

# Programming Guide

Central Processing Unit 1000  
Version 1.38

The logo consists of the letters 'HBX' in a bold, black, sans-serif font. The letters are centered between two horizontal red bars. The top bar is above the 'H' and 'B', and the bottom bar is below the 'B' and 'X'.

**HBX**

# CPU-1000

HBX Control Systems Inc.



Control Systems Inc.

HBX CPU-1000 HVAC Controller  
Version 1.38



Control Systems Inc.

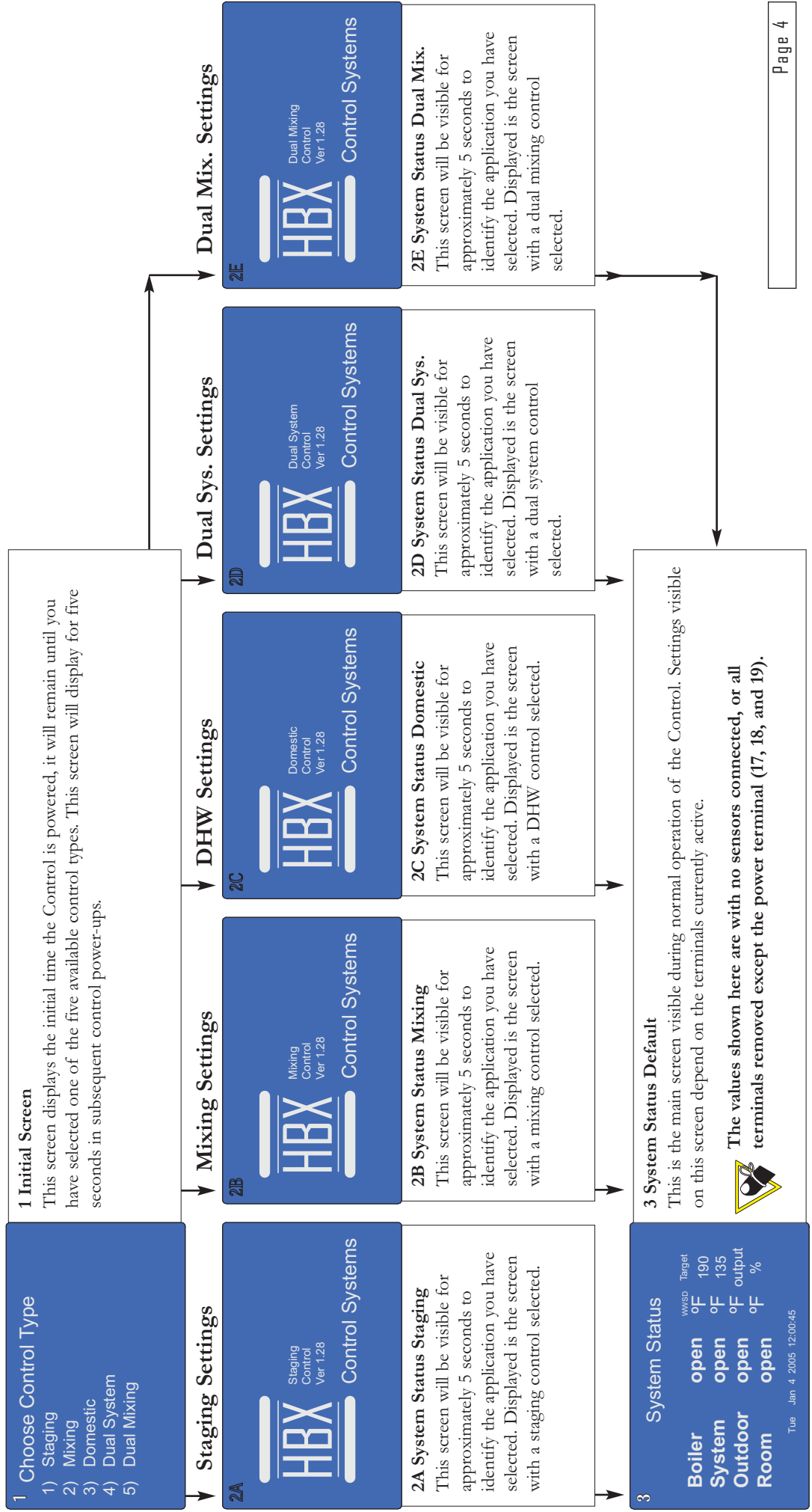
HBX CPU-1000 HVAC Controller  
Version 1.38

NOTES:

# NAVIGATING THE DISPLAY

The programming instructions are broken down into five columns to accommodate each control type. Steps in the first column are for “staging” control/common steps, the second column is applicable for “mixing” control steps, the third column pertains to the “DHW” control, the fourth step applies to the “dual system” control, and the last column is designated for the “dual mixing” control.

## Combined Settings



### Staging Settings

**4A** System Function  
wwsd Cycles  
**HT Sys Pump** OFF 236  
**Boiler** OFF 720

**4A System Function**  
 You can toggle between main screens by pressing either the A or B button. For a staging control (with a single boiler selected) the screen will look like above (depending on current terminal activity).

### Mixing Settings

**4B** System Function  
wwsd Cycles  
**Boiler Pump** OFF 236  
**System Pump** OFF 472  
**Injection** OFF 720  
**Boiler** OFF 236

**4B System Function**  
 You can toggle between main screens by pressing either the A or B button. For a mixing control (with a single boiler selected) the screen will look like above (depending on current terminal activity).

### DHW Settings

**4C** System Function  
wwsd Cycles  
**Boiler Pump 1** OFF 236  
**Boiler** OFF 720  
**DHW Valve** OFF 236

**4C System Function**  
 You can toggle between main screens by pressing either the A or B button. For a DHW control (with a single boiler selected) the screen will look like above (depending on current terminal activity).

### Dual Sys. Settings

**4D** System Function  
CYCLES  
**HT Sys Pump** OFF 5  
**Boiler** OFF 68  
**DHW Boiler** OFF 0  
**DHW Valve** OFF 65535

**4D System Function**  
 You can toggle between main screens by pressing either the A or B button. For a dual system control the screen will look like above (depending on current terminal activity).

### Dual Mix. Settings

**4E** System Function  
HTD HD2 CYCLES  
**Boiler Pump1** ON 1  
**System Pump1** OFF 0  
**System Pump2** ON 1  
**Injection** OFF 0  
**Injection2** OFF 0  
**Boiler** OFF 0

**4E System Function**  
 You can toggle between main screens by pressing either the A or B button. For a dual mixing control the screen will look like above (depending on current terminal activity).

## 5 Programming

- 1) Control Options
- 2) System Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

## 5 Programming - Control Options

To access the Programming Menu, press the D button. To scroll to one of the 7 options, press the A button to move down the page or the B button to move up the page. Option two will vary depending on the specific control type that you have chosen.

## 6A Programming

- 1) Control Options
- 2) System Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**6A Programming - Control Options Enter**  
 To enter the desired selection press the C button. For example, with line 1 flashing press button C to enter the Control Options screen.

## 6B Programming

- 1) Control Options
- 2) Mixing Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**6B Programming - Control Options Enter**  
 To enter the desired selection press the C button. For example, with line 1 flashing press button C to enter the Control Options screen.

## 6C Programming

- 1) Control Options
- 2) Domestic Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**6C Programming - Control Options Enter**  
 To enter the desired selection press the C button. For example, with line 1 flashing press button C to enter the Control Options screen.

## 6D Programming

- 1) Control Options
- 2) Dual Stage Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**6D Programming - Control Options Enter**  
 To enter the desired selection press the C button. For example, with line 1 flashing press button C to enter the Control Options screen.

## 6E Programming

- 1) Control Options
- 2) Dual Mixing Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**6E Programming - Control Options Enter**  
 To enter the desired selection press the C button. For example, with line 1 flashing press button C to enter the Control Options screen.

## Combined Settings

### 7 Control Options

- 1) Display Options
- 2) Always HD? N
- 3) Use Room Therm? N
- 4) Mins and Maxs
- 5) Testing
- 6) Stage Run Times
- 7) Use Zone Module? N

### 7 Control Options Selections

- 1) Set up the display and clock
- 2) Program a permanent heat demand
- 3) Trigger the Control with a thermistor input via an Expansion Module
- 4) View temp values effecting each thermistor
- 5) Manually test each relay
- 6) View the running times of each boiler stage for all connected boilers
- 7) Option allowing you to add and use Zone Control Modules (under development)

### 8 Display Options

- 1) Change Time
- 2) Reset Cycles
- 3) Display in °F
- 4) D-lite Savings? N
- 5) Reset Run Times

### 8 Display Options

- 1) Set your date and time (MFG suggests to enter your clock setup now)
- 2) Reset the internal relay counter for pump and boiler cycles
- 3) Program and Display either °F or °C
- 4) Program the Control to allow for Daylight Savings time shifting
- 5) Clears stage accumulated hours counter

### 9 Display Options

- 1) Change Time
- 2) Reset Cycles
- 3) Display in °F
- 4) D-lite savings? N
- 5) Reset Run Times

### 9 Display Options: Change Time

It is recommended that you setup the correct time on your Control before configuring other options, as the real-time settings are effected by the "Change Time" feature.

### 9A Year 2000

### 9A Display Options: Change Time - Year

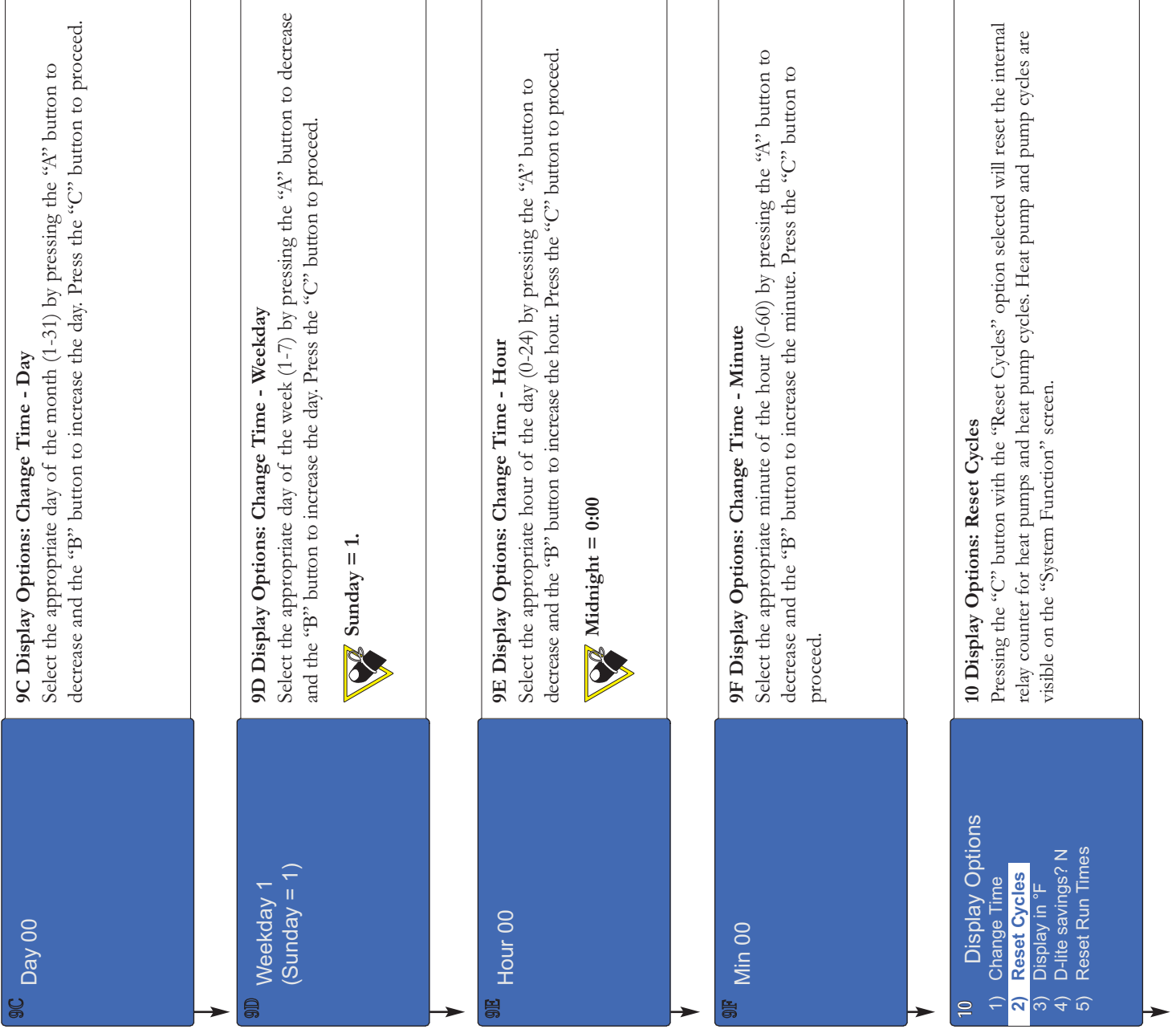
Select the appropriate year by pressing the "A" button to decrease and the "B" button to increase the year. Press the "C" button to proceed.

### 9B Month 00

### 9B Display Options: Change Time - Month

Select the appropriate month (1-12) by pressing the "A" button to decrease and the "B" button to increase the month. Press the "C" button to proceed.

## Combined Settings



## Combined Settings

### 11 Display Options

- 1) Change Time
- 2) Reset Cycles
- 3) Display in °C**
- 4) D-lite savings? N
- 5) Reset Run Times

### 11 Display Options: Display in °F/°C

Pressing the “C” button with the “Display in °F/°C” option selected will allow you to program the Control and display in either °F or °C scales.

### 12 Display Options

- 1) Change Time
- 2) Reset Cycles
- 3) Display in °C
- 4) D-lite savings? Y**
- 5) Reset Run Times

### 12 Display Options: D-Lite Savings

Pressing the “C” button with the “D-Lite Savings” option selected will allow you to program the Control to allow for Daylight Savings time shifting.

### 3 Display Options

- 1) Change Time
- 2) Reset Cycles
- Display in °C
- D-lite savings? Y
- 5) Reset Run Times**

### 13 Display Options: Reset Run Times

Pressing the “C” button with the “Reset Run Times” option selected will clear the stage accumulated hours counter. To view the stage runtime, select the “Stage Run Times” option within the “Control Options” menu.

### 14 Control Options

- 1) Display Options
- 2) Always HD? N**
- 3) Use Room Therm? N
- 4) Mins and Maxs
- 5) Testing
- 6) Stage Run Times
- 7) Use Zone Module? N

### 14 Always Heat (Mixing) Demand/Use Room Therm

**Option #2** allows you to set a permanent heat demand using the software program and does not require the use of an external signal. Eg. In a commercial staging control application.

### 15 Control Options



- 1) Display Options
- Always HD? N
- 3) Use Room Therm? N**
- 4) Mins and Maxs
- 5) Testing
- 6) Stage Run Times
- 7) Use Zone Module? N

### 15 Use Room Therm

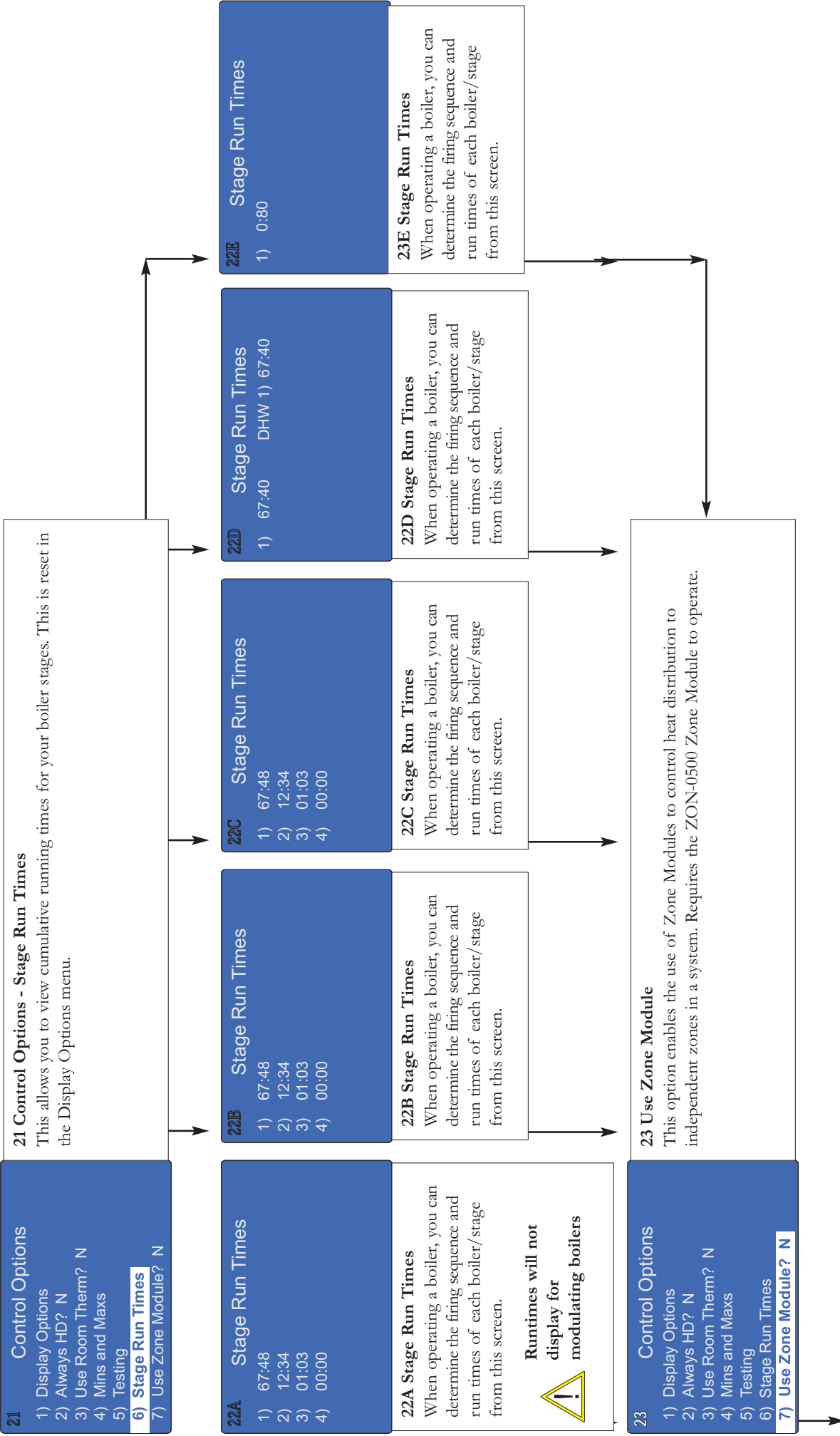
**Option #3** requires the use of an Expansion Module (EXP-0100 or EXP-0300) for a fourth sensor value. Eg. When a room thermistor is selected to ‘Y’, the Control looks for a fourth thermistor.



## Combined Settings

<p><b>16 Control Options</b></p> <ol style="list-style-type: none"> <li>1) Display Options</li> <li>2) Always HD? N</li> <li>3) Use Room Therm? N</li> <li><b>4) Mins and Maxs</b></li> <li>5) Testing</li> <li>6) Stage Run Times</li> <li>7) Use Zone Module? N</li> </ol>	<p><b>16 Control Options - Mins and Maxs</b></p> <p>This allows you to view extreme temperatures that the thermistor has been subjected to. These values can be reset at any time.</p>				
<p><b>17 Mins and Maxs</b></p> <ol style="list-style-type: none"> <li><b>1) Thermistor 1</b></li> <li>2) Thermistor 2</li> <li>3) Thermistor 3</li> <li>4) Thermistor 4</li> <li>5) Thermistor 5</li> <li>6) Thermistor 6</li> <li>7) Reset All</li> </ol>	<p><b>17 Mins and Maxs</b></p> <p>Allows you to look at up to six different thermistor min/max temperature extremes and reset back to zero. When formatting the Control, existing min/max values are reset. Selecting the 'Reset All' option clears the time and date stamps. To see updated Min/Max values return to the System Status screen to refresh the view.</p>				
<p><b>18 Thermistor 1</b></p> <table border="0"> <tr> <td>30/09/05 03HRS</td> <td>Min Temp 89°F</td> </tr> <tr> <td>24/09/05 16HRS</td> <td>Max Temp 201°F</td> </tr> </table>	30/09/05 03HRS	Min Temp 89°F	24/09/05 16HRS	Max Temp 201°F	<p><b>18 Thermistor 1</b></p> <p>Each min/max value also has a time and date stamp to show when the value was reached.</p> <p> <b>This can serve as a valuable troubleshooting tool while diagnosing system problems.</b></p>
30/09/05 03HRS	Min Temp 89°F				
24/09/05 16HRS	Max Temp 201°F				
<p><b>19 Control Options</b></p> <ol style="list-style-type: none"> <li>1) Display Options</li> <li>2) Always HD? N</li> <li>3) Use Room Therm? N</li> <li>4) Mins and Maxs</li> <li><b>5) Testing</b></li> <li>6) Stage Run Times</li> <li>7) Use Zone Module? N</li> </ol>	<p><b>19 Control Options Testing</b></p> <p>This allows you to manually test/run each relay for up to 30 seconds.</p> <p> <b>You can cycle the relay faster by pressing the C button, this skips the 30 second elapse time.</b></p>				
<p><b>20 Testing</b></p> <ol style="list-style-type: none"> <li><b>1) Relay # 1</b></li> <li>2) Relay # 2</li> <li>3) Relay # 3</li> <li>4) Relay # 4</li> <li>5) Relay # 5</li> <li>6) Relay # 6</li> <li>7) Relay # 7</li> </ol>	<p><b>20 Testing Relays</b></p> <p>There are five relays on the main control box. Relays six and higher will be run with the corresponding Expansion Module connected. By continually pressing the 'A' button you can access extra screens showing Relays #8 and higher.</p>				

## Combined Settings



### Staging Settings

#### 4A Programming

- 1) Control Options
- 2) **System Options**
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

#### 24A System Options

Access programming settings for a staging control through this selection.

### Mixing Settings

#### 24B Programming

- 1) Control Options
- 2) **Mixing Options**
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

#### 24B Mixing Options

Access programming settings for a mixing control through this selection.

### DHW Settings

#### 24C Programming

- 1) Control Options
- 2) **Domestic Options**
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

#### 24C Domestic Options

Access programming settings for a DHW control through this selection.

### Dual Sys. Settings

#### 24D Programming

- 1) Control Options
- 2) **Dual Stage Options**
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

#### 24D Dual Stage Options

Access programming settings for a dual system control through this selection.

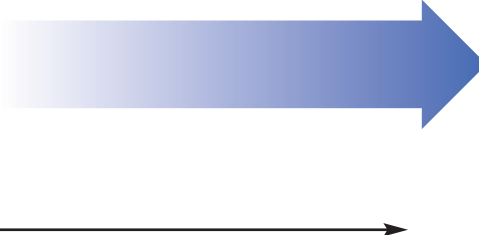
### Dual Mix. Settings

#### 24E Programming

- 1) Control Options
- 2) **Mixing Options**
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

#### 24E Dual Mixing Options

Access programming settings for a dual mixing control through this selection.



#### 24B Mixing Settings

- 1) **Boiler Options**
- 2) Injection is PMlv

#### 25B Boiler Options

Selection #1 will direct you to the System Options screen.

#### 25C Domestic Setup

- 1) **DHW Boiler Options**
- 2) Indirect Fire Tank

#### 25C DHW Boiler Options

Selection #1 will direct you to the System Options screen.

#### 25D Dual System Options

- 1) DHW System Options
- 2) **System Options**

#### 25D Dual Sys. Boiler Options

Selection #2 will direct you to the System Options screen.

#### 25E Domestic Setup

- 1) **Boiler Options**
- 2) Injection is PMlv
- 3) Injection2 is PMlv

#### 25E Dual Mix. Boiler Options

Selection #1 will direct you to the System Options screen.

#### 26 System Options

- 1) **Staging Options**
- 2) Pump Options
- 3) # of Stages 1
- 4) Rotate Boilers? Y
- 5) Mod Boiler Options
- 6) Mod Prepurge On? N
- 7) Use Flow Proof? N

These steps provide the necessary options to configure the boiler staging component in your system.

#### 27 Staging Options

- 1) **Hi/Lo Fire? N**
- 2) Fixed First? N
- 3) Fixed Last? N
- 4) Lo/Lo - Hi/Hi? N
- 5) Boiler Diff'nial
- 6) Min Boiler LagTime
- 7) 4-Stage? N

#### 27 Staging Options - Hi/Lo Fire

Enable the Hi/Lo Fire option if you are utilizing dual stage boilers with high and low output settings.

## Combined Settings

### 28 Staging Options

- 1) Hi/Lo Fire? N
- 2) **Fixed First? N**
- 3) Fixed Last? N
- 4) Lo/Lo - Hi/Hi? N
- 5) Boiler Diff'n'tial
- 6) Min Boiler LagTime
- 7) 4-Stage? N

### 28 Staging Options - Fixed First

Fixed First designates a boiler to function as the initial firing boiler, regardless of settings such as rotate boiler. This boiler will consistently be the first to fire when a heat demand is present.

### 29 Staging Options

- 1) Hi/Lo Fire? N
- 2) Fixed First? N
- 3) **Fixed Last? N**
- 4) Lo/Lo - Hi/Hi? N
- 5) Boiler Diff'n'tial
- 6) Min Boiler LagTime
- 7) 4-Stage? N

### 29 Staging Options - Fixed Last

Fixed Last designates a boiler to function as the last firing boiler, regardless of setting such as rotate boiler. This boiler will consistently be the last to fire when a heat demand is present.

### 30 Staging Options

- 1) Hi/Lo Fire? N
- 2) Fixed First? N
- 3) Fixed Last? N
- 4) **Lo/Lo - Hi/Hi? N**
- 5) Boiler Diff'n'tial
- 6) Min Boiler LagTime
- 7) 4-Stage? N

### 30 Staging Options - Lo/Lo - Hi/Hi

The Lo/Lo - Hi/Hi function of the Control instructs a heating system containing two dual stage boilers to engage the first stage of each boiler prior to igniting the second stage of either boiler. The Control will turn on the second stages of the boilers as the call for heat is required.

### 31 Staging Options

- 1) Hi/Lo Fire? N
- 2) Fixed First? N
- 3) Fixed Last? N
- 4) Lo/Lo - Hi/Hi? N
- 5) **Boiler Diff'n'tial**
- 6) Min Boiler LagTime
- 7) 4-Stage? N

### 31 Staging Options - Boiler Differential

The Boiler Differential option creates the margin for error above or below the target temperature. A higher boiler differential will allow for a greater discrepancy in target/actual temperature before there is a heat demand.



**The boiler differential can only be manually set for single boiler applications.**

### 32 Boiler Diff'n'tial

AUTO

NB. Single Stage Only

### 32 Staging Options - Boiler Differential

This option allows the user to set the differential for a single boiler only. This will override automatic differential and PID control for the boiler.

## Combined Settings

<p>33 Staging Options</p> <ol style="list-style-type: none"><li>1) Hi/Lo Fire? N</li><li>2) Fixed First? N</li><li>3) Fixed Last? N</li><li>4) Lo/Lo - Hi/Hi? N</li><li>5) Boiler Diff'n'tial</li><li>6) <b>Min Boiler LagTime</b></li><li>7) 4-Stage? N</li></ol>	<p><b>33 Staging Options - Minimum Boiler Lag Time</b> The Minimum Boiler Lagtime enforces a minimum time period that must expire before a new boiler cycle may begin. This minimizes short cycling and functions to promote a more energy efficient system.</p>
<p>3 Boiler Min LagTime</p> <p>20 mins</p>	<p><b>34 Staging Options - Minimum Boiler Lag Time Cont'd</b> This screen allows you to set the desired time frame that must pass before consecutive boiler cycles may commence.</p>
<p>3 Staging Options</p> <ol style="list-style-type: none"><li>1) Hi/Lo Fire? N</li><li>2) Fixed First? N</li><li>3) Fixed Last? N</li><li>4) Lo/Lo - Hi/Hi? N</li><li>5) Boiler Diff'n'tial</li><li>6) Min Boiler LagTime</li><li>7) <b>4-Stage? N</b></li></ol>	<p><b>35 4 Stage Boiler</b> Choose this option when running a 4-stage boiler.</p>
<p>36 System Options</p> <ol style="list-style-type: none"><li>1) Staging Options</li><li>2) <b>Pump Options</b></li><li>3) # of Stages 1</li><li>4) Rotate Boilers? Y</li><li>5) Mod Boiler Options</li><li>6) Mod Prepurge On? N</li><li>7) Use Flow Proof? N</li></ol>	<p><b>36 Pump Options</b> Access Pump Options to setup and differentiate between boiler pumps and system pumps with post purge features, etc.</p>
<p>37 Pump Options</p> <ol style="list-style-type: none"><li>1) <b>1 Pump/Boiler? N</b></li><li>2) Pump Sequencer? N</li><li>3) Pumps Always ON? N</li><li>4) Post Purge 30 Sec</li><li>5) Sequence Time 72H</li><li>6) Rotate Normal? Y</li><li>7) Use Flow Proof? N</li></ol>	<p><b>37 Pump Options - 1 Pump/Boiler</b> This feature asks you whether or not the boiler pumps are controlled by the boiler circuit. <b>N</b> = Boiler pumps controlled by boiler circuit <b>Y</b> = Boiler pumps controlled by CPU-1000 When selected 'Y' an automatic 30 sec post purge time is activated for the boiler pumps (Set on Option 4).</p>

## Combined Settings

### 3 Pump Options

- 1) Pump/Boiler? N
- 2) **Pump Sequencer? N**
- 3) Pumps Always ON? N
- 4) Post Purge 30 Sec
- 5) Sequence Time 72H
- 6) Rotate Normal? Y
- 7) Use Flow Proof? N

### 38 Pump Options - Pump Sequencer

If Pump Sequencing 'Y' is selected, the Control will alternate (sequence) 2 pumps connected to terminals 20-22 & 23-25 every 72 hours of run time. In addition the Control will exercise all pumps every 3 days, based on actual time.

This option is not valid for mixing controls.

### 3 Pump Options

- 1) Pump/Boiler? N
- 2) Pump Sequencer? N
- 3) **Pumps Always ON? N**
- 4) Post Purge 30 Sec
- 5) Sequence Time 72H
- 6) Rotate Normal? Y
- 7) Use Flow Proof? N

### 39 Pump Options - Pump Always On

Selection #3 gives you the option to run all of the pumps continuously regardless of a call for heat.



**When selected 'Y' all pumps connected to the CPU will be permanently powered.**

### 4 Pump Options

- 1) Pump/Boiler? N
- 2) Pump Sequencer? N
- 3) Pumps Always ON? N
- 4) **Post Purge 30 Sec**
- 5) Sequence Time 72H
- 6) Rotate Normal? Y
- 7) Use Flow Proof? N

### 40 Pump Options - Post Purge

Selection #4 gives you the ability to program a post purge cycle time which runs all pumps for a selectable duration (30-240 Secs) after the initial off-signal has been sent. Post purge does not effect the injection pumps.



**This feature applies to both boiler pumps and system pumps.**

### 41 Post Purge Time 30 Secs

### 41 Pump Options - Post Purge Time

This screen allows you to set the desired time frame for system and boiler pumps to run after a heat demand has been satisfied. This features process is to circulate tempered water into the loop which would otherwise be trapped in the boiler, causing energy waste.

### 42 Pump Options

- 1) Pump/Boiler? N
- 2) Pump Sequencer? N
- 3) Pumps Always ON? N
- 4) Post Purge 30 Sec
- 5) **Sequence Time 72H**
- 6) Rotate Normal? Y
- 7) Use Flow Proof? N

### 42 Pump Options - Sequence Time

Sequence Time is the number of hours that pass before the Control will rotate the active pump in an installation which contains 2 main system pumps.

# Combined Settings

3

**Sequence Time**  
72 hrs

**43 Pump Options - Sequence Time Cont'd**  
 Choose the amount off time you would like to pass before pumps are rotated.  
**This setting must be used in conjunction with pump sequencer.**

44

**Pump Options**

- 1) Pump/Boiler? N
- 2) Pump Sequencer? N
- 3) Pumps Always ON? N
- 4) Post Purge 30 Sec
- 5) Sequence Time 72H
- 6) **Rotate Normal? Y**
- 7) Use Flow Proof? N

**44 Pump Options - Rotate Normal**  
 This option allows the user to set the rotation of the pump sequencer pumps. 'Y' means the running pump will shut off first and the static pump will come on. 'N' means that the static pump will come on first followed by the active pump shutting down two seconds later.

45

**Rotate Normal**

- 1) Pump/Boiler? N
- 2) Pump Sequencer? N
- 3) Pumps Always ON? N
- 4) Post Purge 30 Sec
- 5) Sequence Time 72H
- 6) **Rotate Normal? N**
- 7) Use Flow Proof? N

**45 Pump Options - Rotate Normal Cont'd**  
 This setting may help to alleviate hammering on check valves.  
**The 'N' setting may momentarily overpressure the system with both pumps running concurrently for two seconds.**

46

**Rotate Normal**

- 1) Pump/Boiler? N
- 2) Pump Sequencer? N
- 3) Pumps Always ON? N
- 4) Post Purge 30 Sec
- 5) Sequence Time 72H
- 6) Rotate Normal? N
- 7) **Use Flow Proof? N**

**46 Use Flow Proof**  
 Selection #7 gives you the option to check flow through your pump(s), thus minimizing the possibility of damaging pump motors in "dry" conditions.  
**This feature is only active with the Staging and Dual System controls, and only when pump sequencing is activated.**

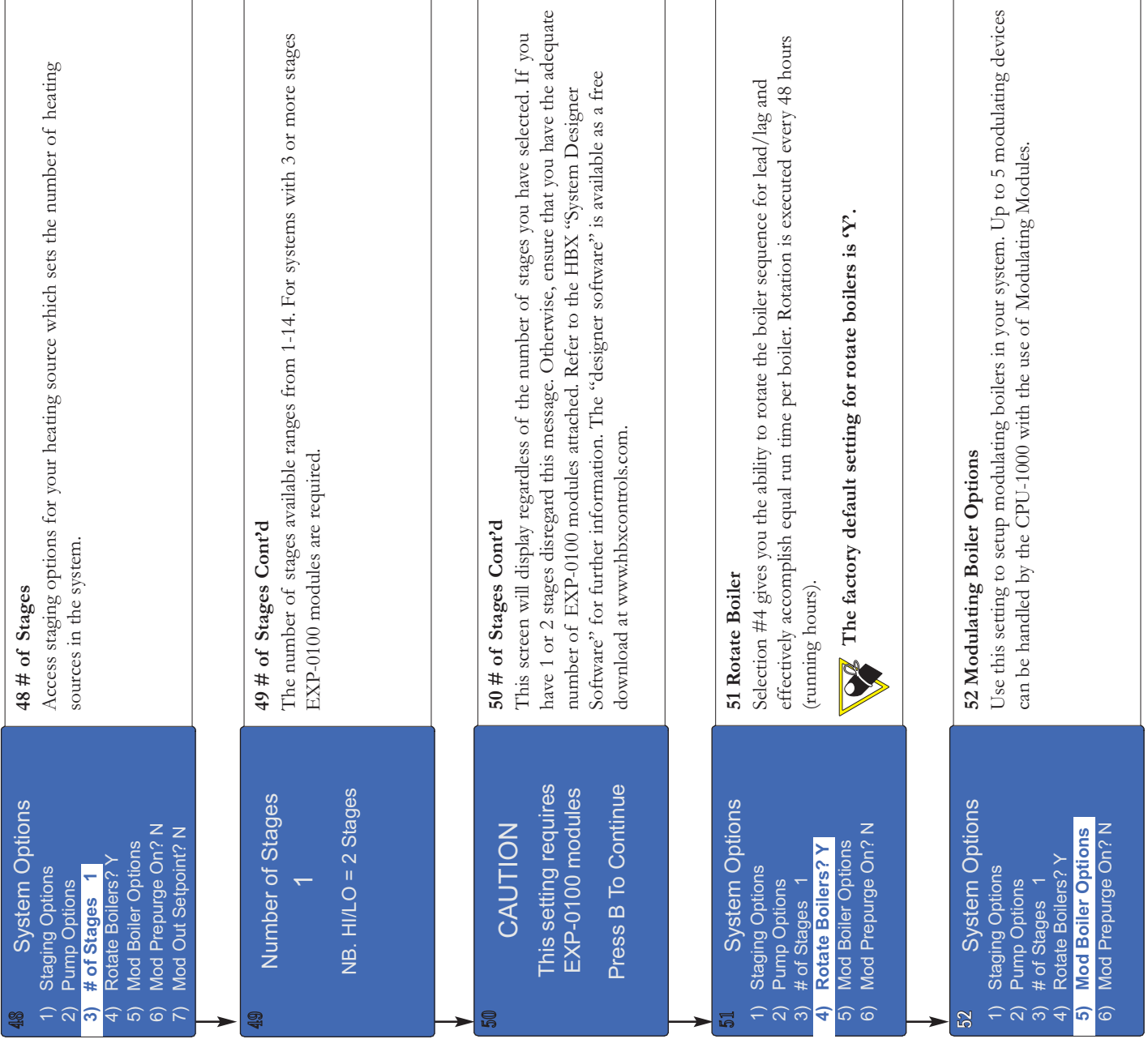
47

**System Function**

	<small>WVSD</small>	<small>Cycles</small>
<b>HT Sys Pump 1</b>	OFF	236
<b>HT Sys Pump 2</b>	NF	188
<b>Boiler Pump 1</b>	OFF	720
<b>Boiler</b>	OFF	720

**47 System Function**  
 The letters NF (no flow) are visible on the System Status screen to indicate a failure. The Control will automatically switch to the back-up pump.

## Combined Settings





## Combined Settings

### 3 Mod Boiler Option

- 1) **Parallel**
- 2) Start Percent 10%
- 3) # of Boilers 0
- 4) Pump/Boiler? N
- 5) Fast StepTime 10 secs
- 6) Slow StepTime 10 secs
- 7) Step Percent 1%

### 53 Modulating Boiler Options - Parallel

Toggle between Series, Parallel and Progressive modes. See the “Modulating Theory and Types” section of this manual for a breakdown of modulating types.

### 54 Mod Boiler Option

- 1) Parallel
- 2) **Start Percent 10%**
- 3) # of Boilers 0
- 4) Pump/Boiler? N
- 5) Rotate Boilers? N
- 6) Step Time 10 secs
- 7) Step Percent 1%

### 54 Modulating Boiler Options - Start Percent

This value is the percentage of modulation that you would like each modulating boiler to begin firing at. This is also the lowest value that the modulating boiler will drop to before shutting off.



**If Mod Prepurge is set to 'Y' then the boiler will fire at 50%**

### 55

Mod Start Percent  
10%

### 55 Modulating Start Percent

The modulating start percent must be between 10% and 100%. Press the “B” button to increase the amount and the “A” button to decrease the amount. When each boiler fires it will stay at the start percentage (Min Fire) for at least 45 seconds or if the step time is longer it will stay at min fire until the step time is reached.

### 56 Mod Boiler Option

- 1) Parallel
- 2) Start Percent 10%
- 3) **# of Boilers 0**
- 4) Pump/Boiler? N
- 5) Fast StepTime 10 secs
- 6) Slow StepTime 10 secs
- 7) Step Percent 1%

### 56 Modulating Boiler Options - Number of Boilers

This option allows you to designate the number of modulating boilers that are installed in your system (up to 5 modulating boilers).

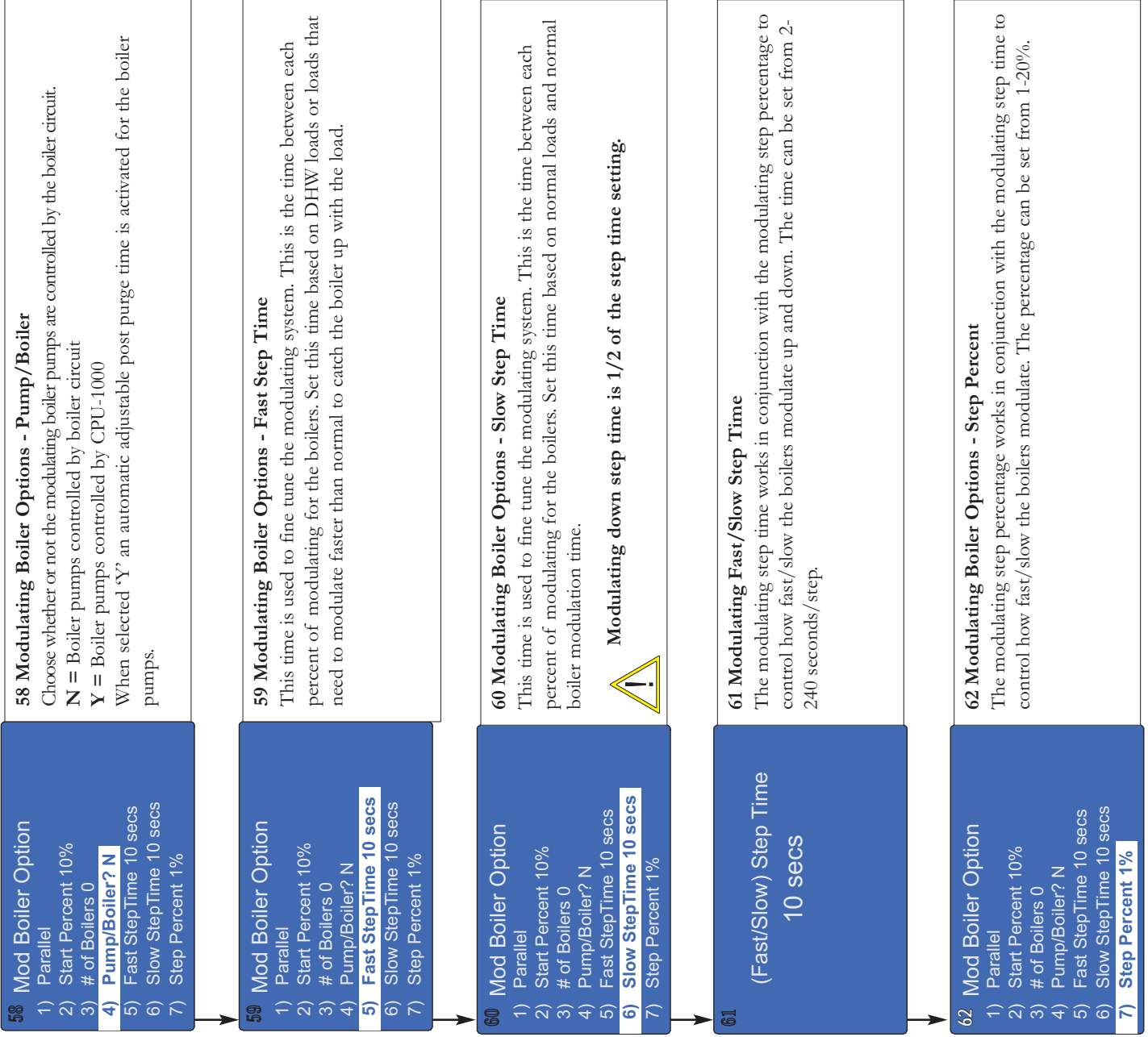
### 57

# of Boilers  
0

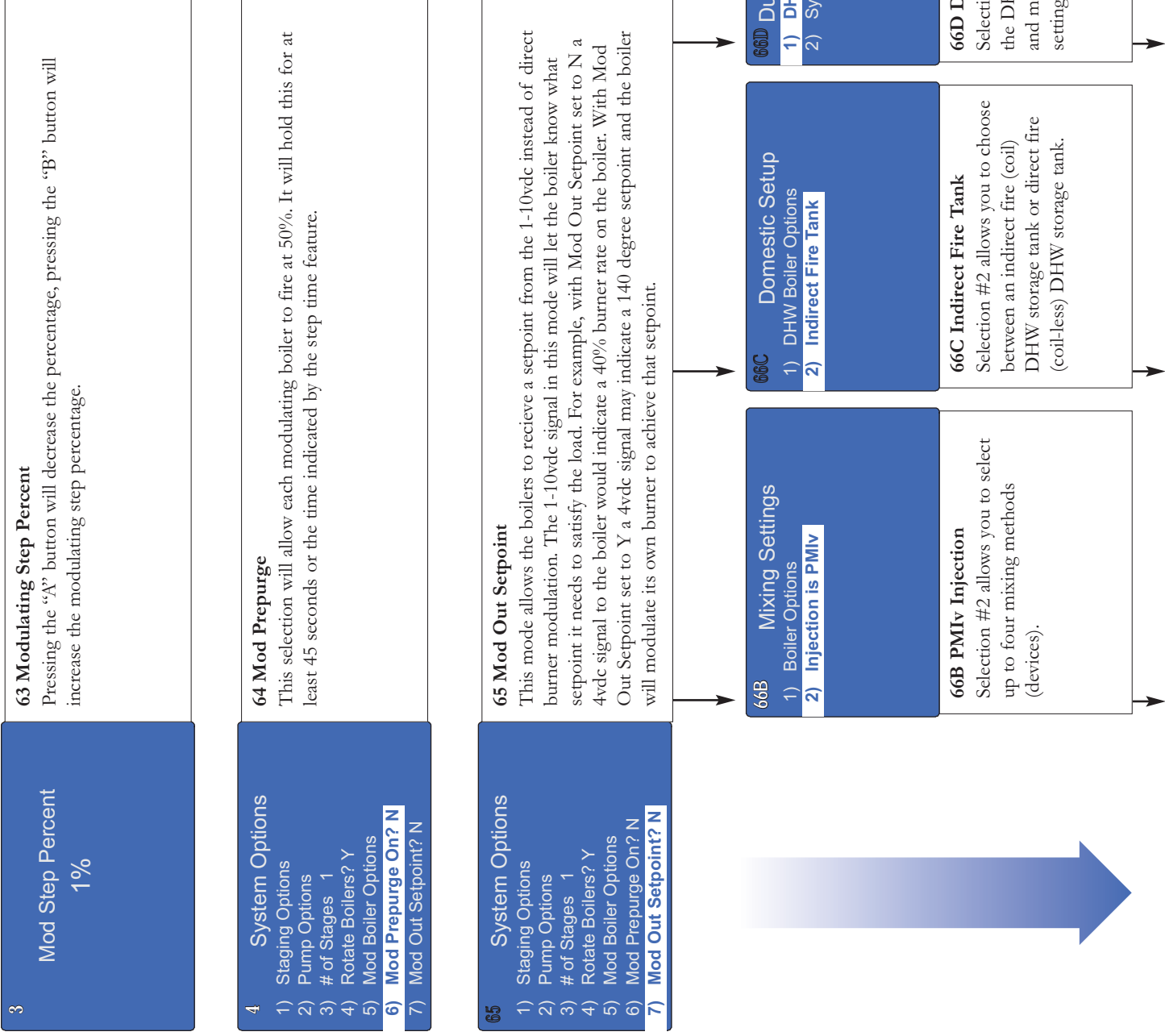
### 57 Modulating Boiler Options - Number of Boilers Cont'd

Increase or decrease the number of desired modulating boilers in this screen.

## Combined Settings



## Combined Settings



Staging Settings

Mixing Settings

DHW Settings

Dual Sys. Settings

Dual Mix. Settings

**67B** Injection Type

- 1) PMI Valve
- 2) PMI Pump
- 3) Modulating
- 4) Floating Action

**67B Injection Type**  
Select one of the following:

- 1) Valve
- 2) Pump
- 3) Modulating
- 4) Floating Action

**67D** Domestic Options

- 1) **DHW Boiler Options**
- 2) Indirect Fire Tank

**67D DHW Boiler Options**  
Enter this section to designate staging options for the DHW side of a dual system.

**67E** Injection Type

- 1) PMI Valve
- 2) PMI Pump
- 3) Modulating
- 4) Floating Action

**67E Injection Type**  
Select one of the following:

- 1) Valve
- 2) Pump
- 3) Modulating (This option is only available for single mixing)
- 4) Floating Action

**68B** Injection Type

- 1) PMI Valve
- 2) **PMI Pump**
- 3) Modulating
- 4) Floating Action

**68B PMI Pump**  
Some system configurations are not compatible with the PMIP (pump) injection mixing option. See next step.

**68D** DHW Boiler Options

- 1) **Hi/Lo Fire? N**
- 2) # of Stages = 1

**68D Hi/Lo Fire Boiler**  
This option allows you to enable a Hi/Lo fire boiler to service your DHW needs.

**68E** Injection Type

- 1) PMI Valve
- 2) **PMI Pump**
- 3) Modulating
- 4) Floating Action

**68E PMI Pump**  
Some system configurations are not compatible with the PMIP (pump) injection mixing option. See next step.

**69B** Error

PMIP Injection can't be used with DHWP Injection set back to PMIV

Press B to Continue

**69B PMIP Injection Error**  
You will receive an error when attempting to use PMIP injection with a DHW pump.

**69D** DHW Boiler Options

- 1) Hi/Lo Fire? N
- 2) **# of Stages = 1**

**69D # of Stages**  
Designate the total number of stages in your DHW system.

**69E** Error

PMIP Injection can't be used with DHWP Injection set back to PMIV

Press B to Continue

**69E PMIP Injection Error**  
You will receive an error when attempting to use PMIP injection with a DHW pump.

Staging Settings

**70A** Programming

- 1) Control Options
- 2) System Options
- 3) Change Designs**
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**70A Change Designs**  
Selection #3 guides you through the steps to adjust system design parameters; optimizing your systems performance.

Mixing Settings

**70B** Programming

- 1) Control Options
- 2) Mixing Options
- 3) Change Designs**
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**70B Change Designs**  
Selection #3 guides you through the steps to adjust system design parameters; optimizing your systems performance.

DHW Settings

**70C** Programming

- 1) Control Options
- 2) Domestic Options
- 3) Change Designs**
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**70C Change Designs**  
Selection #3 guides you through the steps to adjust system design parameters; optimizing your systems performance.

Dual Sys. Settings

**70D** Programming

- 1) Control Options
- 2) Dual System Options
- 3) Change Designs**
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**70D Change Designs**  
Selection #3 guides you through the steps to adjust system design parameters; optimizing your systems performance.

Dual Mix. Settings

**70E** Programming

- 1) Control Options
- 2) Mixing Options
- 3) Change Designs**
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

**70E Change Designs**  
Selection #3 guides you through the steps to adjust system design parameters; optimizing your systems performance.

**71** Change Designs

- 1) Manual**
- 2) Factory Defaults
- 3) Format Control

**71 Change Designs Options**  
A combination of manual and factory preprogrammed target temperatures can be accessed from here. These options also give you the ability to initialize the Control back to factory settings.


**72** Change Designs

- 1) Manual**
- 2) Factory Defaults
- 3) Format Control

**72 Change Designs Manual Design**  
Manual design allows you to customize each design temperature for your system.

**3** Design Boiler Temp

190 °F

**73 Design Boiler Temp**  
This screen allows you to set a design max boiler temperature.  
  
**The Control is not a safety limit for your boiler.**

## Combined Settings

### 74 Design System Temp

135 °F

#### 74 Design System Temp

Design System Temp will allow you to provide the required heat for your radiant source, e.g. Fancoil supply temperature and/or protect floor coverings such as hardwood by limiting the temperature of the radiant floor. Design system temp contains a second value when used with dual mixing control.



**This value is ignored on staging and DHW systems.**

### 75 Design Room Temp

70 °F

#### 75 Design Room Temp

This is the design temperature used in the heat curve calculation. Design room temp contains a second value when used with dual mixing controls.



**May be used as a trigger point with an EXP Module and setting up “Use Room Therm” as shown in the “Control Options” screen. This value is ignored in DHW controls.**

### 76 Design Outside Temp

-10 °F

#### 76 Design Outside Temp

In North America ASHRAE have a recommended outside temperature rating for each city or region a heating control can work in. This takes into consideration some of the heat loss from your building. You can change your outside design temperature here to reflect your specific circumstances. Design outside temp contains a second value when used with dual mixing controls.



**This is typically set for the coldest day of the year, and is ignored by strictly DHW systems.**

### 77 Min Boiler Temp (Supply)

120 °F

#### 77 Min Boiler Temp

This is an option that allows you to minimize boiler temp from condensing flue gases. This temp can be adjusted to run either a non-condensing boiler or condensing boiler. Setup as per the boiler manufacturers recommendation.



**This value is ignored in strictly DHW systems.**

### 78 Min System Temp

75 °F

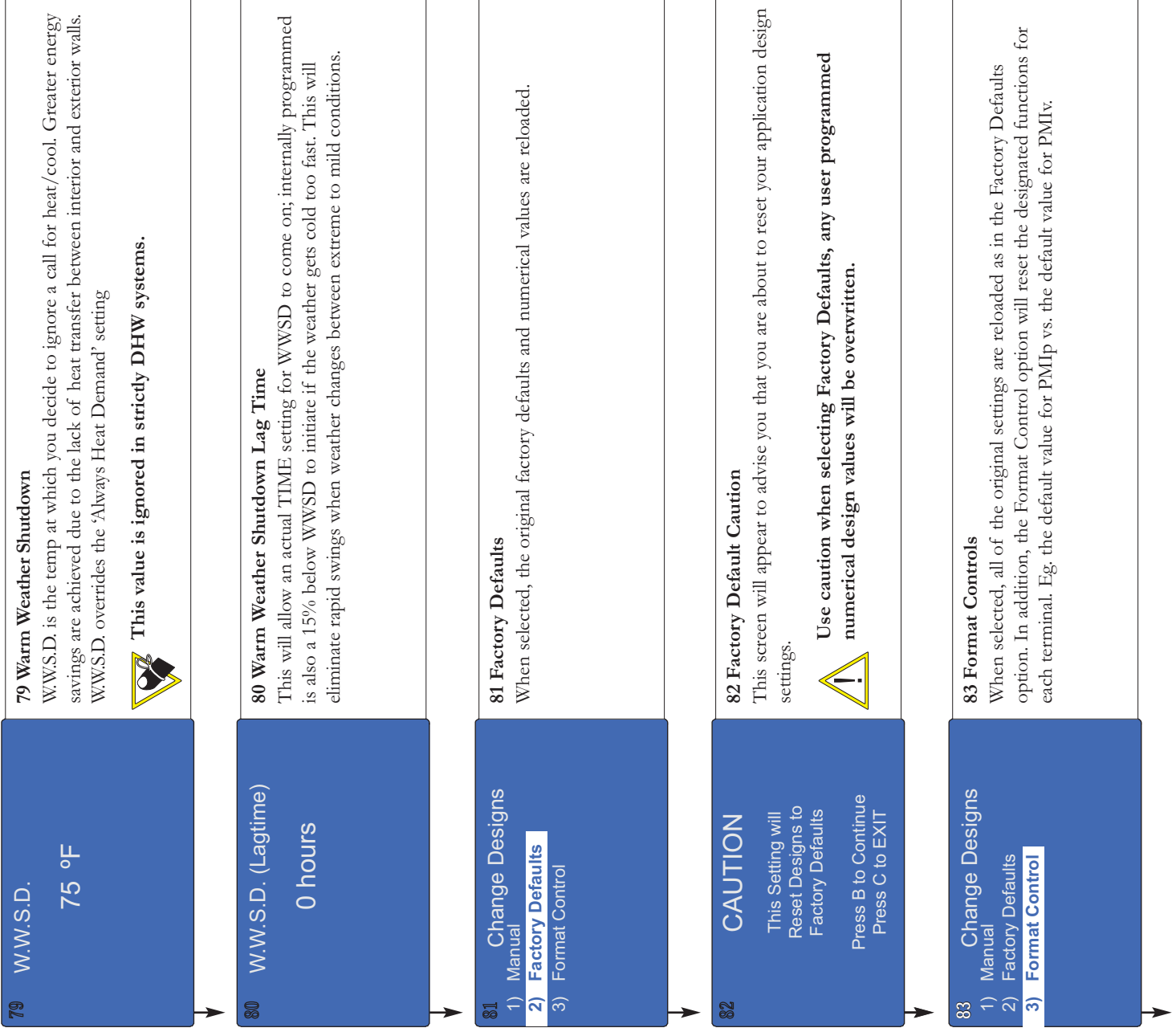
#### 78 Min System Temp

Min System Temp is the lowest water temp in your mixed radiant loop. Min system temp contains a second value when used with dual mixing controls.

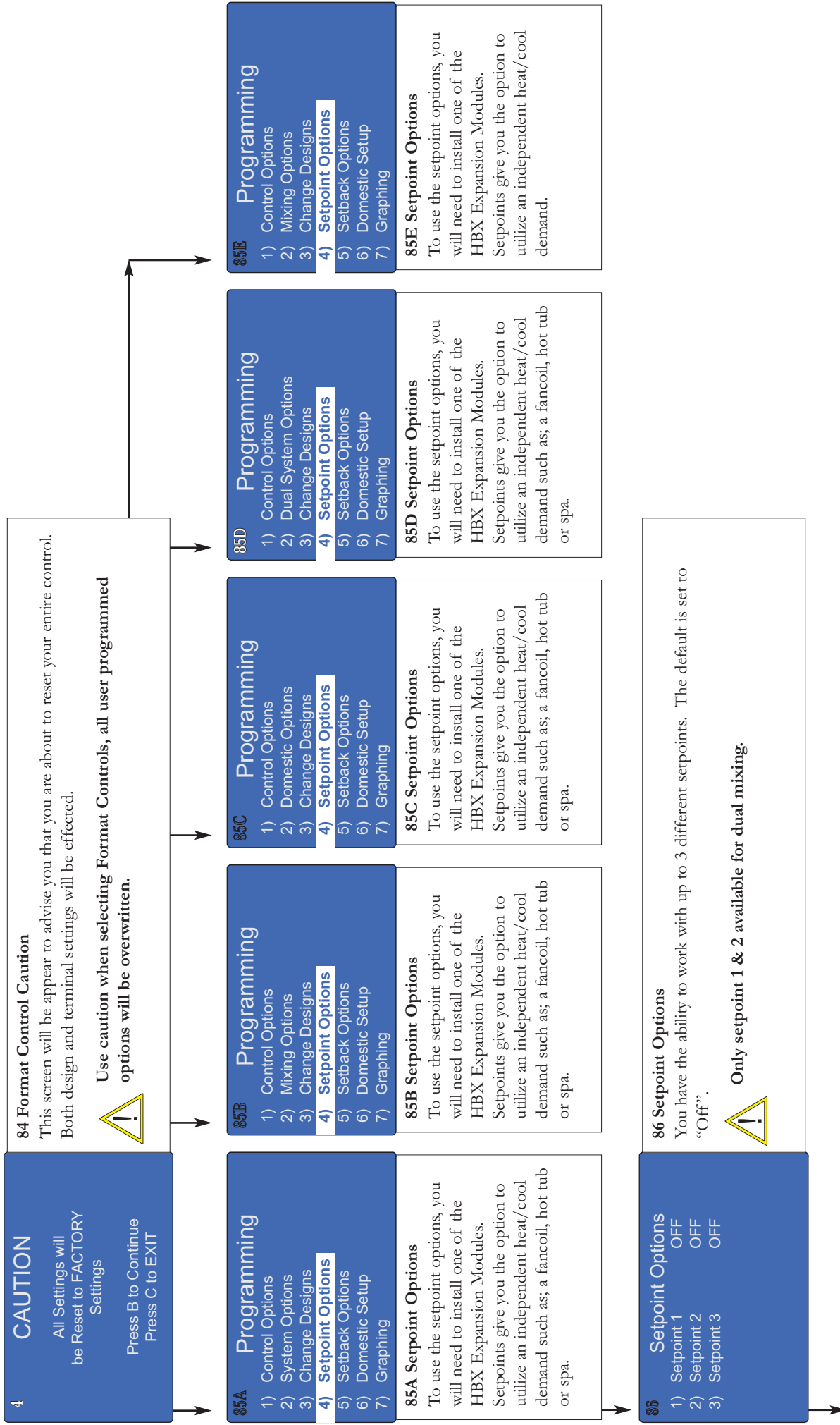


**This value is ignored in staging and DHW systems.**

## Combined Settings

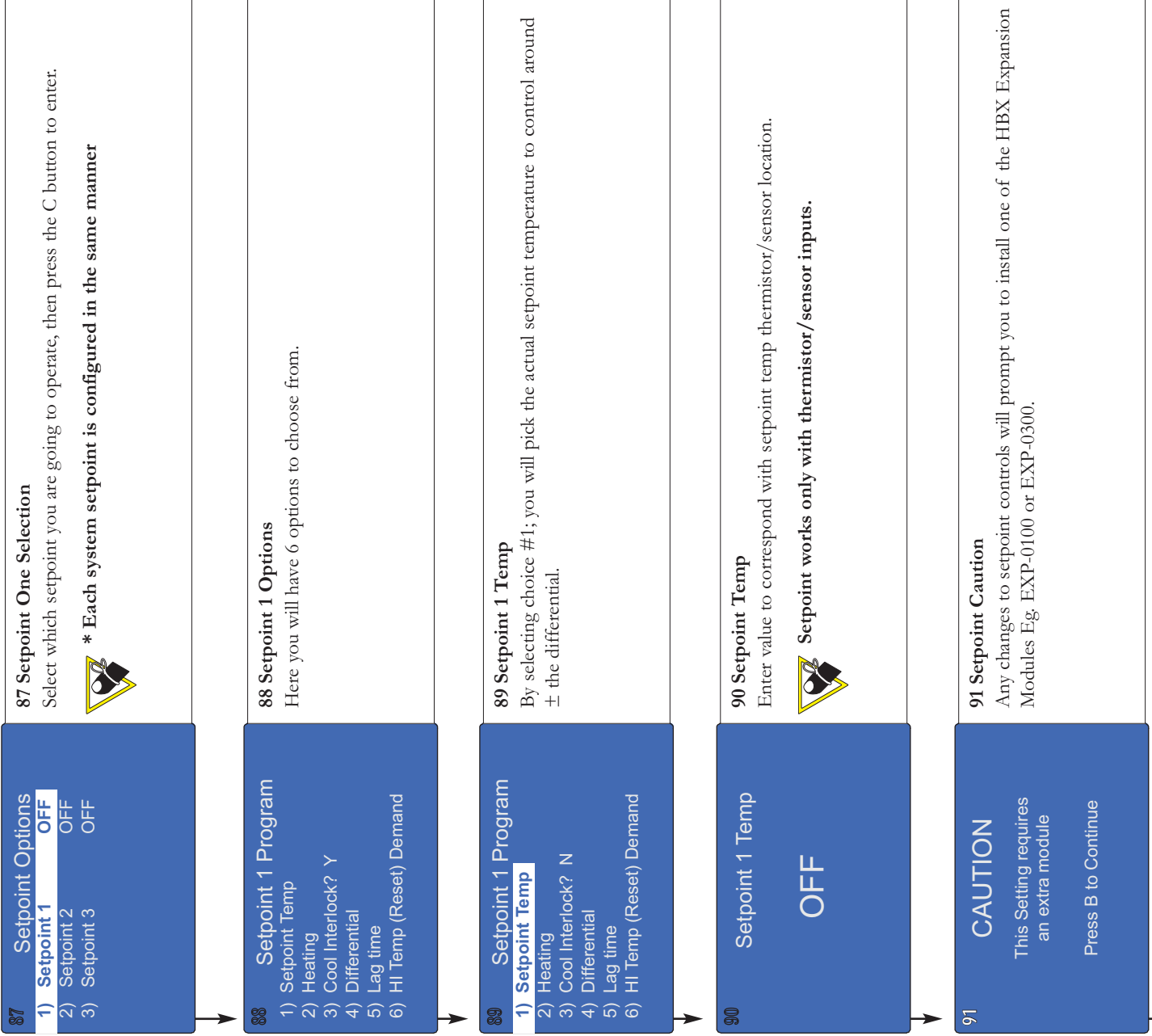


# Combined Settings





## Combined Settings



## Combined Settings

### 92 Setpoint 1 Program

- 1) Setpoint Temp
- 2) **Cooling**
- 3) Cool Interlock? N
- 4) Differential
- 5) Lag time
- 6) HI Temp (Reset) Demand

### 92 Setpoint 1 Cooling

Choice #2 allows you to select either Heating or Cooling Mode. Press 'C' to toggle between choices, Eg. heating/cooling.

Heating - when the temperature drops below the setpoint the relays engage  
Cooling - when the temperature rises above the setpoint the relays engage

### 93 Setpoint 1 Program

- 1) Setpoint Temp
- 2) Cooling
- 3) **Cool Interlock? Y**
- 4) Differential
- 5) Lag time
- 6) HI Temp (Reset) Demand

### 93 Setpoint 1 Cool Interlock

If selected 'Y', this will allow cooling only and not a simultaneous heat demand. If selected 'N', then heating and cooling can be delivered to the same zone space. Eg. Tile floor warming and air conditioning.

### 94 Setpoint 1 Program

- 1) Setpoint Temp
- 2) Cooling
- 3) Cool Interlock? Y
- 4) **Differential**
- 5) Lag time
- 6) HI Temp (Reset) Demand

### 94 Setpoint 1 Differential

Choice #4 (Differential) will allow you to set your margin of error in °F or °C around the setpoint temperature.

### 95 Setpoint 1 Differential

2 °F

### 95 Setpoint 1 Differential Value

Setpoint Differential Value is the temp value which the Control will turn on and off around the setpoint. In this example of 2°F with a setpoint of 68°F, the Control will turn on when the temp falls below 67°F and turn off when the temp rises above 69°F.

### 96 Setpoint 1 Program

- 1) Setpoint Temp
- 2) Heating
- 3) Cool Interlock? Y
- 4) Differential
- 5) **Lag time**
- 6) HI Temp (Reset) Demand

### 96 Setpoint 1 Lag Time

Choice #5 is Lag Time. This allows you to set a minimum "Off Time" between a setpoint demand. This helps to establish a cycle time (length) between heat demands and reduce short cycling.

# Combined Settings

**97** Setpoint 1 LagTime  
0 S

**97 Setpoint 1 Lag Time Value**  
You have a range of 0 to 600 seconds for lag time and it is adjustable in 5 second increments.

**98** Setpoint 1 Program  
1) Setpoint Temp  
2) Heating  
3) Cool Interlock? Y  
4) Differential  
5) Lag time  
6) HI Temp (Reset) Demand

**98 Setpoint 1 Hi Temp (Reset) Demand**  
The setpoint allows for a choice between a HI(Reset),HI(Max Boiler), LO or NO temp demand. A HI(Reset) temp demand will stage the boiler based on outdoor reset and only turn on the hi temp loop.A HI(Max Boiler) will only turn on the hi temp loop as well but it will raise the boiler setpoint to the maximum design temperature of the boiler. When a LO temp is selected the boiler output temperature will follow the outdoor reset curve for boiler and system. This will turn on both the boiler and system loop.

**99A** Programming  
1) Control Options  
2) System Options  
3) Change Designs  
4) Setpoint Options  
5) Setback Options  
6) Domestic Setup  
7) Graphing

**99A Setback Options**  
Choice #5 in Programming will take you to the Setback Options.

**99B** Programming  
1) Control Options  
2) Mixing Options  
3) Change Designs  
4) Setpoint Options  
5) Setback Options  
6) Domestic Setup  
7) Graphing

**99B Setback Options**  
Choice #5 in Programming will take you to the Setback Options.

**99C** Programming  
1) Control Options  
2) Domestic Options  
3) Change Designs  
4) Setpoint Options  
5) Setback Options  
6) Domestic Setup  
7) Graphing

**99C Setback Options**  
Choice #5 in Programming will take you to the Setback Options.

**99D** Programming  
1) Control Options  
2) Dual System Options  
3) Change Designs  
4) Setpoint Options  
5) Setback Options  
6) Domestic Setup  
7) Graphing

**99D Setback Options**  
Choice #5 in Programming will take you to the Setback Options.

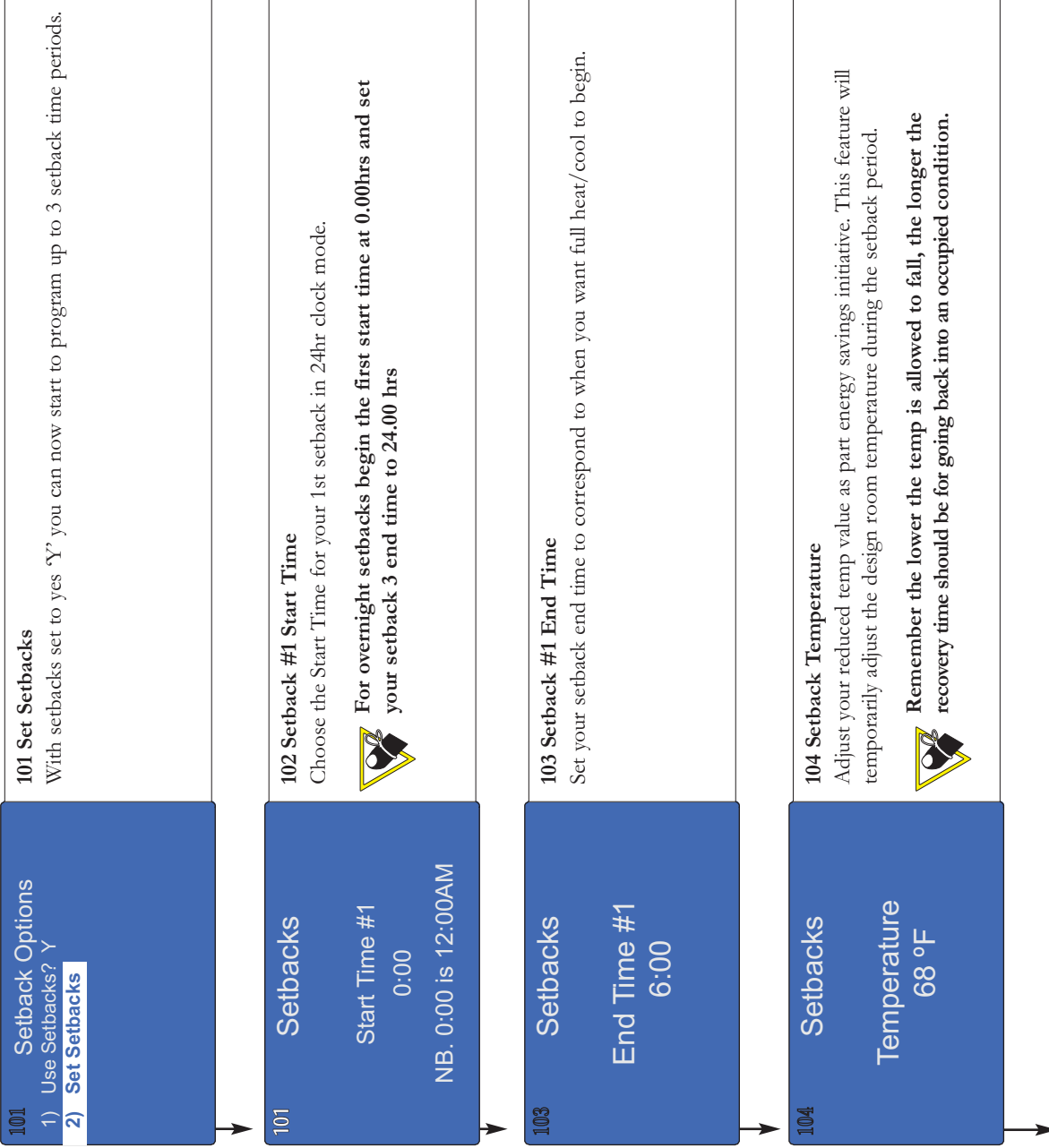
**99E** Programming  
1) Control Options  
2) Mixing Options  
3) Change Designs  
4) Setpoint Options  
5) Setback Options  
6) Domestic Setup  
7) Graphing

**99E Setback Options**  
Choice #5 in Programming will take you to the Setback Options.

**100** Setback Options  
1) Use Setbacks? N  
2) Set Setbacks

**100 Setback Options**  
These 2 choices will allow you to program a setback. A setback can be programmed to maximize energy usage during time frames where the building may be vacant.

## Combined Settings



# Combined Settings

**105 System Status**

HD DHW **open** w/wSD Target 190  
**Boiler** **open** °F 135  
**System** **open** °F output  
**Outdoor** **open** °F  
**Room** **open** °F

S 12:00:45

## 105 Setback System Status

When setbacks are programmed your System Status (default screen) will indicate that setbacks are programmed. If you are in the setback time, a letter “S” will be displayed in the bottom left hand corner of the screen, the shaded bar represents setback times and a clock is also visible.

**106A Programming**

- 1) Control Options
- 2) System Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup**
- 7) Graphing

**106A Domestic Setup**  
 All control types allow you to program DHW options in your system. Follow the next screens to configure your DHW operation.

**106B Programming**

- 1) Control Options
- 2) Mixing Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup**
- 7) Graphing

**106B Domestic Setup**  
 All control types allow you to program DHW options in your system. Follow the next screens to configure your DHW operation.

**106C Programming**

- 1) Control Options
- 2) Domestic Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup**
- 7) Graphing

**106C Domestic Setup**  
 All control types allow you to program DHW options in your system. Follow the next screens to configure your DHW operation.

**106D Programming**

- 1) Control Options
- 2) Dual System Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup**
- 7) Graphing

**106D Domestic Setup**  
 All control types allow you to program DHW options in your system. Follow the next screens to configure your DHW operation.

**106E Programming**

- 1) Control Options
- 2) Mixing Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup**
- 7) Graphing

**106E Domestic Setup**  
 All control types allow you to program DHW options in your system. Follow the next screens to configure your DHW operation.

**107 Domestic Setup**

- 1) Use DHW? N**
- 2) DHW Pump
- 3) DHW Priority? N
- 4) Domestic Setpoint
- 5) Differential
- 6) DHW Interlock? N
- 7) DHW Boiler Setpoint

## 107 Domestic Setup Options

Change option #1 to ‘Y’ if you wish to control DHW with the CPU-1000. Once this option is enabled you will be able to program the remaining options for your DHW setup.



**When a DHW control is selected, Option 1 defaults to ‘Y’.**

**108 ERROR**

PMIv Injection can't be used with DHWv Injection set to PMIp

Press B to Continue

## 108 Domestic PMIv / PMIp Injection Error

You may see this error message depending on how you selected your mixing control options. If Mixing is set to PMIp(Pump Injection) then you must use DHW valve or change your selection in the mixing control to PMIv (Valve Injection). The reverse to goes for PMIv. This error is only applicable to mixing applications.

## Combined Settings

### 109 Domestic Setup

- 1) Use DHW? N
- 2) **DHW Pump**
- 3) DHW Priority? N
- 4) Domestic Setpoint
- 5) Differential
- 6) DHW Interlock? N
- 7) DHW Boiler Setpoint

### 109 Domestic Hot Water Pump / Valve

This option allows you to toggle between a pump and valve within a domestic hot water system.

### 110 Domestic Setup

- 1) Use DHW? N
- 2) DHW Pump
- 3) **DHW Priority? N**
- 4) Domestic Setpoint
- 5) Differential
- 6) DHW Interlock? N
- 7) DHW Boiler Setpoint

### 110 Domestic Setup

Selection #3 will allow the DHW demand to override the heating system for a max of 60 mins in order to satisfy the DHW demand. Once 60 mins has elapsed and there is still an unsatisfied heat demand, the Control will automatically switch back to accommodate the call for heat.

### 111 Domestic Setup

- 1) Use DHW? N
- 2) DHW Pump
- 3) DHW Priority? N
- 4) **Domestic Setpoint**
- 5) Differential
- 6) DHW Interlock? N
- 7) DHW Boiler Setpoint

### 111 Domestic Setpoint

Selection #4 allows you to select your DHW target temperature. Eg. 135°F.



**Domestic setpoint will only operate from a thermistor input signal.**

### 112 Domestic Setpoint 100 °F

### 112 Domestic Setpoint

Designate your systems Domestic Hot Water temperature in this step.

### 113 Domestic Setup

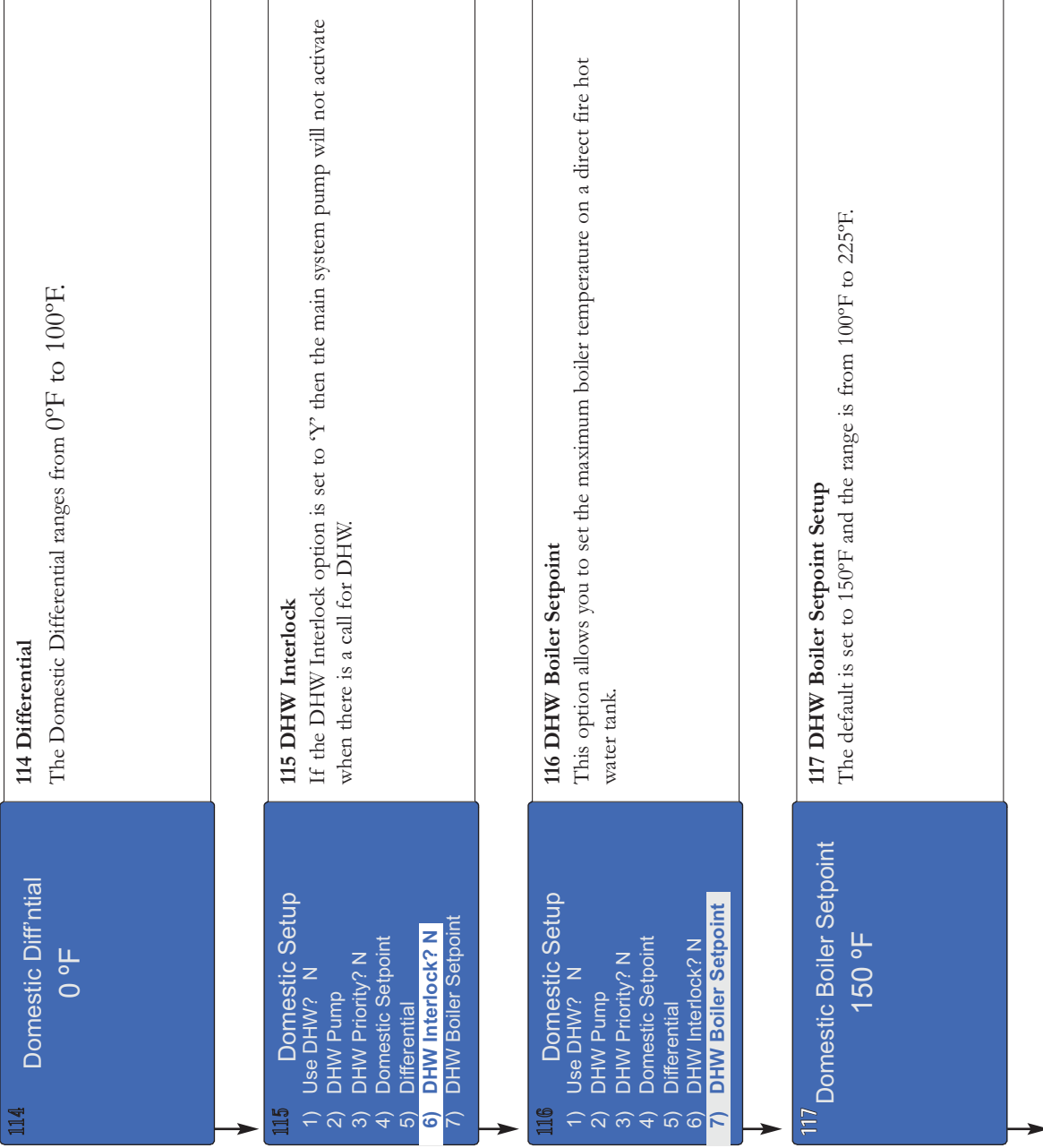
- 1) Use DHW? N
- 2) DHW Pump
- 3) DHW Priority? N
- 4) Domestic Setpoint
- 5) **Differential**
- 6) DHW Interlock? N
- 7) DHW Boiler Setpoint

### 113 Differential

Selection #5 allows you to program the error value, overshoot and undershoot of the target setpoint temperature.

In this example of 2°F with a setpoint of 68°F, the Control will turn on when the temp falls below 67°F and turn off when the temp rises above 69°F.

## Combined Settings



Staging Settings

Mixing Settings

DHW Settings

Dual Sys. Settings

Dual Mix. Settings

118A Programming

- 1) Control Options
- 2) System Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

118A Graphing

The display allows you to get a visual impression of how your system is performing by selecting choice #7 in the programming menu.

118B Programming

- 1) Control Options
- 2) Mixing Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

118B Graphing

The display allows you to get a visual impression of how your system is performing by selecting choice #7 in the programming menu.

118C Programming

- 1) Control Options
- 2) Domestic Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

118C Graphing

The display allows you to get a visual impression of how your system is performing by selecting choice #7 in the programming menu.

118D Programming

- 1) Control Options
- 2) Dual System Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

118D Graphing

The display allows you to get a visual impression of how your system is performing by selecting choice #7 in the programming menu.

118E Programming

- 1) Control Options
- 2) Mixing Options
- 3) Change Designs
- 4) Setpoint Options
- 5) Setback Options
- 6) Domestic Setup
- 7) Graphing

118E Graphing

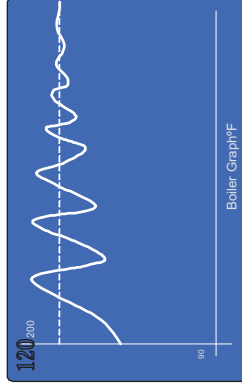
The display allows you to get a visual impression of how your system is performing by selecting choice #7 in the programming menu.

119 Programming

- 1) Boiler Graph
- 2) System Graph

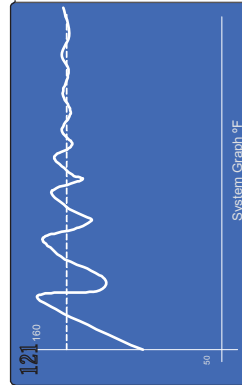
119 Graphing Options

You have the option to look at either the Boiler Graph (Actual vs. Target) or System Graph (Actual vs. Target).



120 Boiler Graph

The Y and X axis are not adjustable. The dotted line represents the target temperature and the solid line represents the actual temperature. One full screen will display approx 10 mins of temperature data in 20 sec intervals.



121 System Graph

The Y and X axis are not adjustable. The dotted line represents the target temperature and the solid line represents the actual temperature. One full screen will display approx 10 mins of temperature data in 20 sec intervals.



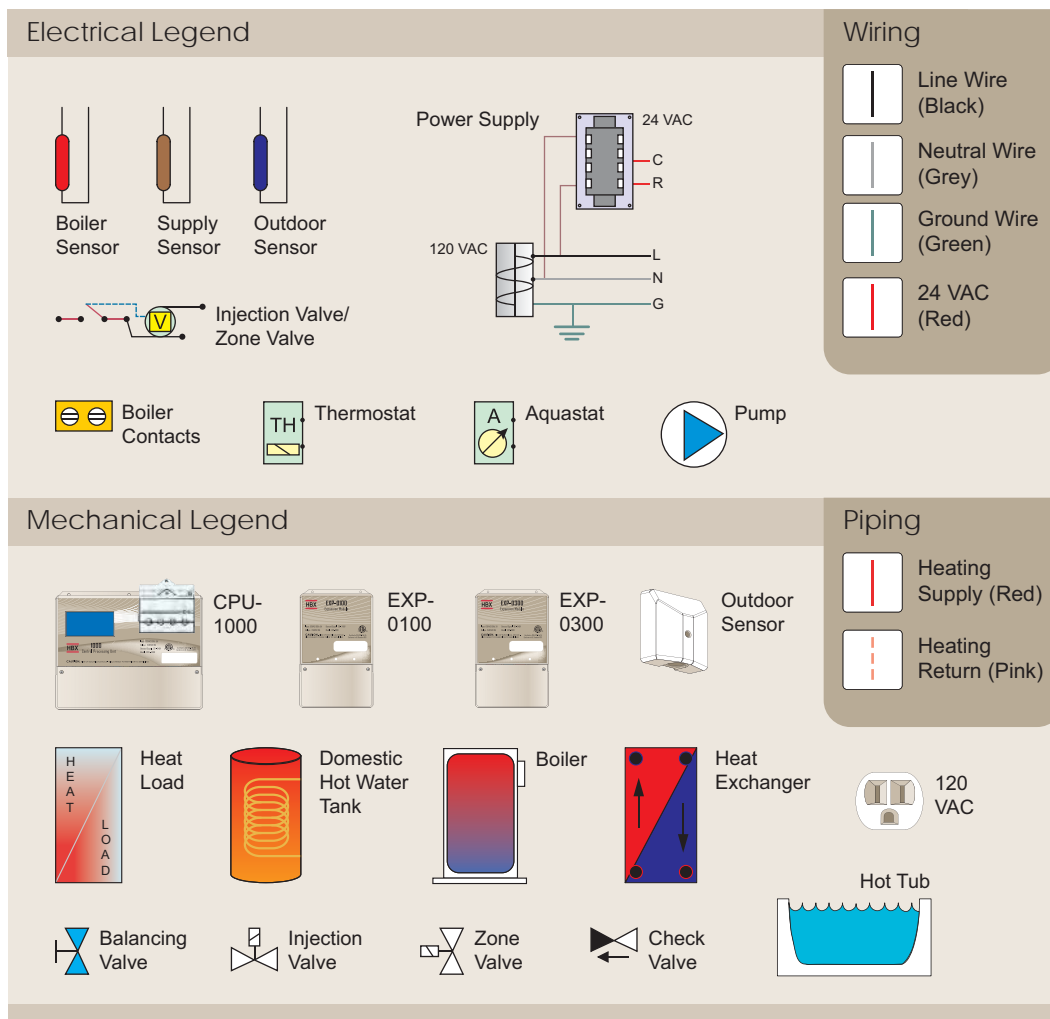
## APPLICATION DRAWINGS

The following application drawings are intended to be a guide for a number of mechanical installations, and the corresponding electrical wiring schematic to control the applications. Please note the disclaimer below as to the accuracy, reliability and suitability of any particular installation the installer is attempting. The installer, as a professional, is ultimately responsible for their installation.

HBX Controls hopes that these illustrations will assist you in gaining confidence to tackle a multitude of HVAC applications with our control and optional accessories.



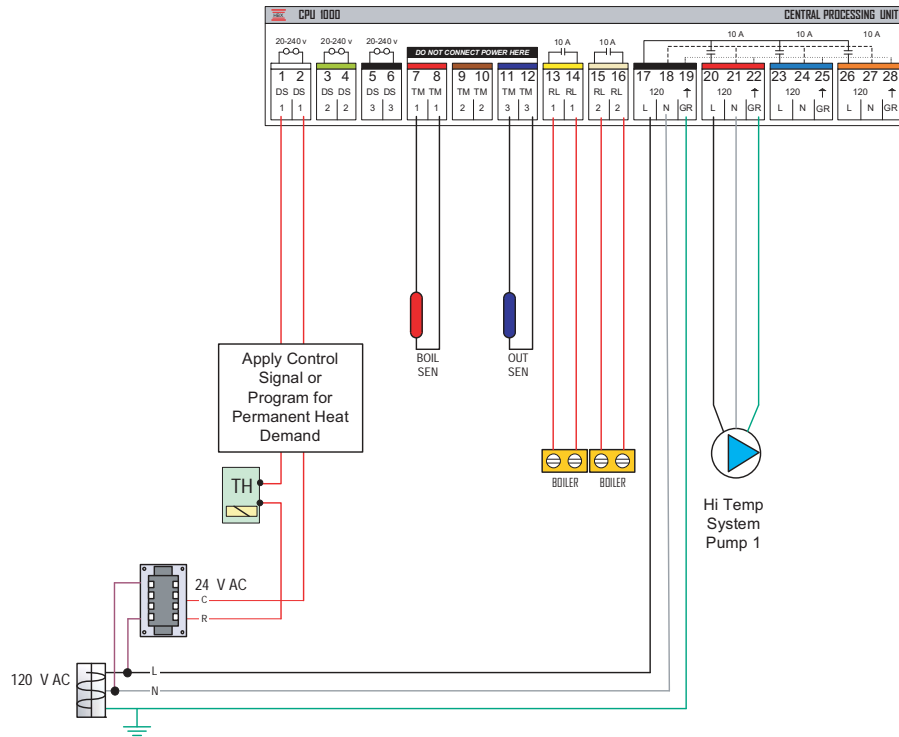
These are not engineered drawings and do not necessarily include all the components for an entire system. They are intended as representations of how the Control may be wired for a sample application. It is the responsibility of the installer to seek professional advice and/or install the system to meet all necessary codes for the jurisdiction of the actual installation.



## STAGING CONTROL STG 1000-02

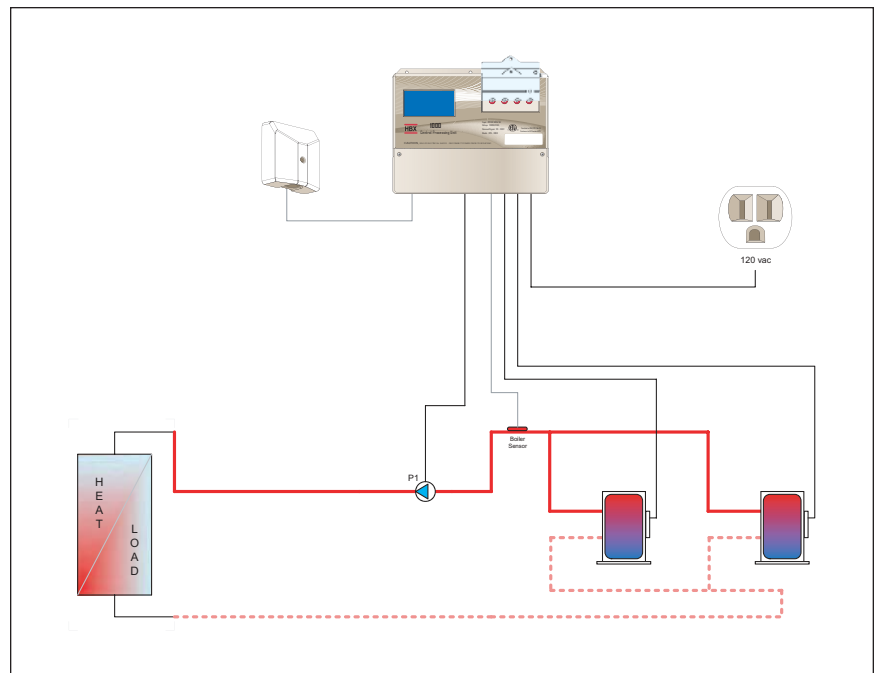
- 2 single stage boilers with 1 single Hi Temp system pump
- 1 boiler sensor on supply protecting the boiler, 1 outdoor sensor for outdoor reset control

### ELECTRICAL



### MECHANICAL

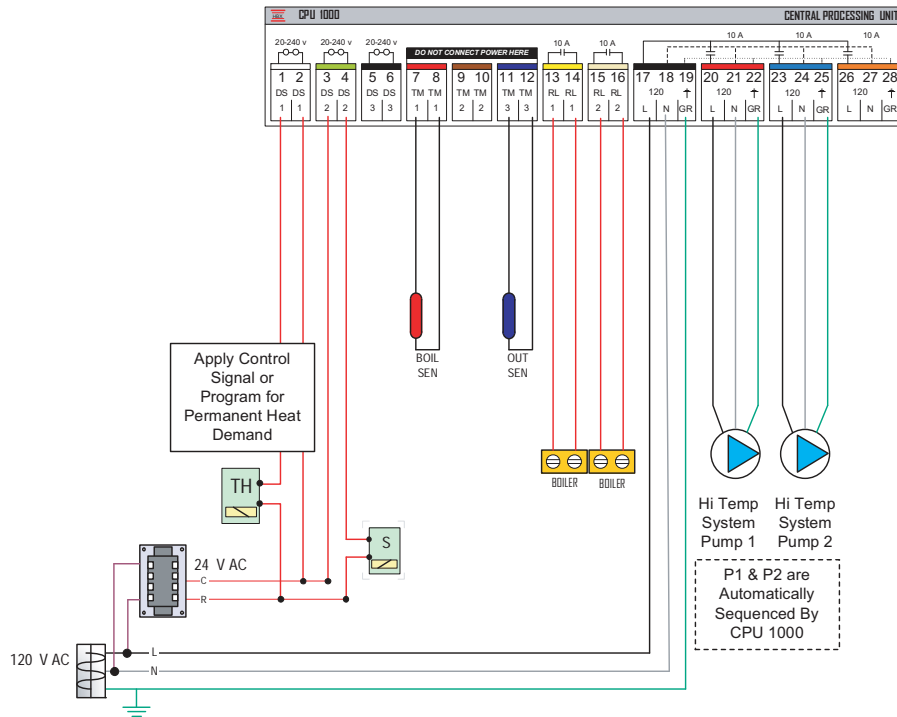
**Pump Legend:**  
• P1 - System Pump



## STAGING CONTROL STG 1000-03

- 2 single stage boilers with 2 sequenced Hi temp system pumps allowing the pumps to alternate, optional flow sensor shown
- 1 boiler sensor on supply protecting the boiler, 1 outdoor sensor for outdoor reset control

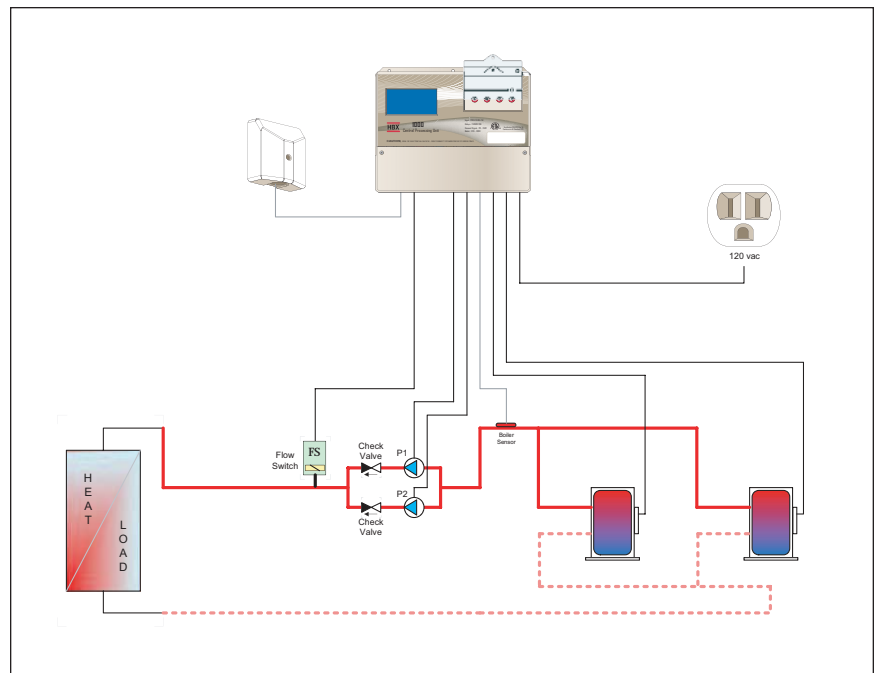
### ELECTRICAL



#### Pump Legend:

- P1 - System Pump 1
- P2 - System Pump 2

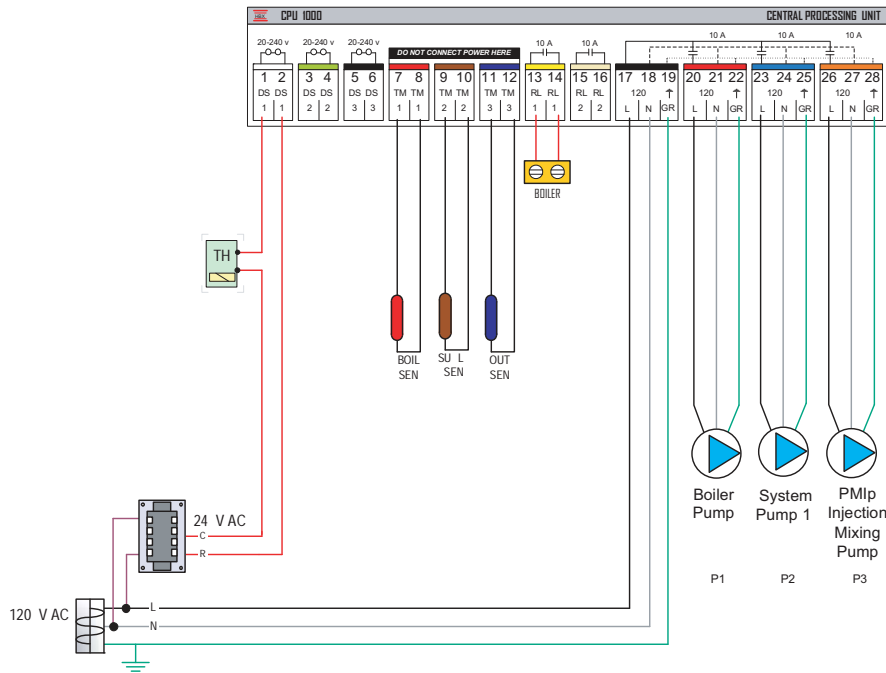
### MECHANICAL



## MIXING CONTROL MIX 1000-01

- Single stage mixing control using PMIp (Pump Injection)
- The Control is running the boiler pump, Lo temp system pump, and injection pump
- 1 boiler sensor on supply protecting the boiler, 1 system sensor measuring the mixed system temp, 1 outdoor sensor for outdoor reset control

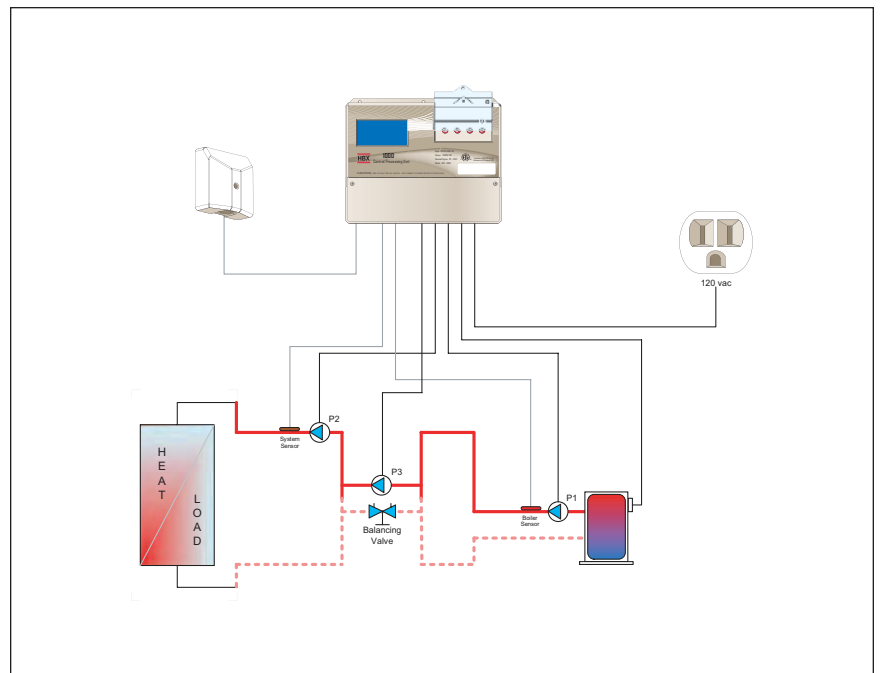
### ELECTRICAL



### MECHANICAL

#### Pump Legend:

- P1 - Boiler Pump
- P2 - System Pump
- P3 - Injection Pump

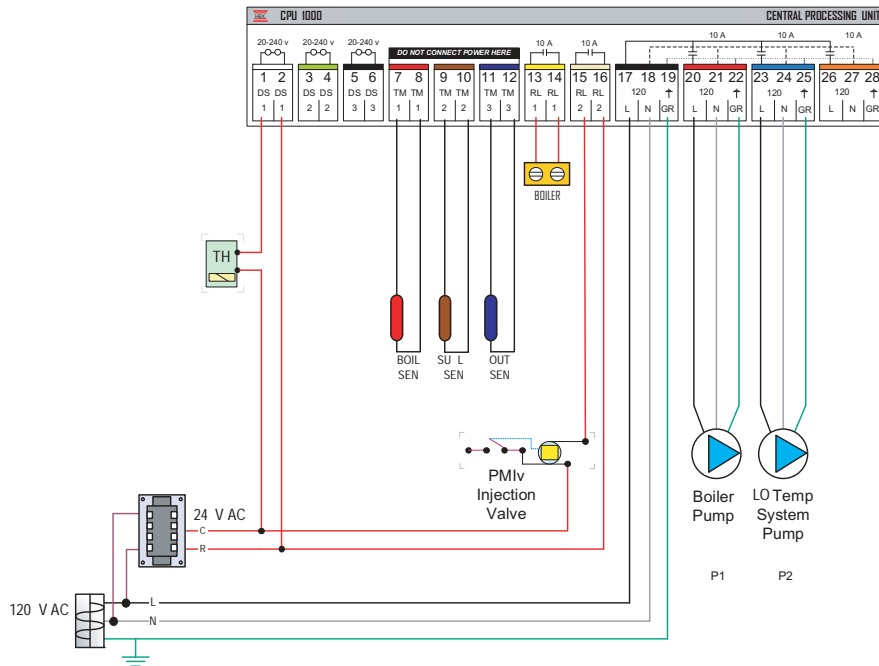




## MIXING CONTROL MIX 1000-02

- Single stage mixing control using PMIV (valve injection)
- Control is running the boiler pump and the Lo temp system pump
- 1 boiler sensor on the supply protecting the boiler, 1 system sensor measuring the mixed system temp, and 1 outdoor sensor for outdoor reset control

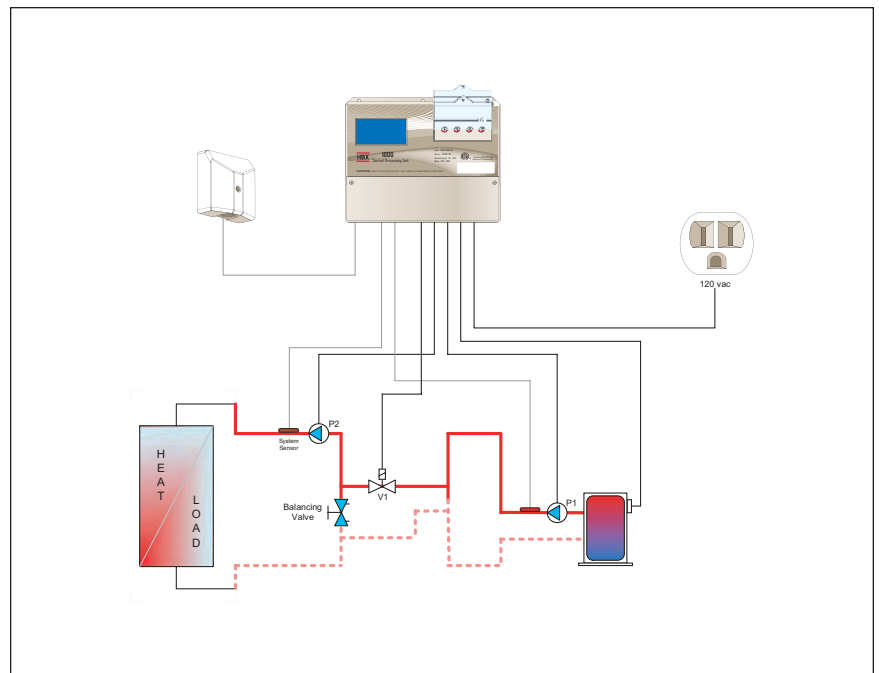
### ELECTRICAL



### MECHANICAL

**Pump/Valve Legend:**

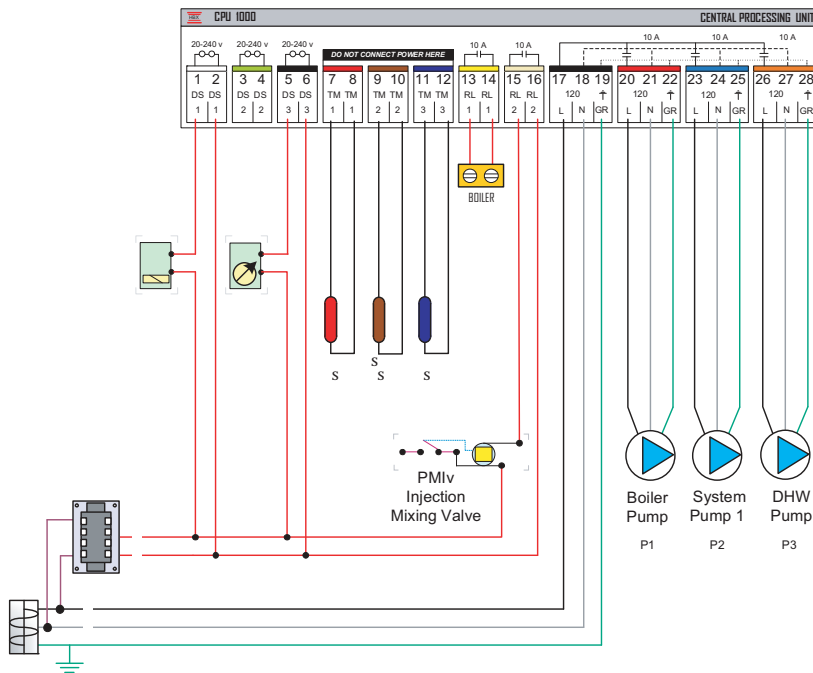
- P1 - Boiler Pump
- P2 - System Pump
- V1 - Injection Valve



## MIXING CONTROL MIX 1000-11

- Single stage mixing control using PMIV (valve injection)
- Control is running the boiler pump and the Lo temp system pump
- Indirect DHW tank is supplied via a third pump
- 1 boiler sensor on the supply protecting the boiler, 1 system sensor measuring the mixed system temp, and 1 outdoor sensor for outdoor reset control

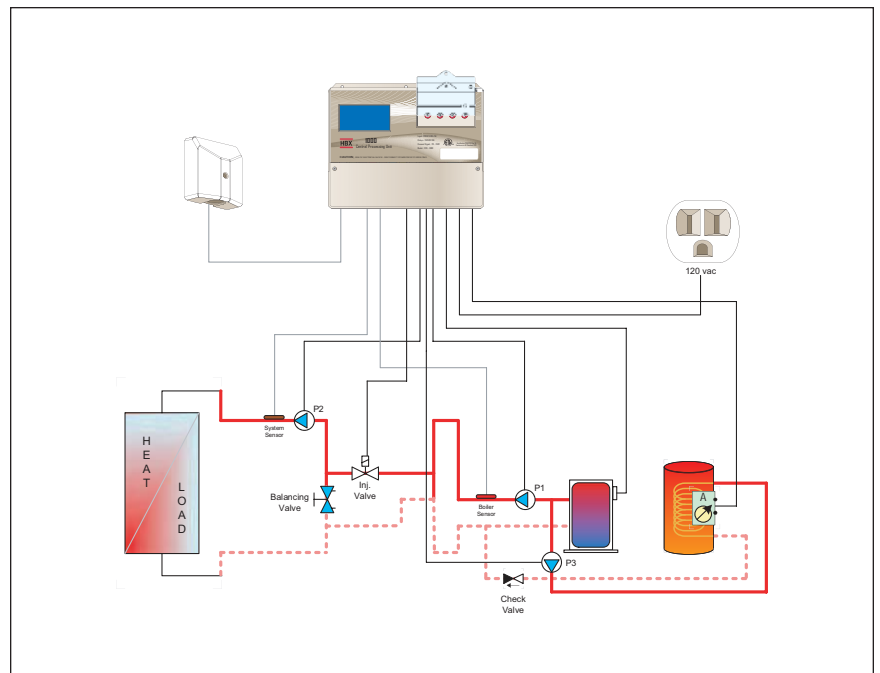
### ELECTRICAL



### MECHANICAL

**Pump/Valve Legend:**

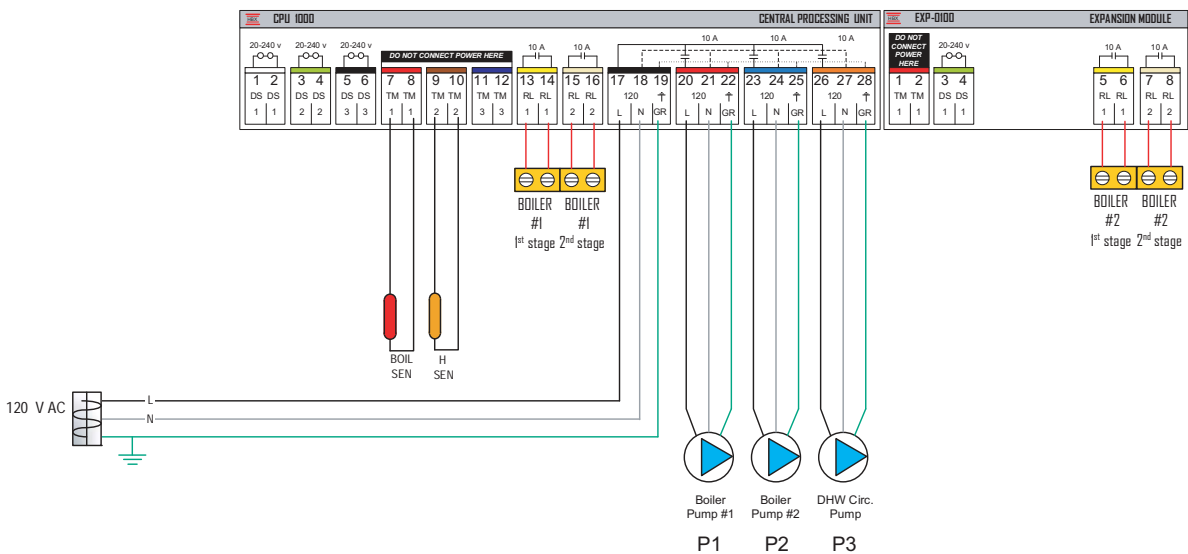
- P1 - Boiler Pump
- P2 - System Pump
- P3 - DHW Pump
- V1 - Injection Valve



## DHW CONTROL DHW 1000-04

- Four stage boiler control for dedicated DHW
- 2 - Hi/Lo fire boilers supply hot water to 4 indirect DHW storage tanks
- Each boiler pump is controlled by the CPU-1000 in addition to the system pump
- 1 boiler sensor located on the upstream supply monitoring boiler output, 1 DHW sensor maintaining the DHW setpoint temp signal back to the control
- Boiler stages 3 and 4 are controlled by the EXP-0100 Expansion Module
- Boiler pumps can be set with a post-purge time

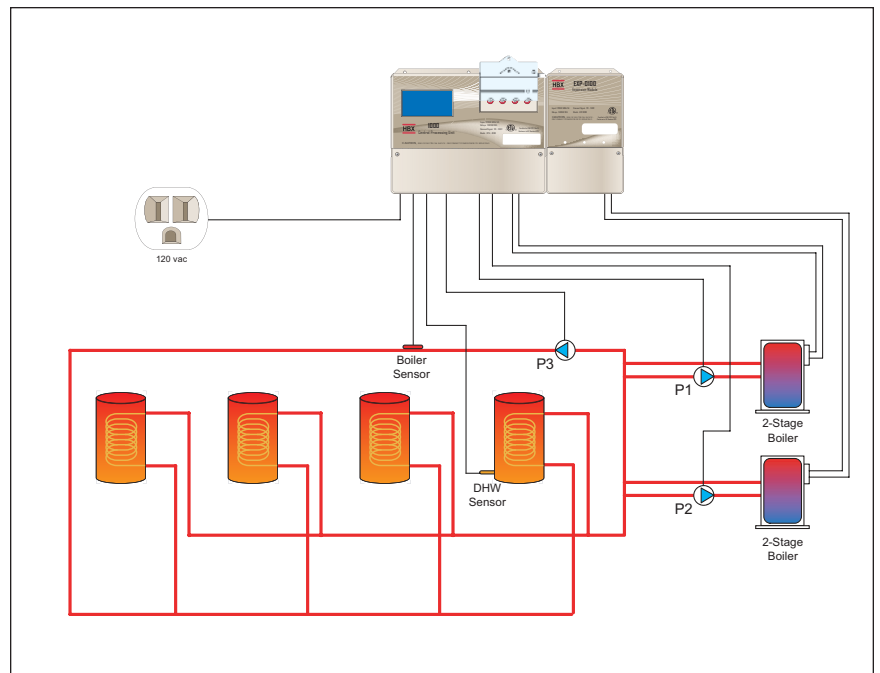
### ELECTRICAL



### MECHANICAL

**Pump Legend:**

- P1 - Boiler Pump 1
- P2 - Boiler Pump 2
- P3 - DHW Circulator

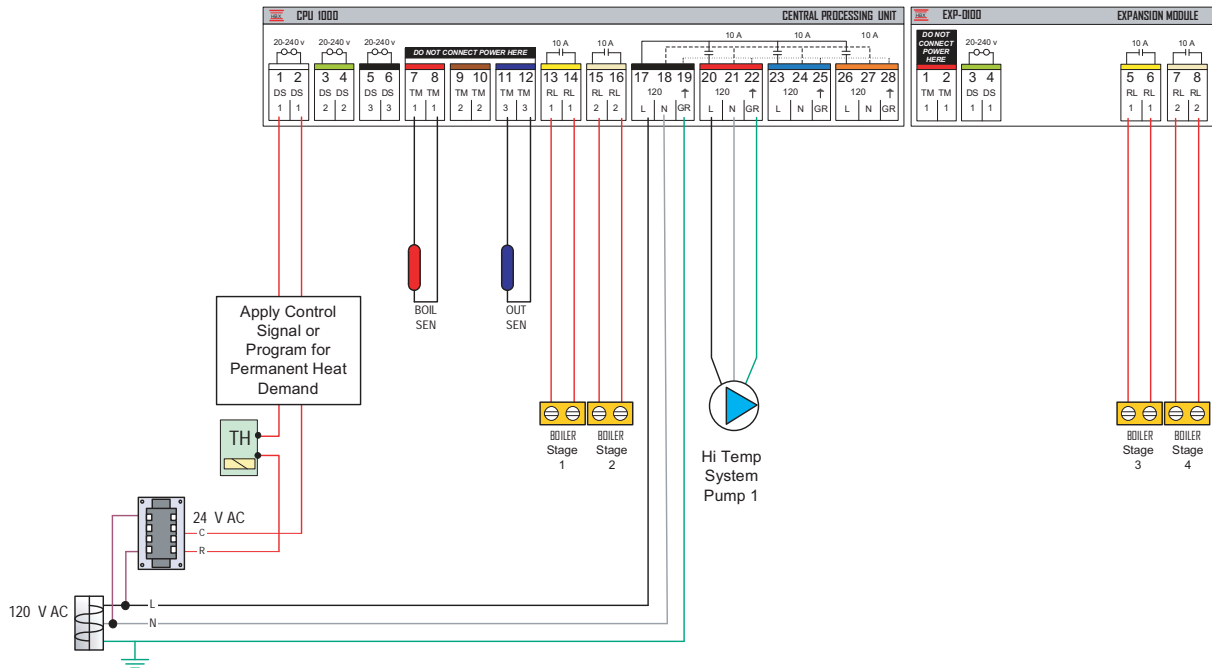




## STAGING CONTROL STG 1000-04

- 4 Single stage boilers with 1 individual Hi temp system pump
- 1 boiler sensor on supply protecting the boiler, 1 outdoor sensor for outdoor reset control
- Boilers (stages) 3 and 4 are staged on by use of 1 Expansion Module (EXP-0100)

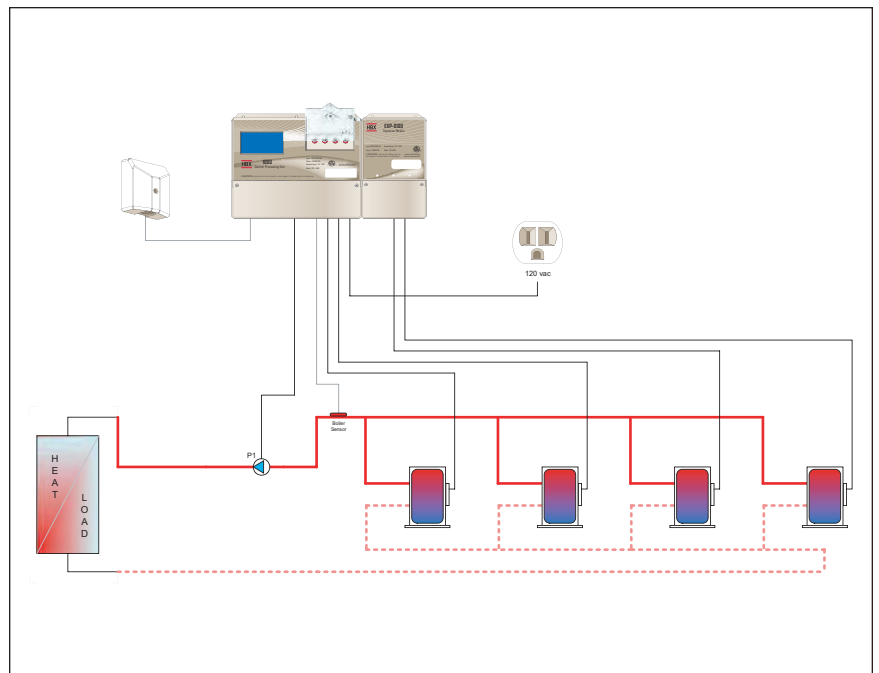
### ELECTRICAL



### MECHANICAL

#### Pump Legend:

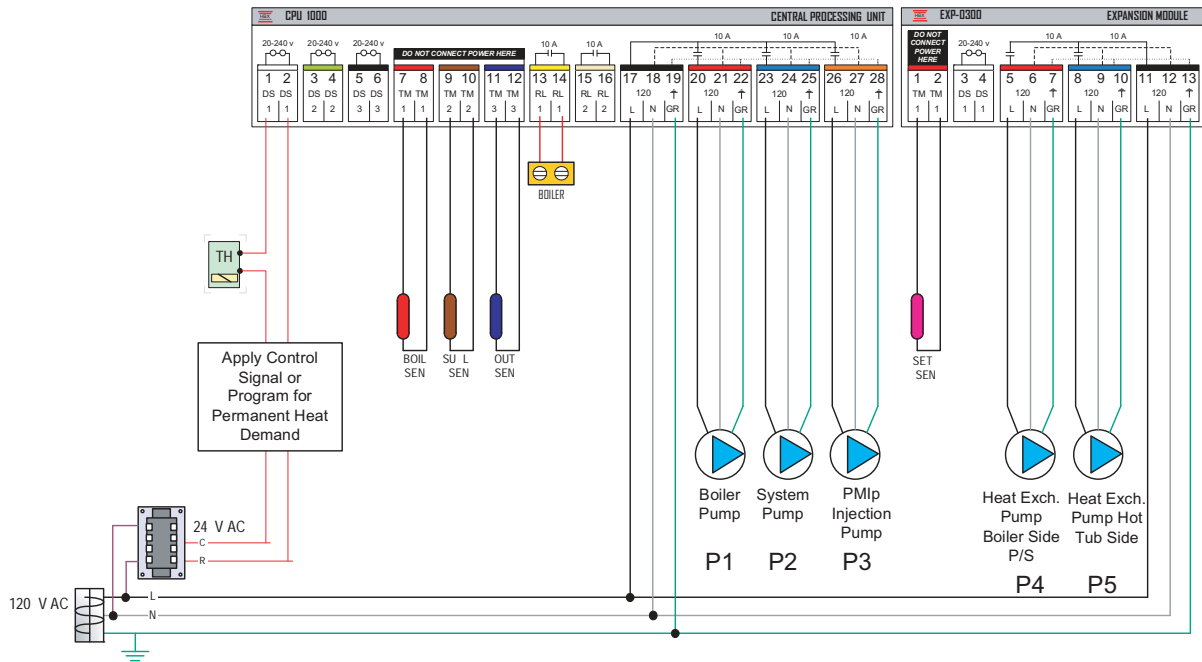
- P1 - System Pump



## MIXING CONTROL MIX 1000-20

- Single stage mixing control running 1 mixed loop and 1 setpoint load via a plate heat exchanger
- Mixed injection using PMIp(pump injection), 1 boiler pump, and 1 Lo temp system pump
- Setpoint load for a hot tub requires the use of 1 EXP-0300 which also controls 2 pumps(P4 and P5) for both sides-- of the heat exchanger

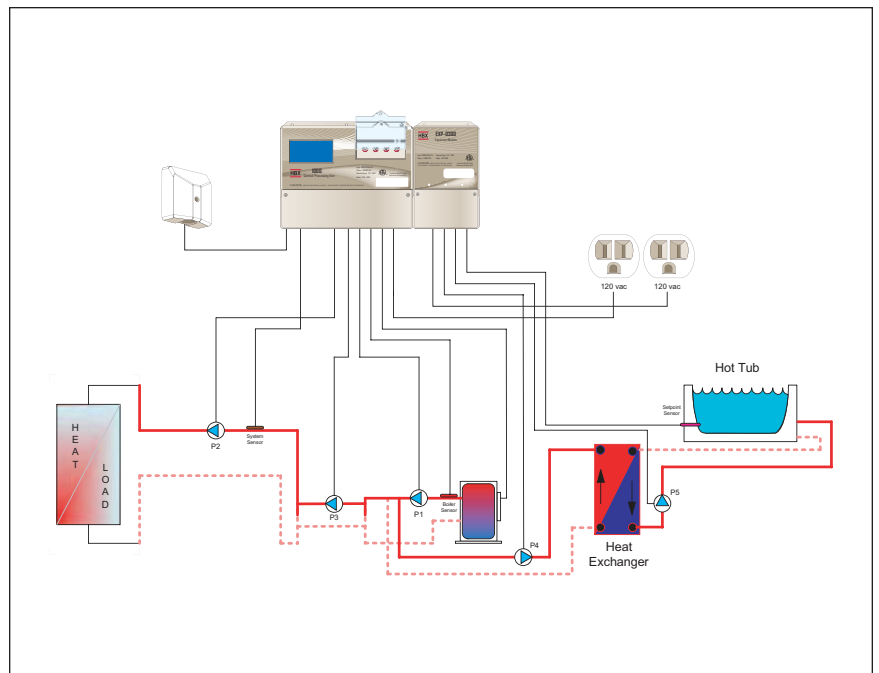
### ELECTRICAL



### MECHANICAL

#### Pump Legend:

- P1 - Boiler Pump
- P2 - System Pump
- P3 - Injection Pump
- P4 - Heat Exchanger Boiler Side
- P5 - Heat Exchanger Hot Tub Side





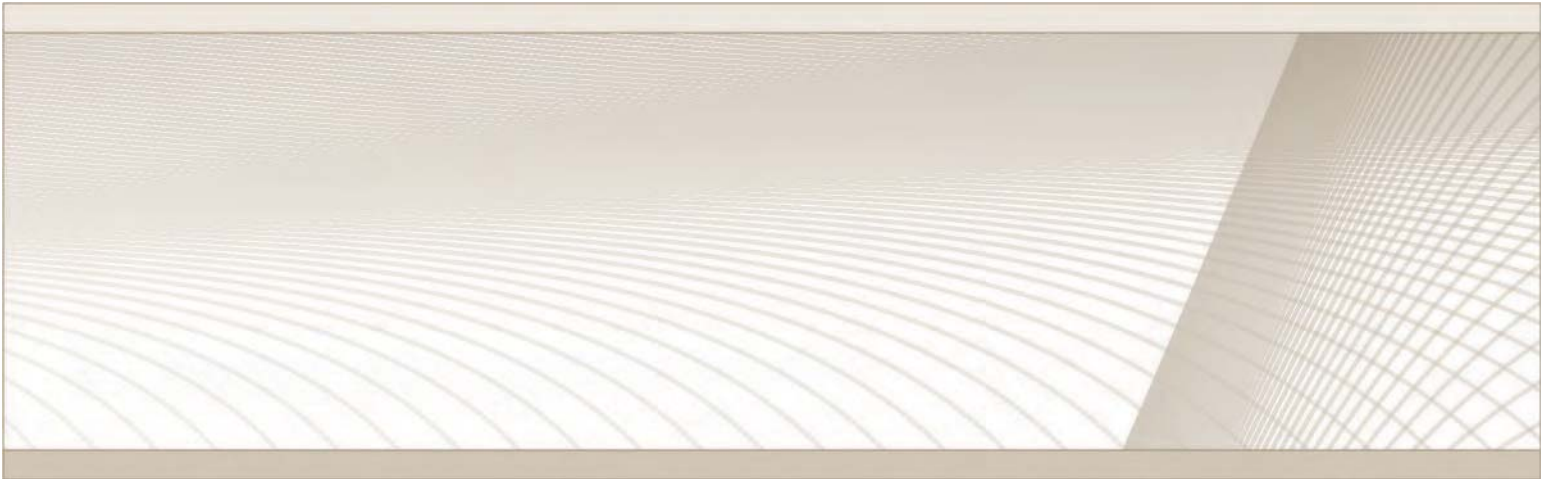
**HBX**

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HBX CPU-1000 HVAC Controller  
Version 1.38

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