers, or two lo/hi fire boilers directly (see pgs 36 - 38 for wiring diagrams). When the switch is in the **INTERFACE** position, the HWR-Q is hooked up to either an SEQ-4 or SEQ-8 output panel (see pgs. 39 and 40 for wiring diagrams).

CAUTION: If the **OUTPUT MODE** switch is not set correctly, no stages will be turned on, and no heat will be given.



Set for number of stages HWR-Q controls directly

10. Number of Stages

The **Number of Stages** knob only applies when the HWR-Q is controlling stages directly. This switch has no effect when using an SEQ output panel.

Set the **Number of Stages** knob to the number of stages the HWR-Q controls directly. The HWR-Q alone can control up to 4 on/off boilers, or up to two lo/hi fire boilers.

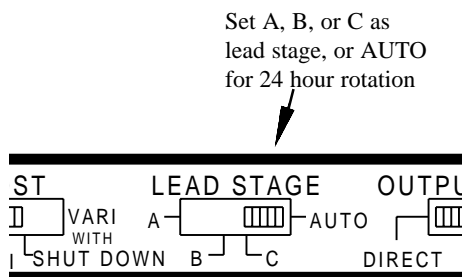
NOTE: When selecting two stages, be sure to turn the **Number of Stages** knob fully counter-clockwise until it hits the stop.

11. Lead Stage

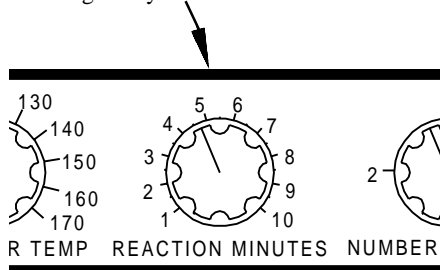
The *Lead Stage* switch only applies when the HWR-Q is controlling stages directly. This switch has no effect when using an SEQ output panel.

The lead stage will always be the first stage brought on, and the last stage turned off when the HWR-Q is calling for heat. If the *LEAD STAGE* is set to *AUTO*, the lead stage will change to a different boiler at 2 AM every morning, promoting even wear among the stages. For instance, if the lead stage is A one day, then the next day, the lead stage will be B. If it is preferable to have one stage always be the first on and the last off, then set the lead switch to stage A, B, or C.

NOTE: If using 2 lo/hi boilers, the lead stage will automatically rotate only to the lo stages, which are A and C.



Set to the number of minutes it takes for a stage to begin affecting the system.



12. Reaction Minutes

Set the *REACTION MINUTES* knob to the time it takes for a single stage to start affecting the system. This time must be longer than any purge cycles the boiler may go through.

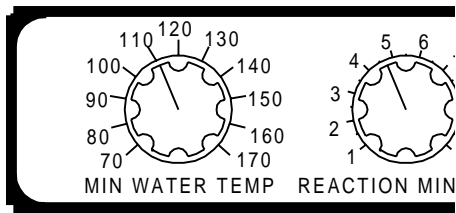
To determine the optimum time, start with a hot system. Turn on a single boiler stage and time how long it takes until the system begins to respond to the single stage. This time period is the *REACTION MINUTES*.

Displaying the *REACTION MINUTES*

To display the value of the *REACTION MINUTES* knob do the following:

1. Switch the *RUN/PROGRAM* switch to the *PROGRAM* position.
2. Press the *COMPUTED WATER TEMP* button.
3. As long as the button is being pressed, the small right-hand display will show the value of the *REACTION MINUTES*. If you rotate the knob, you will see the display change value.
4. Return the *RUN/PROGRAM* switch back to *RUN* when done.

Minimum Water Temperature

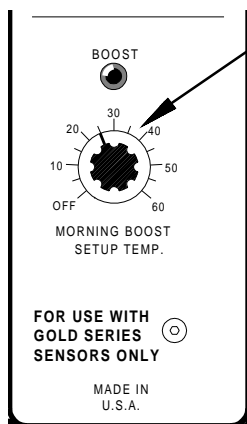


Set the knob to the boiler manufacturer's specification.

WARNING: If the Minimum Water Temp knob is not set to the boiler manufacturer's specifications the boiler(s) may be damaged.



Set the Boost to VARI to quickly bring the ambient temperatures up after the Night Setback.



Set this knob to the number of degrees you wish to increase the actual water temperature during the Boost period.

13. Minimum Water Temperature

The *MINIMUM WATER TEMPERATURE* knob must be set to the boiler manufacturer's specification. The HWR-Q will calculate the temperature of the circulating system water based on the outdoor temperature, the Reset Ratio, and the Offset value. The HWR-Q will then stage the boilers to hold either the calculated temperature, or the temperature of the *MINIMUM WATER TEMPERATURE* knob, whichever is *higher*.

Displaying the *MINIMUM WATER TEMPERATURE*

To display the value of the *MINIMUM WATER TEMPERATURE* knob do the following:

1. Switch the *RUN/PROGRAM* switch to the *PROGRAM* position.
2. Press the *OUTSIDE TEMP* button.
3. As long as the button is being pressed, the small right-hand display will show the value of the *MINIMUM WATER TEMPERATURE*. If you rotate the knob, you will see the display change value.
4. Return the *RUN/PROGRAM* switch back to *RUN* when done.

14. Morning Boost

The morning Boost is designed to return the building to comfortable ambient temperatures after the cooler Setback (Night) period. The HWR-Q will accomplish this by running elevated water temperatures for a given time period based on the **1d** time for that day. If you do not want a Boost on a day of the week, simply program the **1d** to *NONE* (see pg. 21), and use the **2d** program for any Normal (Day) settings.

To set up the morning Boost, you must set the type of Boost you need (3-way *BOOST* switch) and the amount of Boost (*MORNING BOOST SETUP TEMP.* knob).

There are three modes of Boost:

1. *OFF* - The HWR-Q will begin running the Normal (Day) water temperatures at the **1d** time.
2. *VARI-BOOST* - This Boost begins earlier than the **1d** time. The length of the Boost time depends on the outside temperature (see pg. 33 for details). During the Boost period, the HWR-Q will increase the calculated water temperature by the number of degrees set on the *MORNING BOOST SETUP TEMP* knob.

3. *VARI-BOOST WITH SHUTDOWN* - This should be used in commercial buildings where the building will be unoccupied in the Setback (Night) times. A Vari-Boost as described above is run. In addition, the HWR-Q will switch into the Setback mode earlier than the latest *n* setting for that day. The warmer it is outside, the earlier the HWR-Q will shift into Setback (see pg. 33 for details).

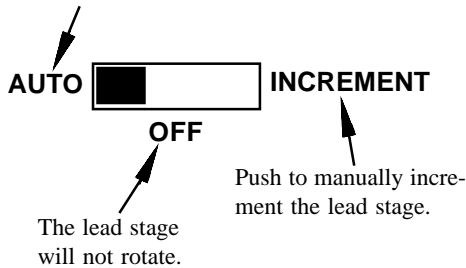
The *MORNING BOOST SETUP TEMP* should initially be set to the same number of degrees as the *WATER TEMPERATURE NIGHT SETBACK*. For instance, if the *WATER TEMPERATURE NIGHT SETBACK* is set at 20° (2 o'clock position), then the *MORNING BOOST SETUP TEMP* knob should be set to 20° (11 o'clock position).

If the ambient building temperatures are too cold at the **1d** time, then increase the *MORNING BOOST SETUP TEMP* in increments of 10°. If the *MORNING BOOST SETUP TEMP* is turned all the way up, and it is still too cold at the **1d** time, it might be necessary to decrease the amount of the *WATER TEMPERATURE NIGHT SETBACK*.

If it is too warm at the **1d** time, then decrease the *MORNING BOOST SETUP TEMP* in increments of 10°

Optional SEQ Panel Control Settings

The lead stage will rotate every 24 hours among the active stages.



15. Auto/Off/Increment Switch

The *Auto/Off/Increment* switch will determine which stage is the lead stage. The lead stage will always be the first stage brought on, and the last stage turned off when there is a call for heat. To promote even wear on all stages, it is desirable to rotate the lead stage among all the active stages. The lead stage will rotate among stages with their *ON/AUTO/OFF* switches in *AUTO* position. (If using lo/hi fire boilers, only stages 1, 3, 5 and 7 can be lead.) The lead stage is easily recognizable as the green light next to the stage switch will be on.

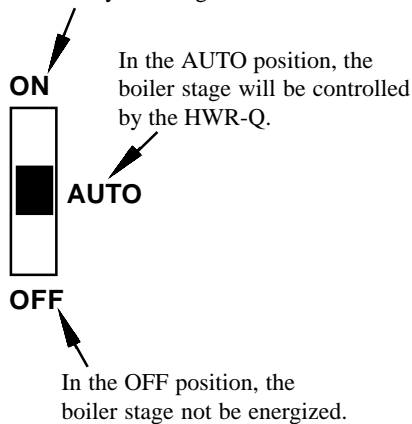
The lead stage switch can be set to any of the following three positions:

1. *AUTO* - The lead stage will rotate at 2 a.m. each day among the active stages.
2. *OFF* - The automatic rotation is disabled. The present lead stage will remain the lead stage until the switch is changed.
3. *INCREMENT* - Every time the switch is pushed to the increment position the lead stage will rotate. Keep pushing the switch until the green lead stage light next to the desired stage lights up.

16. On/Auto/Off Stage Switches

Any active stages should be switched to *AUTO*. This means they will be controlled by the HWR-Q and be part of the automatic sequencing. Any output stages which are not attached to a boiler stage should be turned to *OFF*.

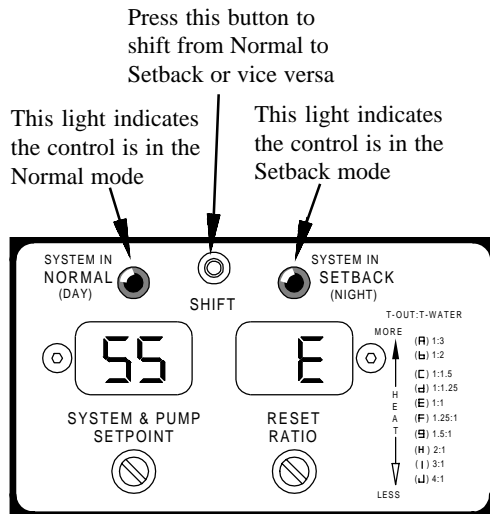
In the ON position, the boiler stage will constantly be energized.



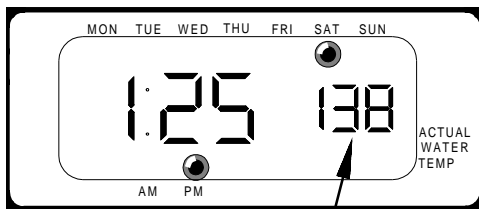
A complete description of each position follows:

1. *ON* - This will cause the N.O. contacts to energize. This can be used for testing specific stages, and also can be used as a manual override.
2. *AUTO* - The stage will be part of the automatic sequencing. The stage will be turned on and off based on the signals it receives from the HWR-Q.
3. *OFF* - The N.O. contacts will not be energized. When a stage position is not attached to boiler, it should be switched *OFF*. *OFF* can also be used for maintenance, or as a manual shutdown. If a boiler is not operating properly, and has been disabled at the boiler, be sure to switch the stage to *OFF* so the HWR-Q will not try to use it in the sequencing.

Additional HWR-Q Functions



When the Normal mode light is flashing, this means the control has been manually shifted from Setback. In 90 minutes from the shift time, the Normal light will stop flashing, and the Setback light will come on.



This display continuously displays the Actual Water Temperature. To display the Outside or Computer Water temperatures push the buttons shown below.



Shift Button

The *SHIFT* button allows you to manually shift from Normal (Day) settings into Setback (Night) settings or vice versa. This can be used to temporarily override the program. A typical example where the shift would be used is in a school where an event has gone into overtime. Instead of reprogramming the control to keep it from going into the Setback mode, simply press the *SHIFT* button and the HWR-Q will run the Normal program.

The amount of time the HWR-Q will hold the shift is:

Shifting from Normal to Setback - The control will stay in the Setback mode until either the control is shifted again, or until the next programmed Normal mode time

Shifting from Setback to Normal - The control will stay in the Normal mode for 90 minutes, and then revert automatically back to the program. This prevents a user (without a programming key) from putting the HWR in Normal mode for an extended period of time when it is programmed for Setback.

When the control is manually shifted to Normal, the red light indicating the control is in the Normal mode will flash.

Displaying the Temperature Values

The small right-hand display of the HWR-Q constantly shows the temperature of the water being circulated (as measured by the heating system sensor). However, the HWR-Q can also display the outdoor temperature and the computed water temperature.

To check the outside temperature, press the button marked *PRESS TO DISPLAY OUTSIDE TEMP*. The small right hand display will change to read the value of the outdoor sensor for as long as the button is pressed. If the outside temperature does not appear to be correct, check the Troubleshooting section, pg. 49.

To check the computed water temperature, press the button marked *PRESS TO DISPLAY COMPUTED WATER TEMP*. The small right hand display will change to read the temperature computed water temperature for as long as the button is pressed. The HWR-Q will control the heating system to hold the computed water temperature.

NOTE: If the HWR-Q is switched to *SUMMER*, or if the outdoor temperature is above the *SYSTEM AND PUMP SET POINT*, then the computed water temperature will display *OFF*. This means both the pump and heating system should not be activated.

Appendix

This section contains detailed technical information on the HWR-Q. All of the following are included:

- Specifications
- Reset Ratio and Offset Charts
- Vari-Boost and Early Shutdown Charts
- Piping Diagrams
- Wiring Diagrams
- Troubleshooting Guide

The Reset Ratio and Offset charts allow you to quickly determine how much heat the HWR-Q will put into a building. The Vari-Boost chart shows the time of the recovery period after Setback (Night). Finally, the Early Shutdown chart shows how much earlier the system will be switched into Setback (Night).

The piping and wiring diagrams should help you during the installation. The Troubleshooting section has guides to follow for most heating problems.

**General
Specifications
HWR-Q**

Voltage Input: 120 VAC 60 Hz
Power Consumption: 30 VA Max
Pump Output: 1 S.P.D.T. and 1 N.O.
Heating Outputs: 1 S.P.D.T. and 3 N.O.
Auxiliary Output: 1 S.P.D.T.
Output Relay Ratings: 1 Amp inductive, 6Amp resistive
at 120 VAC 60 Hz, 15A total for all circuits
Ambient Temp: Min 20°F, Max 130°F
Sensor Indicating Ranges:
Outdoor temperature sensor - minus 35°F to 250°F
Heating system sensor - minus 35°F to 250°F
Pump Set Point Range: 30°F to 75°F, ON and OFF
Reset Ratio Range: 1:3 to 4:1 (Outdoor:Water)
Offset Adjustment: minus 40 to plus 40 F degrees
Water Temperature Setback: 0 to 80 F degrees
Minimum Water Temperature: 70°F to 170°F
Reaction Minutes: 1 to 10 minutes
Heating Clock: 4 NORMAL and 4 SETBACK settings
per day
Morning Boost:
Vari-Boost - Self-adjusting from 0 to 90 minutes - Water tempera-
ture increase 0 to 60 F degrees
Shutdown - Self-adjusting from 0 to 90 minutes
Power Backup: Lithium coin battery, 100 days minimum
5 year replacement
Enclosure: NEMA 1
Dimensions: 4-5/8"D x 12-1/4"H x 12-3/8"W
Weight: 14 pounds

Optional SEQ Panels

Voltage Input: 120 VAC 60 Hz
Power Consumption: 20 VA Max
Output Types:
SEQ4 - 4 with 2 N.O. contacts per stage
SEQ8 - 7 with 2 N.O. contacts per stage, 1 with N.O. and
S.P.D.T.
Output Ratings: 1 Amp inductive, 6 Amp resistive
at 120 VAC 60 Hz
Ambient Temp: Min 20°F, Max 130°F
Enclosure: NEMA 1
Dimensions: 4-5/8"D x 12-1/4"H x 12-3/8"W

Reset Ratio

T-OUT : T-WATER	
MORE	(A) 1 : 3
	(B) 1 : 2
	(C) 1 : 1.5
	(D) 1 : 1.25
	(E) 1 : 1
	(F) 1.25 : 1
	(G) 1.5 : 1
	(H) 2 : 1
	(I) 3 : 1
LESS	(J) 4 : 1

The HWR-Q offers a range of 10 Reset Ratios (see side chart). Each Reset Ratio adjusts the amount of heat that enters the building based on the outdoor temperature. The ideal Reset Ratio for any building is when the amount of heat being input to the building exactly equals the amount of heat leaving the building through the walls, windows, and doors.

With any of the Reset Ratios, the colder it gets outside, the hotter the temperature of the circulating system water. What does change with each ratio is how much hotter the circulating water temperature becomes based on a 1° drop in the outdoor temperature. With an *A* ratio, for instance, the computed water temperature will increase 3° with a 1° drop in outdoor temperature. It is very unlikely that any building would lose heat as quickly as an *A* ratio would input heat. An *A* ratio might be used in a building under construction, with some of the windows or doors not in place yet.

With an *E* ratio, the computed water temperature will increase 1° with a 1° drop in outdoor temperature. This Reset Ratio is what would be most commonly used with standard baseboard radiation. In a new well insulated building, an *F* or *G* ratio might be applicable. In an older building with poor insulation, a *D* or *C* ratio might be needed.

Finally, with *J* ratio, the computed water temperature will increase just one quarter of a degree with a 1° drop in outdoor temperature. An *I* or *J* ratio might be used in a building with radiant floor heating. With radiant floor heating, there is a lot of radiation and relatively low water temperatures can be maintained.

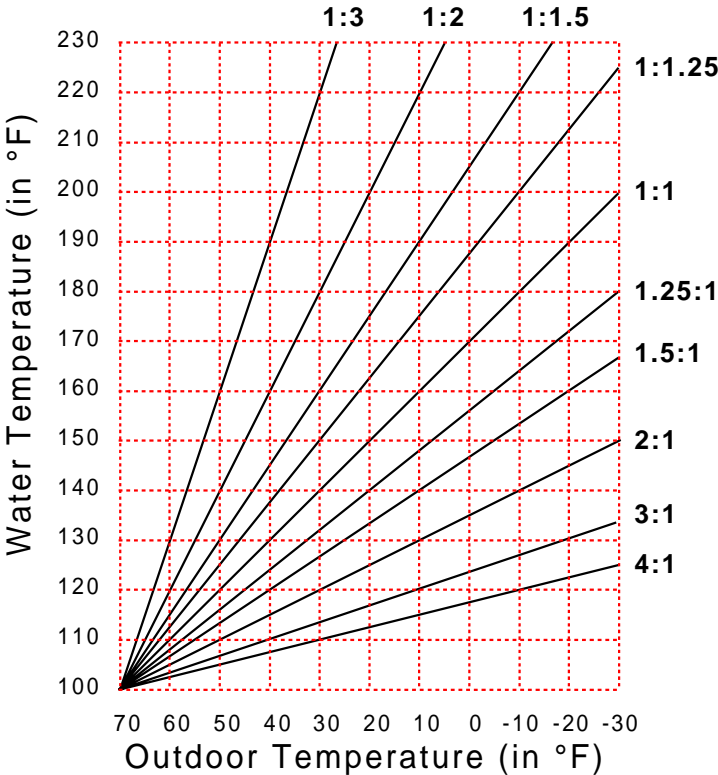
Adjust the Reset Ratios in the cold weather (in mild weather, adjust the Offset, see pg. 31). The reason for this can be seen by looking at the complete Reset Ratio chart on the next page. In mild weather (the lower left hand side of the chart), all the Reset Ratio lines are grouped closely together. However, as the outdoor temperature falls (moving toward the right) the Reset Ratio lines spread apart. The difference in computed water temperature between an *D* ratio and a *F* ratio at 60°F is just 4.5°, but at 30°F outside, the difference is 18° and at 0°F outside, the difference is 31.5°. Therefore, an incorrect Reset Ratio change made in the mild weather might not have much of an effect, but when the outdoor temperature got colder, the building could be significantly over- or under-heated.

Adjust the Reset Ratio using the following procedure: If the ambient building temperatures are too cold in cold weather, change the

Offset Adjustment

Reset ratio counterclockwise by one letter (ie. from E to D). If the building temperatures are too warm in cold weather, change the Reset ratio clockwise by one letter (ie. from E to F). After making a change to the Reset ratio, wait at least 24 hours before making another change. This will give the ambient temperatures time to stabilize and allow proper evaluation of the new Reset Ratio.

Reset Ratio Chart
 This chart shows the relationship between Outdoor Temperature (horizontal axis) and Computed Water Temperature (vertical axis) for each of the 10 Reset Ratios. The ideal Reset Ratio for a building will be when the amount of heat entering building equals the amount of heat leaving the building. The HWR-Q controls the heating system to hold the actual temperature of the circulating system water at the Computed Water Temperature.

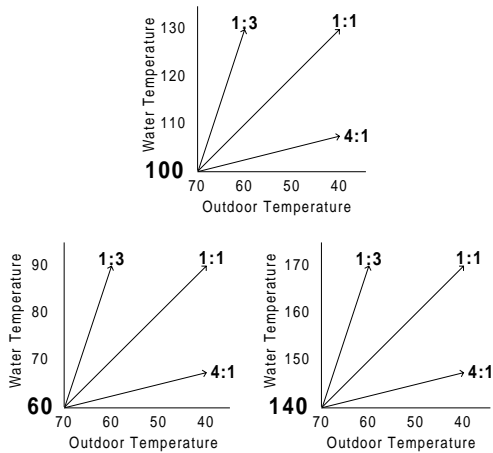


Offset Adjustment

The Offset adjustment sets the starting points of the Reset Ratios (see charts on next page). With an Offset of 0° the starting point of all the Reset Ratio curves are 100°F water temperature at 70°F outdoor temperature (as shown above). The Offset can reduce the starting point of the curve down to 60°F (with a minus 40° Offset) or increase the starting point up to 140° (with a plus 40° Offset).

The Offset adjustment does not change as outdoor temperature changes. Whenever the *OFFSET* knob is changed, that change is directly added or subtracted to the computed water temperature. For instance, if the computed water temperature were 130°F and the *OFFSET* knob were rotated from 0° to 10° (an increase of 10°), then the calculated water temperature would immediately change to 140°F. In other words, the Offset adjustment shifts the

Offset Adjustment



Reset Ratio curves up or down, but it does not affect how much the computed water temperature will change with a change in outside temperature.

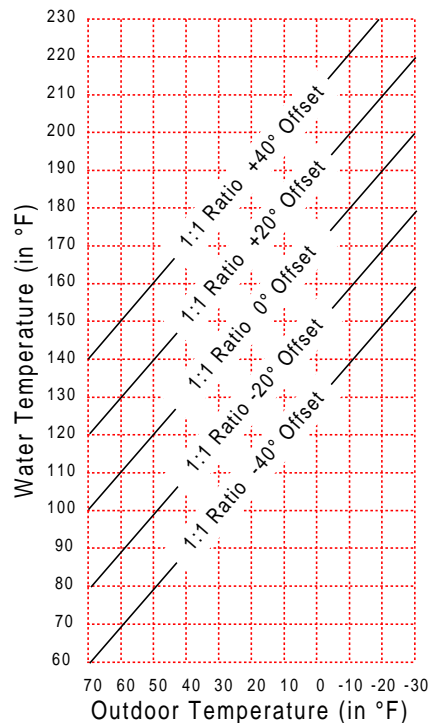
Adjust the *OFFSET* knob in mild weather. As discussed previously, the Reset Ratios are all bunched together in mild weather. In mild weather, a change of several ratios will not greatly effect the computed water temperature. However, changing the Offset can increase or decrease the computed water temperature by up to 80°F.

Use the following procedure to adjust the Offset: If the ambient building temperatures are warm in the warm weather, decrease the Offset. If the ambient building temperatures are cold in the warm weather, increase the Offset.

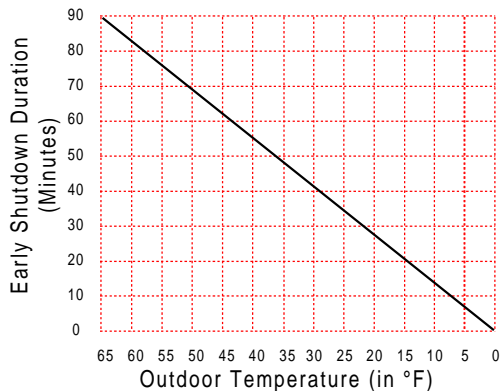
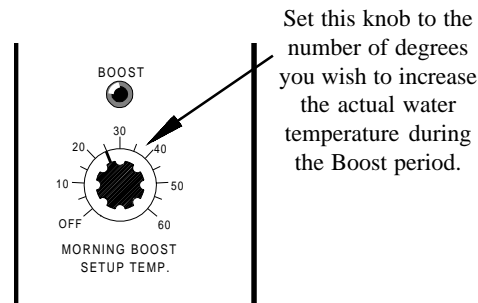
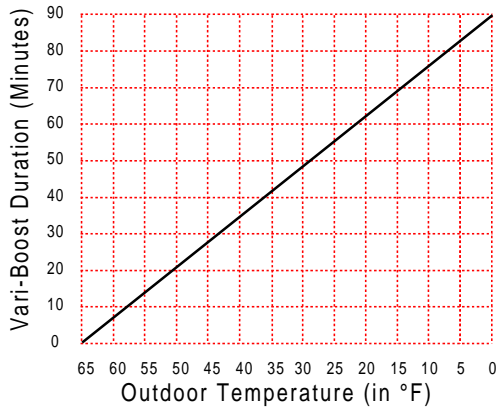
The rule of thumb for baseboard radiation is to change the Offset by 4° for every degree you wish to change the building temperatures. For radiant heat applications, change the Offset by 1° or 2° for every degree you wish to change the building temperature. After making a change, wait at least four hours (longer with radiant applications) before making another change. This will give the ambient temperatures time to stabilize.

Offset Adjustment Chart

This chart shows the effect of the Offset knob on a particular (1:1) Reset Ratio. The Offset knob shifts the particular Reset Ratio curve up or down, but the Reset Ratio curve maintains the same relationship of outdoor temperature to computed water temperature. The Computed Water Temperature will be a function of both the Reset Ratio and the value of the Offset knob.



Vari-Boost and Early Shutdown Graphs



The morning Vari-Boost allows a building to recover comfortable ambient temperatures after cooler Setback (Night) periods. This is accomplished by running hotter than Normal (Day) water temperatures for a time period based on outdoor temperature and the **1d** setting (the first day setting, see pg. 21).

The Vari-Boost should get the ambient building temperatures up to comfortable occupied levels by the time of the **1d** setting. Therefore, the Vari-Boost begins before the **1d** setting, and ends at the **1d** time. The amount of time the Vari-Boost begins before the **1d** setting depends on the outdoor temperature (see chart at side). For example, if the **1d** time is 7:00am, and the outdoor temperature is 30°F, then the Vari-Boost period will begin at 6:10am, or 50 minutes before the **1d** time.

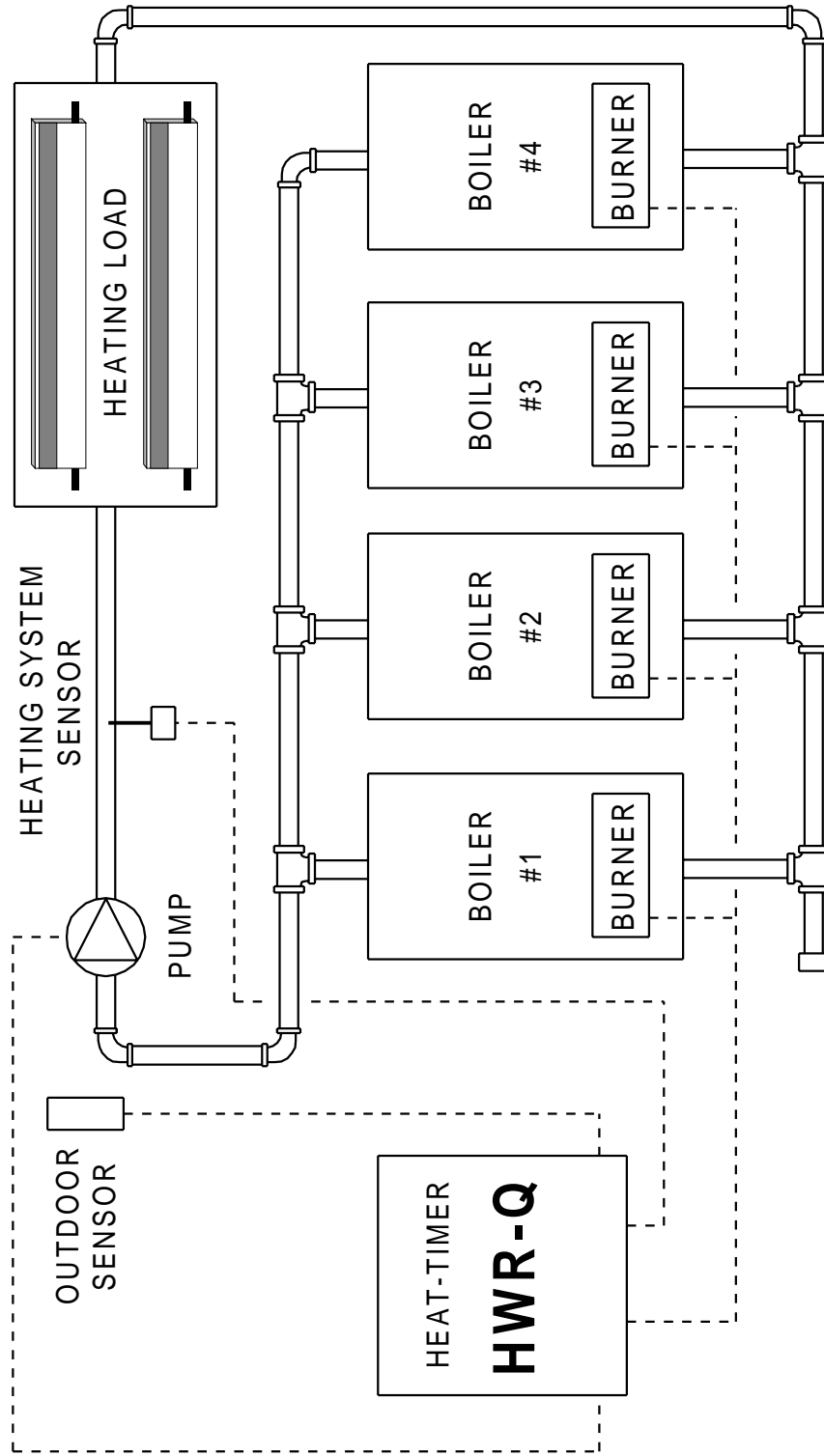
The second element of the Vari-Boost is the amount of increase to the computed water temperature. This is determined by the **MORNING BOOST SETUP TEMP** knob. This knob can increase the computed water temperature up to 60°F above the Normal water temperatures. A good starting point is to set the degrees of Boost equal to the degrees of the Setback. For instance, if the **WATER TEMPERATURE NIGHT SETBACK** knob is set to -30° (approximately the 1:00 position of the knob), then set the **MORNING BOOST SETUP TEMP** to 30°F (approximately the 12:00 position of the knob).

If the ambient temperatures at the time of the **1d** settings are too cold, then increase the temperature of the **MORNING BOOST SETUP TEMP** by 10 degrees, and wait several days before adjusting the knob again. If the ambient temperatures are too hot at the time of the **1d** setting, then reduce the **MORNING BOOST SETUP TEMP** by 10 degrees, and wait several days before adjusting the knob again.

Early Shutdown

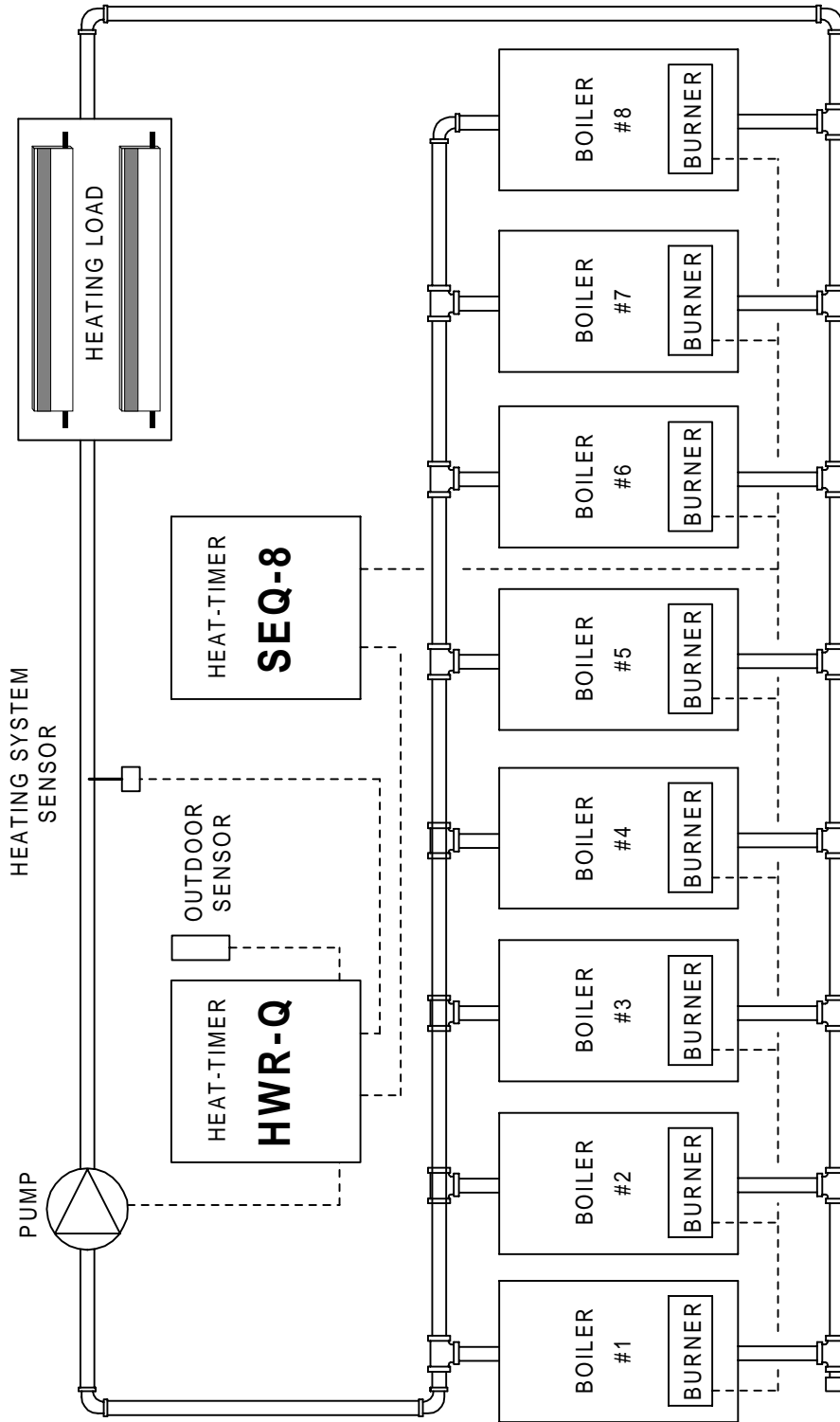
The early shutdown should be used in commercial buildings, or where the building will be unoccupied during the Setback periods. The early shutdown shifts the control into Setback mode before the last **n** setting. The early shutdown time is the reciprocal of the Vari-Boost time (see chart left). The warmer it is outside, the earlier the HWR-Q will shift to night. As it gets colder, the time between early shutdown and the last **n** setting diminishes. The maximum amount of early shutdown is 90 minutes when it is 65°F outside. At 0°F, the HWR-Q will shift back into night at the time of the last **n** setting.

PIPING: HWR-Q CONTROLLING BOILERS DIRECTLY



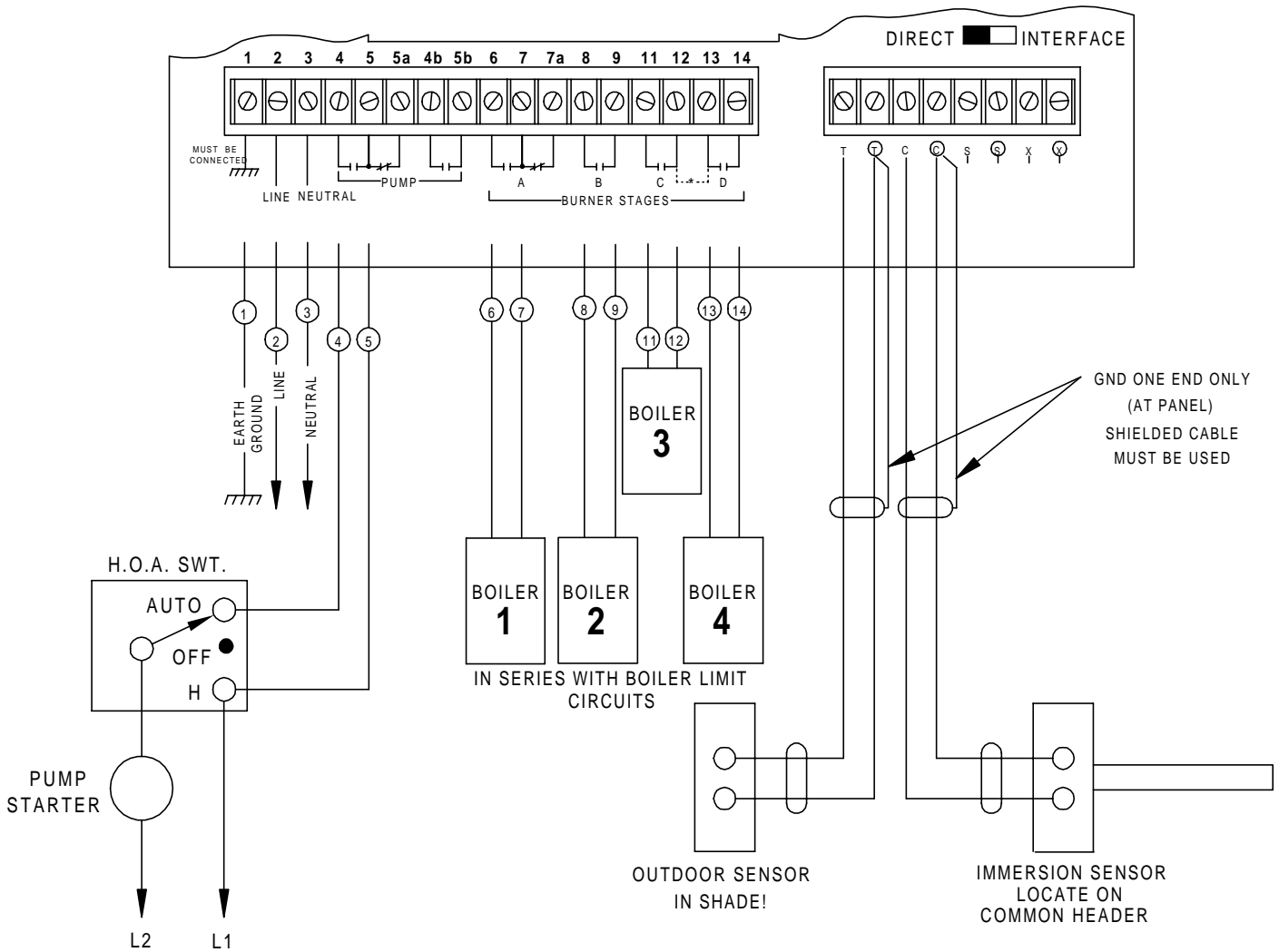
Note: Diagram is for illustration only. It is not a complete piping diagram.

PIPING: HWR-Q and SEQ-8

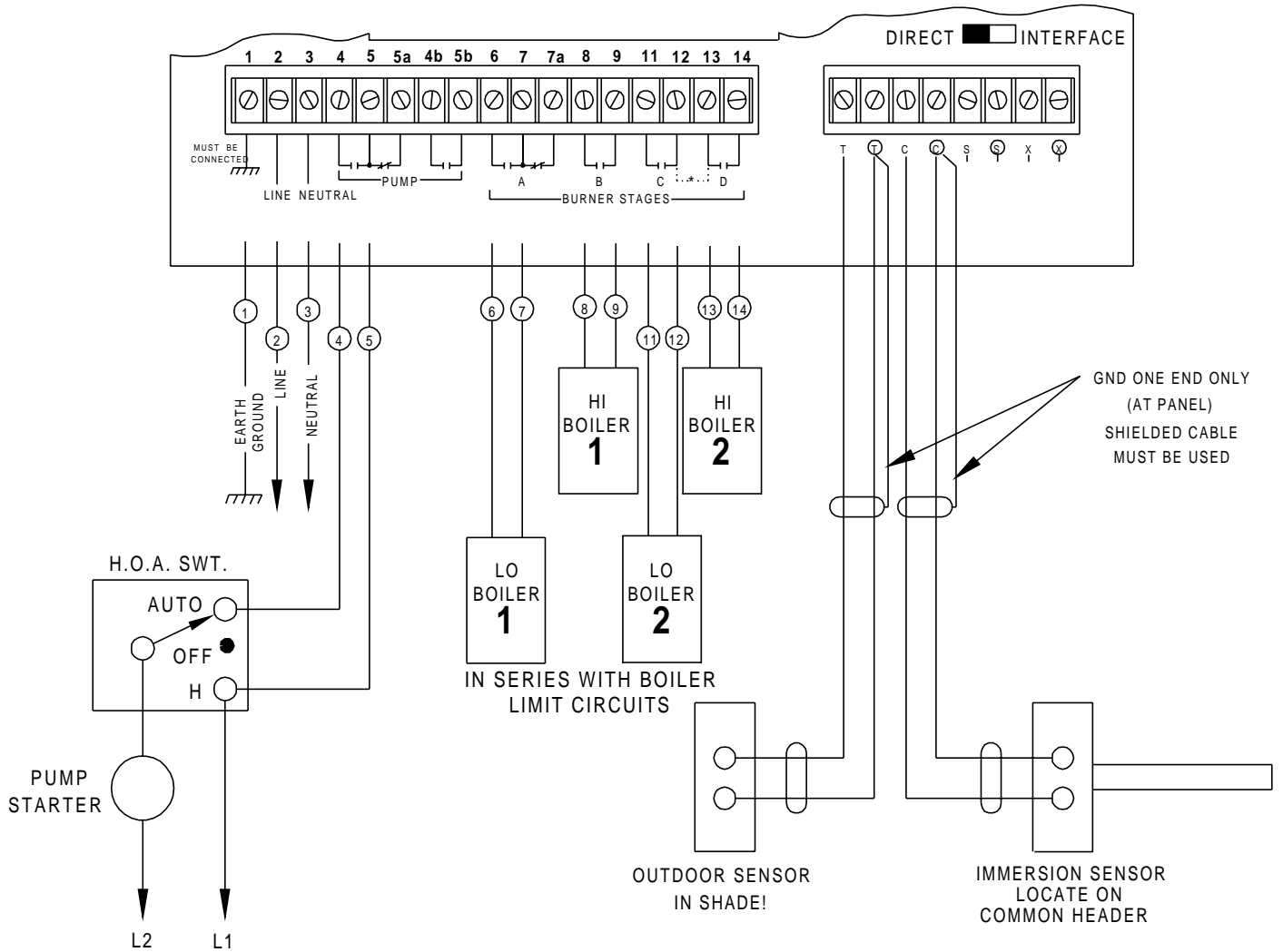


Note: Diagram is for illustration only. It is not a complete piping diagram.

WIRING: HWR-Q CONTROLLING ON/OFF BOILERS DIRECTLY

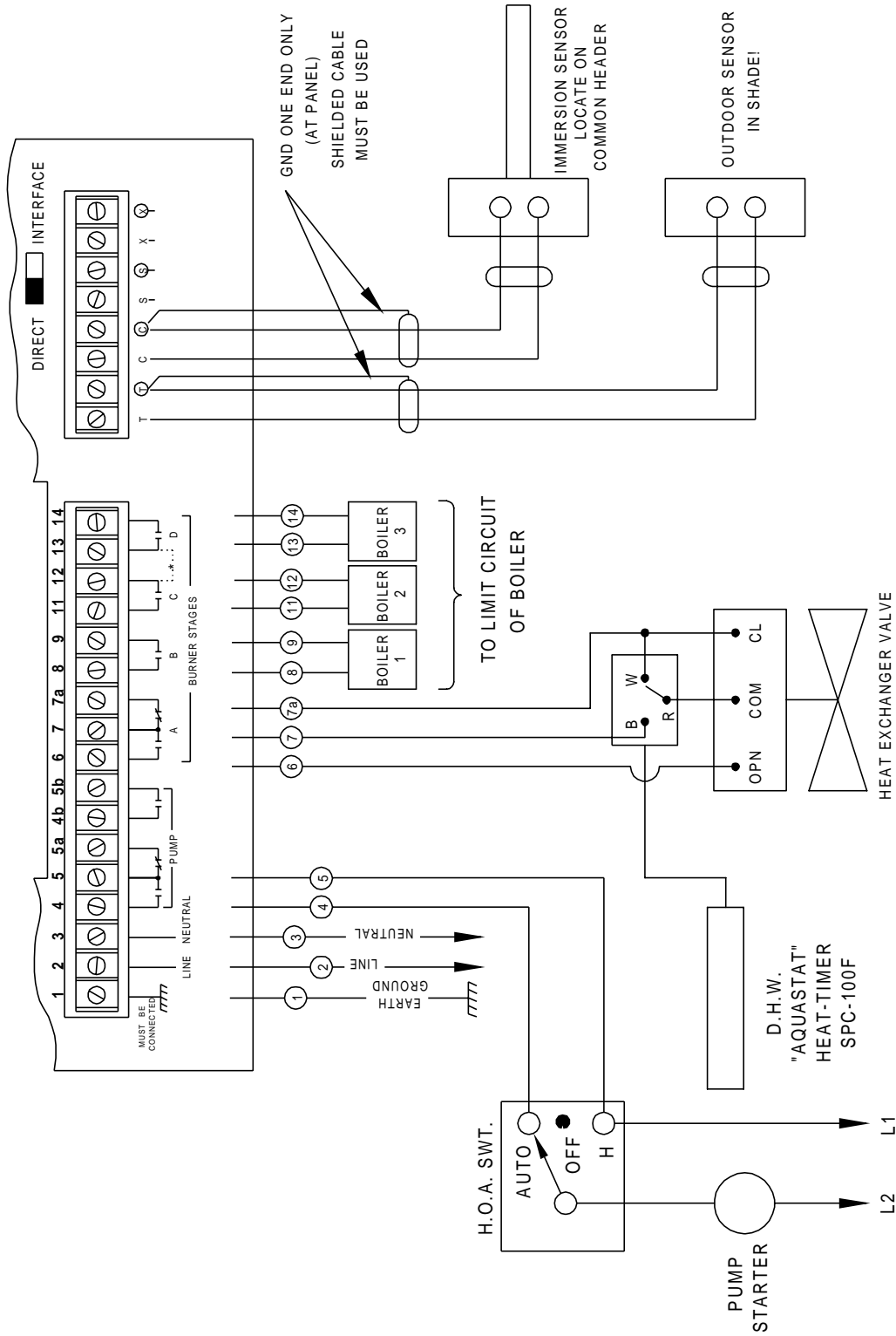


WIRING: HWR-Q CONTROLLING LO/HI FIRE BOILERS DIRECTLY

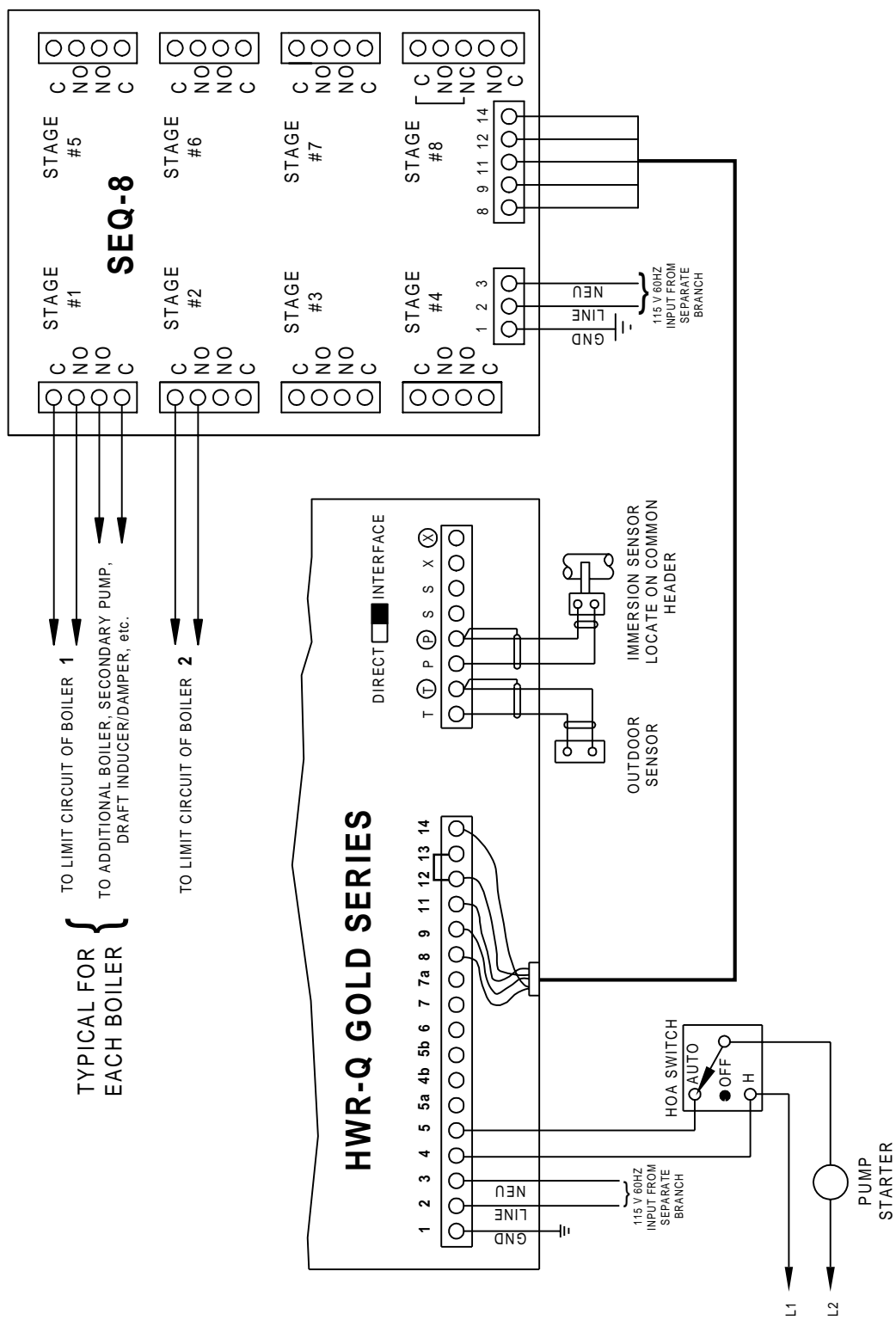


Wiring: HWR-Q with Shared Domestic Hot Water

WIRING: HWR-Q with SHARED DOMESTIC HOT WATER

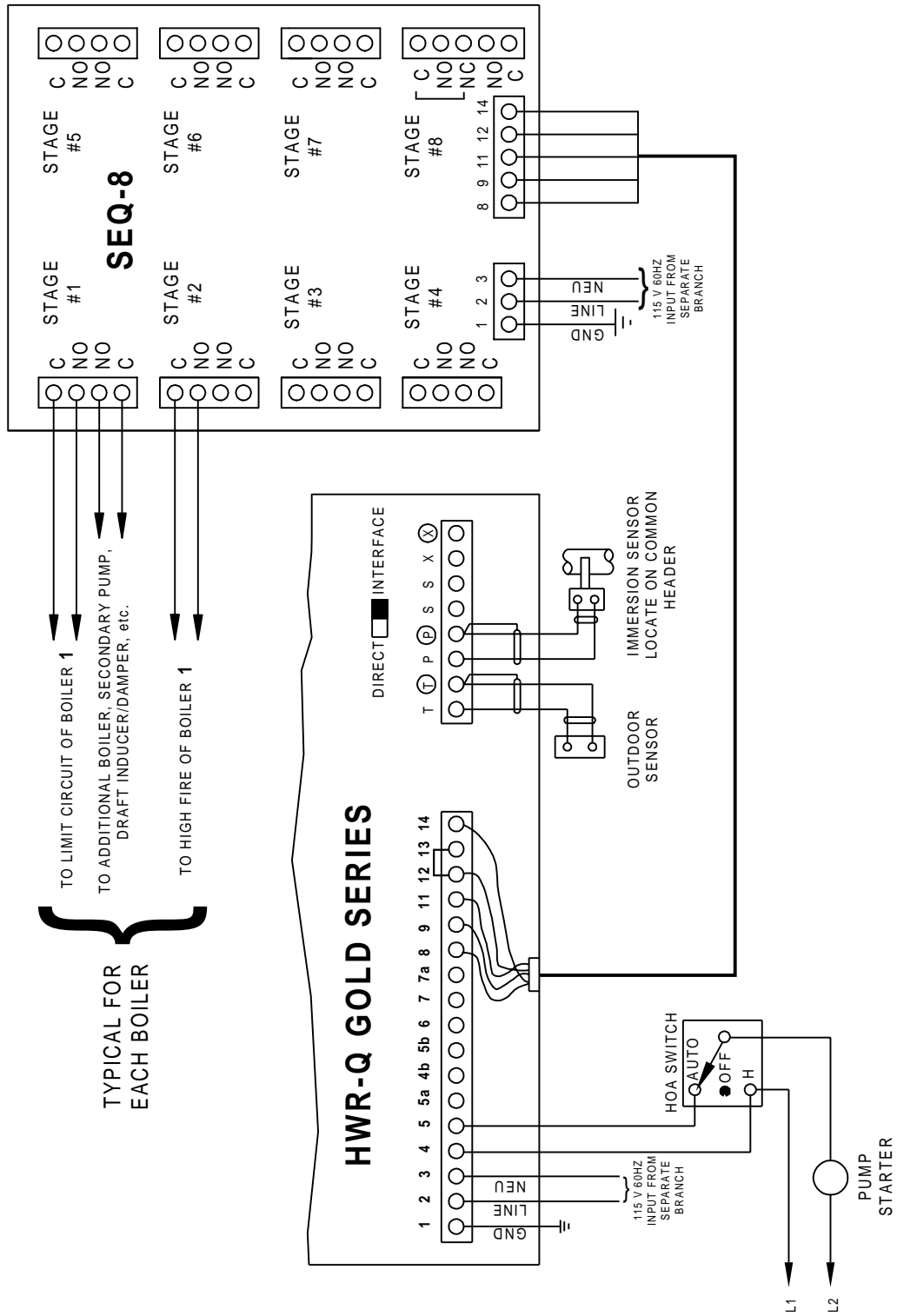


WIRING: HWR-Q with SEQ-8 CONTROLLING ON/OFF BOILERS



Wiring: HWR-Q with SEQ-8 Controlling LO/HI Fire Boilers

**WIRING: HWR-Q with SEQ-8 CONTROLLING
LO/HI FIRE BOILERS**



Troubleshooting Guide

When there is a problem with heat in a building, the first place people look is at the heating control. And the heating control may be the problem, but so may be other system components, or perhaps the heating control is not adjusted properly. To help determine and correct the problem, simply follow the troubleshooting guide that best describes your heating situation:

No Heat, No Pump - pg. 42

No Heat, Pump Running, Direct Application - pg. 43

No Heat, Pump Running, Interface Application- pg. 44

Too Little Heat, Direct Application - pg. 45

Too Little Heat, Interface Application - pg. 46

Too Much Heat - pg.47

In addition to these basic problems, you may have intermittent problems. If you

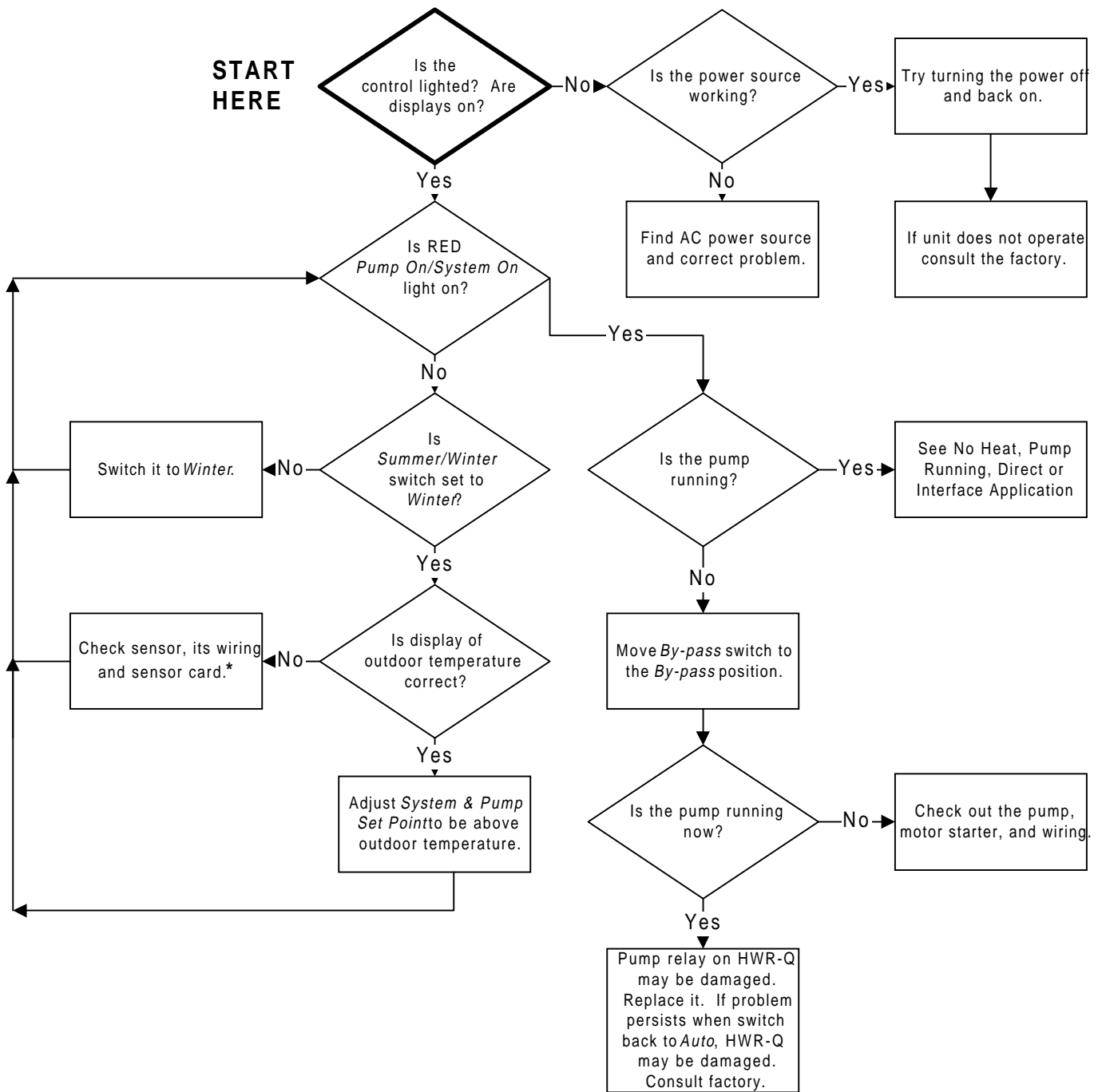
Sometimes have No Heat, too Little Heat or too Much Heat, the control may not be programmed correctly. Check through all the settings of the clock (see pg. 21) to make sure the Normal and Setback modes are when you want them to be. Go through all four settings for each day of the week, making sure any unused settings display *NONE*. Pay special attention to the *AM* and *PM* lights below the times, since if these are incorrect, the program will be 12 hours off.

Have too Little Heat or too Much Heat Only at the 1d Time, adjust your Boost. The Vari-Boost changes with outdoor temperature, and is therefore recommended. If there is too little heat, increase the *MORNING BOOST SETUP TEMPERATURE* by 10°, if there is too much heat, reduce the *MORNING BOOST SETUP TEMPERATURE* by 10° (see pg. 24).

Have too Little Heat Before the Last Setback Program, you may not wish to use the *SHUTDOWN* feature. Simply move the *BOOST* switch to the middle *VARI* position (see pg. 24).

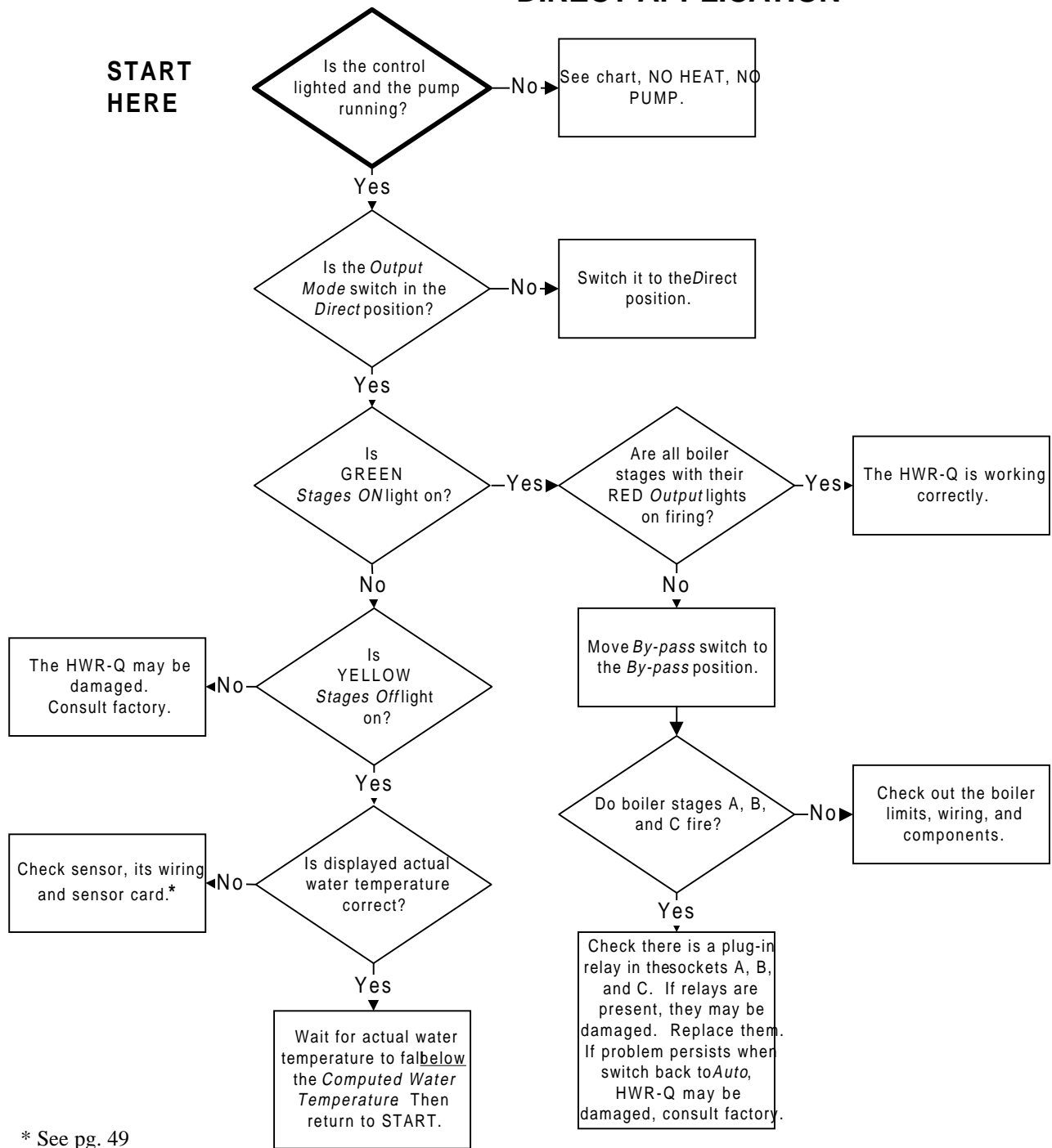
Have too Little Heat or too Little Heat Only in Parts of the Building, then check the heating system components. Check that there is no air trapped in the system, and that the pump(s) are working properly.

TROUBLESHOOTING: NO HEAT, NO PUMP



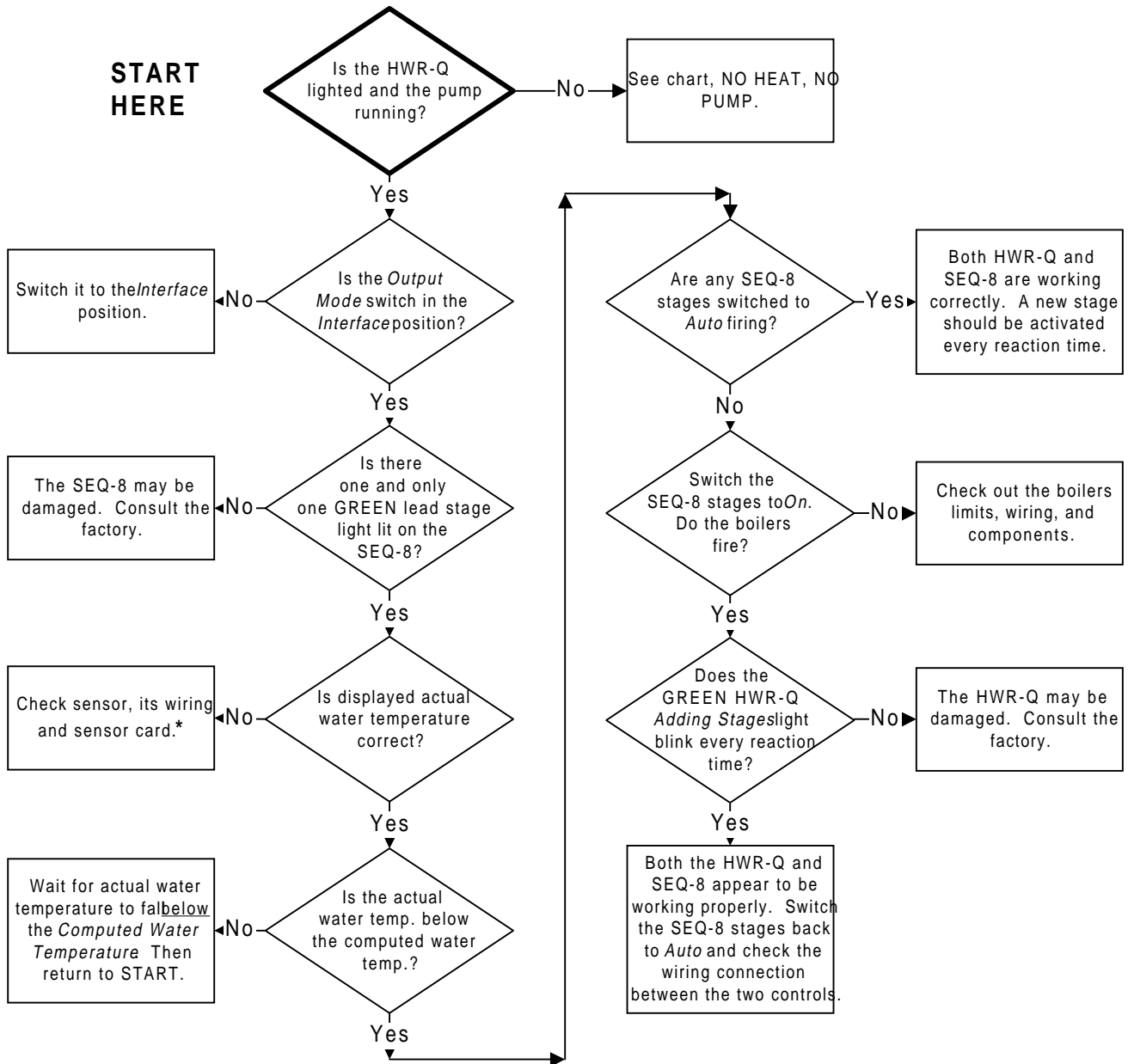
* See pg. 49

**TROUBLESHOOTING: NO HEAT, PUMP RUNNING,
DIRECT APPLICATION**



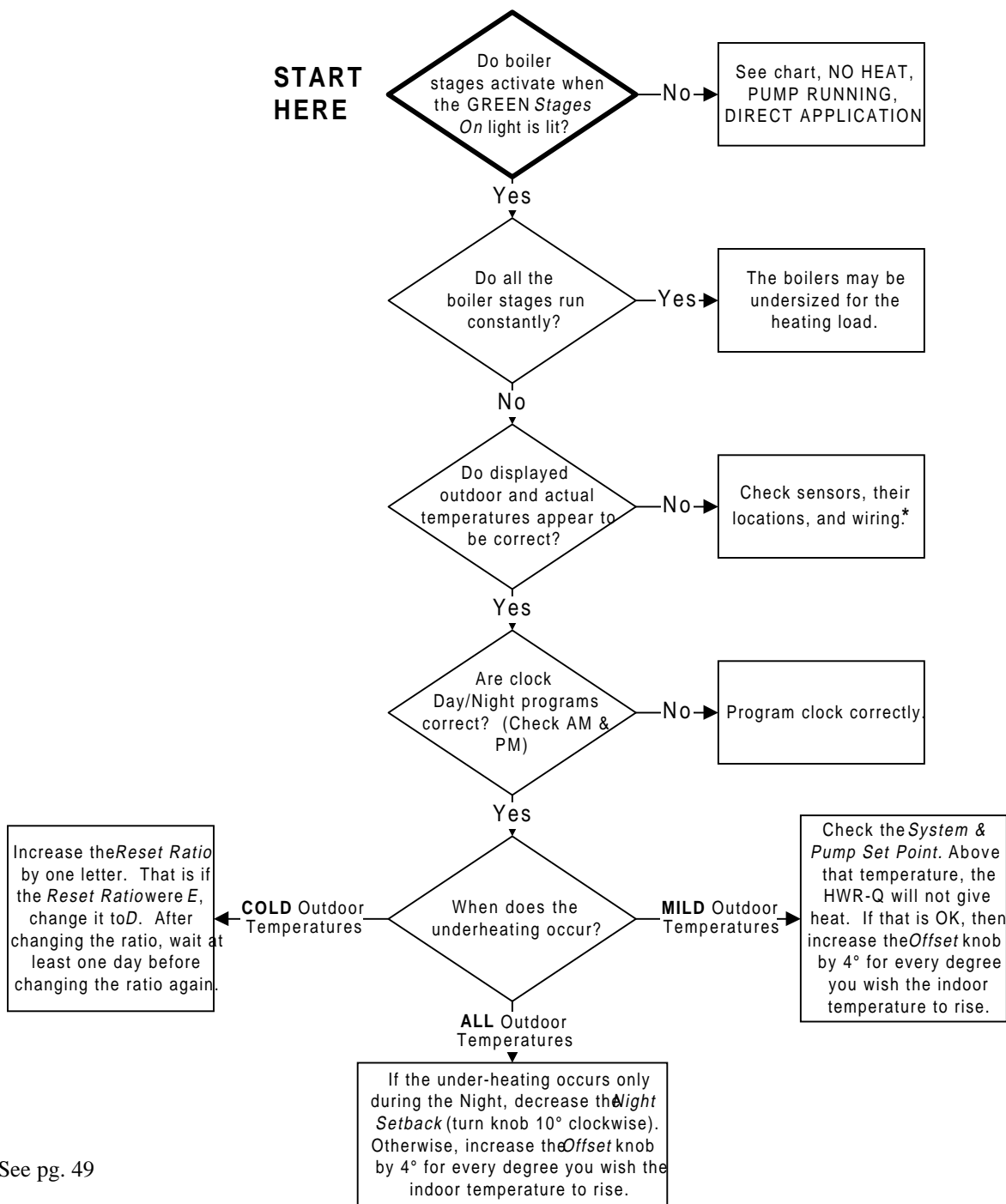
Troubleshooting: No Heat, Pump Running, Interface

TROUBLESHOOTING: NO HEAT, PUMP RUNNING, INTERFACE APPLICATION



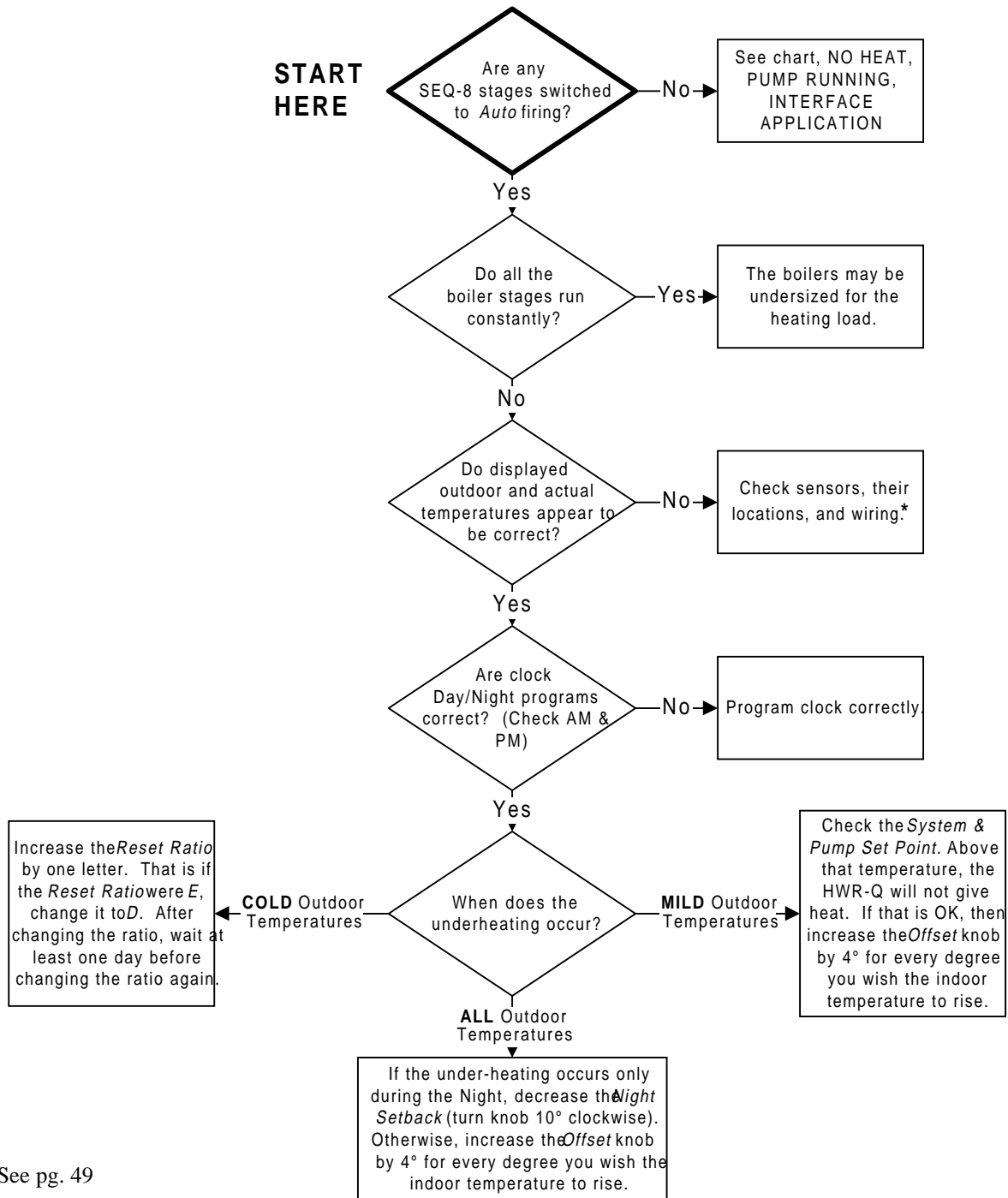
* See pg. 49

TROUBLESHOOTING: TOO LITTLE HEAT, DIRECT APPLICATION

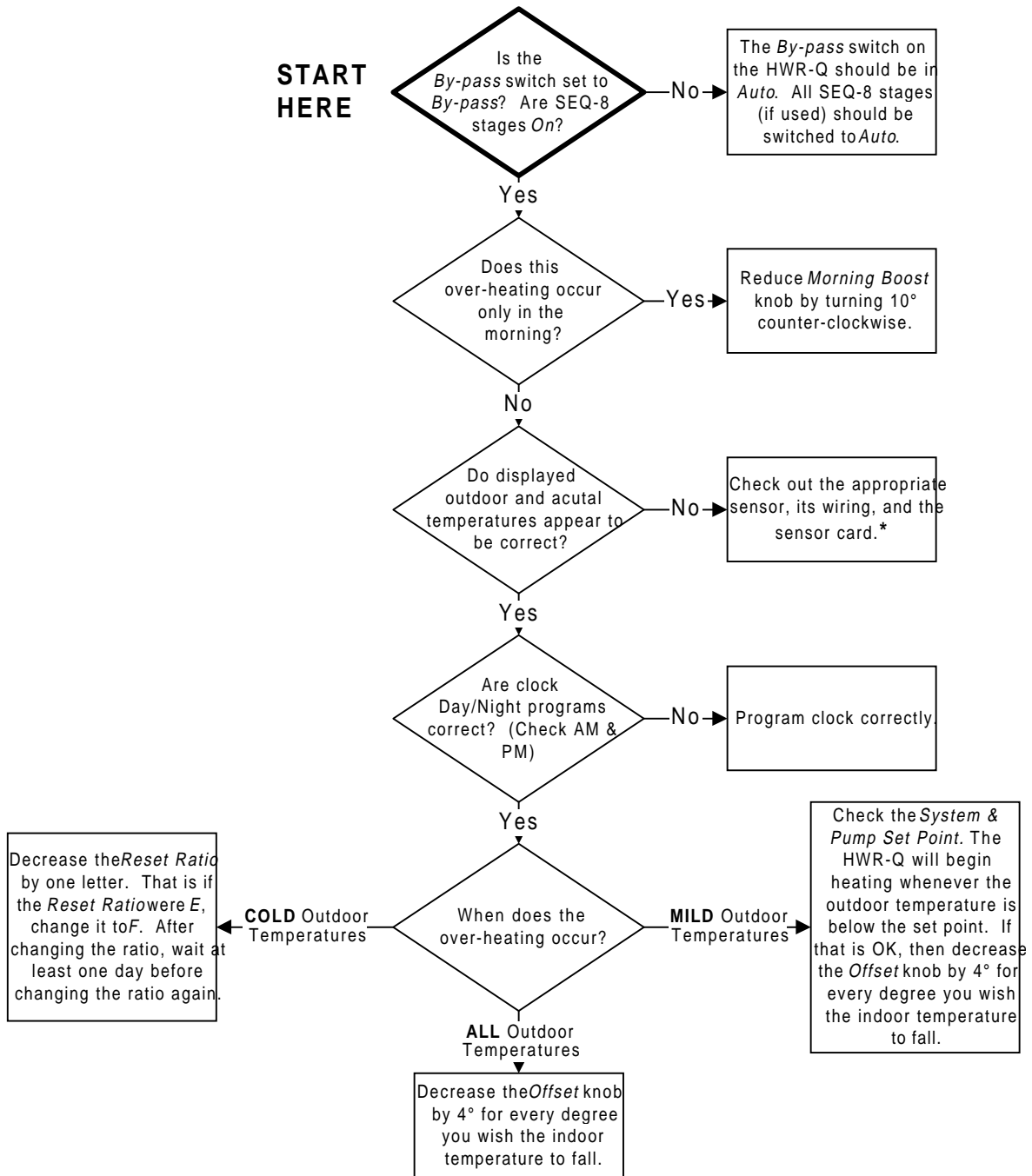


* See pg. 49

TROUBLESHOOTING: TOO LITTLE HEAT, INTERFACE APPLICATION



TROUBLESHOOTING: TOO MUCH HEAT



* See pg. 49

Troubleshooting: Error Messages

Error Messages

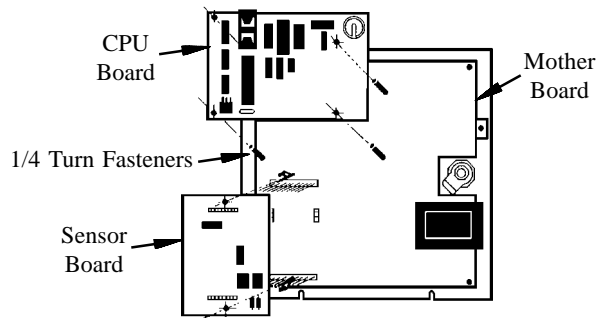
When the HWR-Q is powered up, it runs through approximately 10 seconds of self-diagnostic tests. If there is an error, it will flash a three digit code. These tests will be run on start-up, and whenever the power to the control is interrupted.

If an installed panel begins flashing codes, first shut power off to the panel and then turn it back on. If the HWR-Q then begins displaying normally, you may not need to take any action. If the codes continue to flash after repowering the control, check the following chart for the appropriate action:

DIAGNOSTIC MESSAGES

This Message:	Means this Problem:	The Solution:
(on main display)		
PPP	ROM Error	Replace CPU Board
SSS	RAM Error	Replace CPU Board
bbb	Battery-backed RAM	Replace CPU Board
CCC	Real time clock	Replace CPU Board
EEE	EEPROM Error	Replace CPU Board
AAA	Mother Board	Replace Entire Control
(on small display)		
INP	Input Board A/D	Replace Sensor Board
OPN	Sensor Circuit Open	See next page
SHT	Sensor Circuit Shorted	See next page

Circuit boards easy to replace



The new Gold HWR-Q includes a mother circuit board and two plug-on boards. The larger of the two plug-ons is the Central Processing Unit (CPU) board; the smaller one is the Sensor board. Both can easily be replaced in the field. The Sensor board simply snaps into place, the CPU Board uses four quarter-turn screws.

Checking the Sensors and Sensor Board

The HWR-Q sensors record the temperature where they are located. Before assuming a sensor is not working, it is important to get an accurate reading at the sensor location. If the outdoor sensor is affected by sun, exhaust fans, open doors, or windows, the reading may vary significantly from the actual outdoor temperature. Similarly, if the heating system sensor (HSS) does not appear to be reading correctly, check it is located correctly (see pg. 9).

To perform the test, you will need a digital multimeter capable of reading resistances. The HSS temperature is constantly displayed in the small rightmost digits of the HWR-Q. To see the value of the outside sensor, press the button marked *PRESS TO DISPLAY OUTSIDE TEMP*, and the display will change to read this.

Testing the Sensors

Remove the sensor wires from the *T-T* terminals (for the Outdoor sensor), or the *C-C* terminals (for the HSS). Use the multimeter to take a resistance reading across the detached wires going to the sensor. If the reading shows:

OPEN or a resistance in the Mega Ω s - Check the wires going to the sensor. They may have been broken or become disconnected. If the wires are fine, check the resistance at the sensor itself. If the resistance is still open, the sensor has been damaged and needs to be replaced.

SHORT or a resistance less than 100 Ω s - Check the wires going to the sensor. They may have become shorted together in the run of the wire. If not, check the resistance at the sensor itself. If there still is no resistance, the sensor has been damaged and needs to be replaced.

Resistances from 200 Ω s to 100,000 Ω s - Find the temperature that corresponds to the resistance value on the chart. If the sensor appears to be outputting correctly, check that the wires were properly connected to the HWR-Q inputs. If they were, the Sensor Board may have been damaged (see next page). If the sensor is not outputting correctly, take another reading at the sensor itself. If this is correct, the problem is in the wiring between the sensor and the HWR-Q. Otherwise, the sensor has been damaged, and should be replaced.

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

Troubleshooting: Checking the Sensor Board

Testing the Sensor Board

To test the sensor board, first test the sensors as described in the previous sections. If the sensors outputs test correctly, then use the following procedure:

1. Remove the HSS wires from the *C-C* terminals. The small right-hand display should begin flashing *OPN* (for an OPeN circuit). If it does not, the sensor card should be replaced.
2. Remove the outdoor sensor wires from the *T-T* terminals. Press the button marked *PRESS TO DISPLAY OUTSIDE TEMP*, and the small right-hand display should begin flashing *OPN* (for an OPeN circuit). If it does not, the sensor card should be replaced.
3. Put the blue wires of a Heat-Timer calibrator (Part #900138) across the *T-T* terminals. The outdoor temperature should change to display $54^{\circ}\text{F} \pm 1^{\circ}\text{F}$. If it does not, the sensor card should be replaced. (If you do not have a calibrator, you can use any resistor with a known value. Simply put the resistor across the *T-T* terminals and the display should change to the value found on the chart on the previous page).
4. Put the grey wires of a Heat-Timer calibrator (Part #900138) across the *C-C* terminals. The HSS display should change to display $160^{\circ}\text{F} \pm 1^{\circ}\text{F}$. If it does not, the sensor card should be replaced. (If you do not have a calibrator, you can use any resistor with a known value. Simply put the resistor across the *C-C* terminals and the HSS display should change to the value found on the chart on previous page).
5. If the sensor board passes these tests, it is probably fine. Recheck the sensors and any wiring to the sensors.

Interpreting the Current Status Indicator Lights

The three *CURRENT STATUS INDICATORS* lights show the status of the HWR-Q. By glancing at the lights it is possible to know the status of the heating system.

Seven combinations: There are just seven combinations of ONs and OFFs which tell you what the heating system is doing. Here is the whole list - with some examples of how they can be helpful in troubleshooting.

- (RED) PUMP ON, SYSTEM ACTIVE ○
- (GREEN) STAGES ON/ADDING STAGES ○
- (AMBER) STAGES OFF/SUBTRACTING STAGES ○

1. **ALL LIGHTS OFF** - Nothing is happening. The control is not calling for heat and the system pump is off.

If the building is cold, perform the following checks. Look at the *WINTER/SUMMER* switch to see if it is at *WINTER*. Then check the *SYSTEM AND PUMP SETPOINT* to see if it is above the displayed outdoor temperature. If these are OK, look to the charts on pages 42-47 for full troubleshooting procedures for times when there is no heat.

- (RED) PUMP ON, SYSTEM ACTIVE ●
- (GREEN) STAGES ON/ADDING STAGES ●
- (AMBER) STAGES OFF/SUBTRACTING STAGES ○

DIRECT OPERATION ONLY

2. **RED & GREEN both ON** - The outside temperature is below the *SYSTEM AND PUMP SETPOINT*, and the system pump is on. The HWR-Q is calling for boiler stages to be active, since the actual water temperature is below the computed water temperature. If the building is too cold at this point, check to see if the boilers are working properly and check the charts on pages 42-47.




- (RED) PUMP ON, SYSTEM ACTIVE ●
- (GREEN) STAGES ON/ADDING STAGES ○
- (AMBER) STAGES OFF/SUBTRACTING STAGES ●




3. **RED & AMBER both ON** - The outside temperature is below the *SYSTEM AND PUMP SETPOINT*, and the system pump is on. The HWR-Q is not calling for boiler stages to be active as the actual water temperature is either above the computed water temperature. If the building is too cold at this point, you may need to adjust the *RESET RATIO* and *OFFSET* (check charts on pages 42-47).

- (RED) PUMP ON, SYSTEM ACTIVE ○
- (GREEN) STAGES ON/ADDING STAGES ○
- (AMBER) STAGES OFF/SUBTRACTING STAGES ●

4. **AMBER only ON** - The outside temperature is above the *SYSTEM AND PUMP SETPOINT*, the system pump is off, and no boiler stages are activated.

Current Status Lights

(RED) PUMP ON, SYSTEM ACTIVE 
(GREEN) STAGES ON/ADDING STAGES 
(AMBER) STAGES OFF/SUBTRACTING STAGES 

(RED) PUMP ON, SYSTEM ACTIVE 
(GREEN) STAGES ON/ADDING STAGES 
(AMBER) STAGES OFF/SUBTRACTING STAGES 

INTERFACE OPERATION ONLY

- 5. RED ON GREEN flashing** - The outside temperature is below the *SYSTEM AND PUMP SETPOINT*, and the system pump is on. The HWR-Q is calling for boiler stages to be active, since the actual water temperature is below the computed water temperature. When the green light flashes, the SEQ panel should add an additional output stage. If the building is too cold at this point, check to see if the boilers are working properly and check the charts on pages 42-47.
- 6. RED ON AMBER flashing** - The outside temperature is below the *SYSTEM AND PUMP SETPOINT*, and the system pump is on. However, the actual water temperature is above the computed water temperature, so the HWR-Q is removing boiler stages. When the yellow light flashes, the SEQ panel should subtract a stage. If the building is too cold at this point, you may need to adjust the *RESET RATIO* and *OFFSET* (check charts on pages 42-47).

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