

APPROVED INSTALLATION AND OPERATION INSTRUCTION

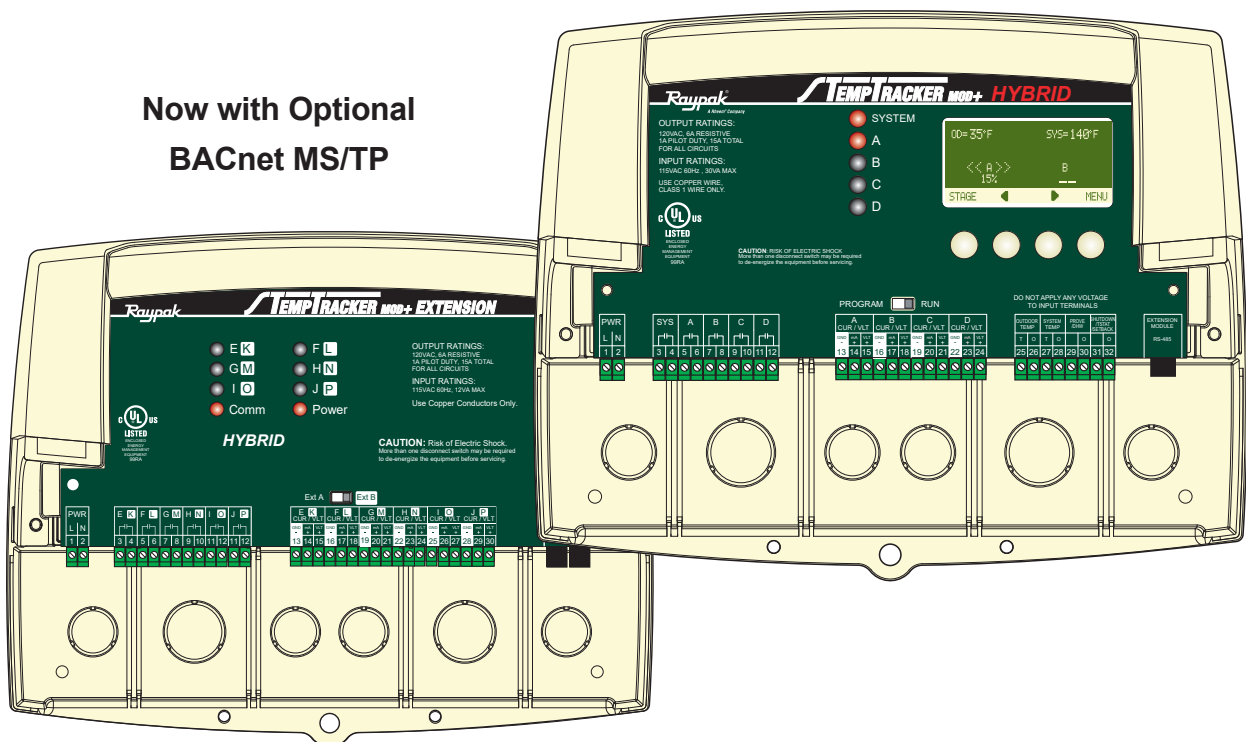
TEMPTRACKER[®] mod+ HYBRID

CONDENSING and NON-CONDENSING HYBRID CONTROL

This product can be used with the following systems:

- Hi Delta Hydronic Boilers, Models 302C-902C
- Hi Delta SS Hydronic Boilers, Models HD101-HD401
- MVB Modulating Vertical Hydronic Boilers 503A-2003A
- MVB Modulating Vertical Hydronic Boilers 504A-2004A
- MVB Modulating Vertical Water Heater 2503-4003
- MVB Modulating Vertical Water Heaters 503A-2003A

Now with Optional
BACnet MS/TP



IMPORTANT SAFETY INSTRUCTIONS. READ AND FOLLOW ALL INSTRUCTION. SAVE THESE INSTRUCTIONS.

⚠ WARNING: The TempTracker mod+ Hybrid is strictly an operating control. It CANNOT be used as a limit control. All boilers 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 TempTracker mod+ Hybrid is installed.

This control must be installed by a licensed electrician.

This manual should be maintained in legible condition and kept adjacent to the unit or in a safe place for future use.

Raypak[®]
A Rheem[®] Company

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Revision 5 reflects the following changes:

Reformatted and reorganized. Additional metric data added. Final paragraph added to Staging Logic Overview on page 4. Final sentence added to Wiring the Voltage Modulating or Staging Boilers on page 16. First bullet point added to Lead Boiler Rotation on page 33.

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1. WARNINGS

Pay Attention to these Terms

 DANGER	Indicates the presence of immediate hazards which will cause severe personal injury, death or substantial property damage if ignored.
 WARNING	Indicates the presence of hazards or unsafe practices which could cause severe personal injury, death or substantial property damage if ignored.
 CAUTION	Indicates the presence of hazards or unsafe practices which could cause minor personal injury or product or property damage if ignored.
CAUTION	CAUTION used without the warning alert symbol indicates a potentially hazardous condition which could cause minor personal injury or product or property damage if ignored.
NOTE	Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

2. HYBRID LOGIC OVERVIEW

In response to new advancements in condensing boiler design and size, many applications utilize both multiple condensing boilers and multiple non-condensing boilers. That triggered Raypak's patented design of the TempTracker mod+ Hybrid ("Hybrid Controller"). It is intended to manage the two groups of boilers to maximize system efficiency at the lowest operating cost while maintaining the desired setpoint. When Hybrid is selected as the Boiler Type, the TempTracker mod+ Hybrid will operate each group based on the Target temperature switching setpoint. See "Boiler Type" on page 19.

Each of the condensing and non-condensing groups of boilers can be either modulating or staging. Modulating boilers can be driven by either a 4-20mA modulating signal or a 0-10V modulating signal. Staging boilers must be driven by a 0-10V signal.

Depending on the actual System Temperature, the TempTracker mod+ Hybrid will determine which group of boilers will be the lead and which group will be the lag group. The Condensing group of boilers will be the Lead group when the System temperature is below the System Target Switching Setpoint. However, when the System temperature rises above the Switching Setpoint, the Non-

Condensing boiler group will be the lead group and the Condensing Group will be the lag group.

The TempTracker mod+ Hybrid will control the condensing group of boilers as the lead group so long as the sensed water temperature is below the Switching Setpoint. See "Switch Setpoint" on page 22. During that period, if additional boilers are needed than are available in the condensing group, the TempTracker mod+ Hybrid will energize the Non-Condensing boilers as needed to meet the load. See "Heavy Load Sequence 2nd Group" on page 23. When less output is required the TempTracker mod+ Hybrid will de-energize the Non-Condensing boilers prior to de-energizing the Condensing boilers.

To eliminate any short-cycling due to rapid changes in the Target Temperature used in the switching, a user-adjustable Switching Delay has been incorporated. See "Switch Delay" on page 22.

For Hybrid settings, See "Boiler Type" on page 19. See "HYBRID Startup Settings" on page 22.

To set the Condensing and Non-Condensing boiler types, see "HYBRID Modulating Boiler Settings" on page 23 and "HYBRID Staging Boiler Settings" on page 24.

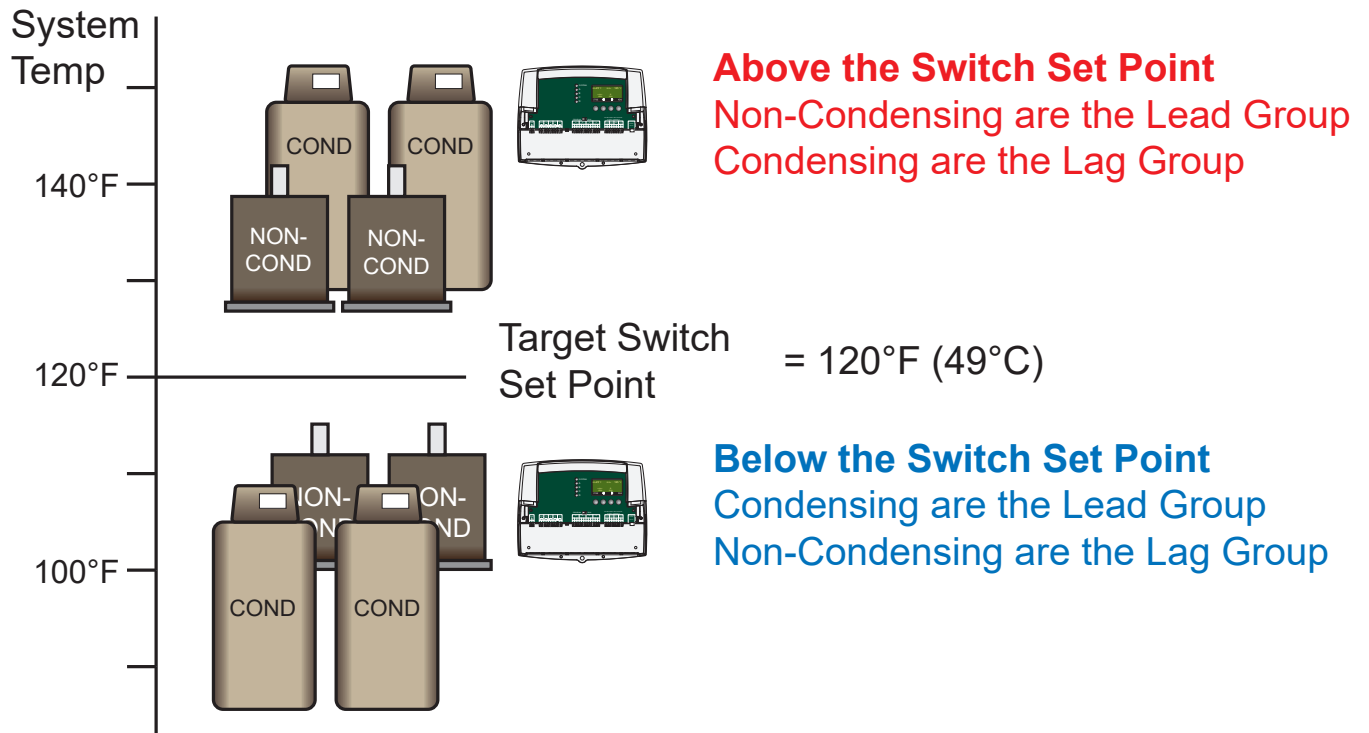


Figure 1. Hybrid Logic Overview

3. MODULATING LOGIC OVERVIEW

The Modulation PID logic provides the capability of controlling multiple modulating-current or modulating-voltage boilers. When heat is required, the control PID will activate the lead boiler and start its purge. See "Purge Delay" on page 33. This will be followed by the initiation of its modulation at the Ignition %. See "Figure 91. Ignition %" on page 42. After the Purge period and when additional heat is needed, the control shall start to increase the lead boiler modulation until the Modulation Start % has been reached. See "Modulation Start Point %" on page 63. That shall be followed by the lag boiler purge initiation. The lead boiler shall resume its modulation while the lag boiler is in purge until the lead boiler reaches full fire (100% modulation). Any additional heat requirements will trigger the control to increase the lag boiler modulation.

When the Temp Tracker mod+ Hybrid PID requires reduced output, it will reduce the modulation of the lag boiler until it reaches its Ignition %. That shall be followed by the reduction of modulation of the lead boiler until it reaches 40% percent of the Modulation Start %. This shall trigger the control to turn off the lag boiler. The control will keep reducing the lead boiler modulation until it reaches its Ignition %. If the Last Stage Hold was activated, the control will hold the lead boiler at the Ignition % until the System Temperature exceeds the Target Setpoint by the Last Stage hold setting. "Last Stage Hold" on page 34.

For Modulating boilers, See "Boiler Type" on page 19. Also, See "Modulating Boiler Settings" on page 24.

4. STAGING LOGIC OVERVIEW

The Staging PID control logic is primarily used with multi-stage boilers. The logic will utilize two primary settings to add or subtract stages. The Reaction Time is used to turn on/energize stages. See "Reaction Time" on page 35. The Minimum Runtime is used to turn off/de-energize stages. See "Minimum Runtime" on page 36. A call for heat, by either closing the TSTAT input or opening the SHUTDOWN input while the outdoor temperature is below the Outdoor Cutoff, will trigger the Temp Tracker mod+ Hybrid to turn on/energize the lowest firing stage of the Lead Boiler to start its Purge. See "Purge Delay" on page 33. After the elapse of the purge period, the Temp Tracker mod+ Hybrid will start calculating the Reaction Period. If after a full Reaction Time the control logic foresees the need for additional stages, the TempTracker mod+ Hybrid will energize the following stage. If that stage was another boiler, that boiler has to go through a full Purge Delay before starting to calculate the Reaction Time for that stage. Otherwise, if the next stage was the higher firing stage on the same boiler, the Reaction Time will start from the moment the higher firing stage relay is energized.

When the Temp Tracker mod+ Hybrid PID logic foresees that the system will overshoot, regardless of the current system and target values, it will make sure that the last stage turned on/energized has elapsed a full Minimum Runtime before it is turned off/ de-energized. Except for the lead stage, no additional stages will be turned off/de-energized until another full Minimum Runtime is elapsed. On the other hand, if the last stage is a lead stage, it will remain energized until the system reading exceeds the target setpoint by the Last Stage Hold value in addition to satisfying the Minimum Runtime condition. That is, if the Setpoint was 150°F and the Last Stage Hold was set to 10°F, the lead stage will remain energized until the system reaches 160°F and a full Minimum Runtime elapses. This is useful in protecting the lead stages from short cycling.

In order for the TempTracker mod+ Hybrid controller to properly drive 2-stage or 4-stage boilers (Raypak firing modes H3 and H9, respectively), it will be necessary to install a stage interface card (sales option B-60) on each unit to translate the modulating signal to stage closure.

5. OUTDOOR RESET CONCEPT

The TempTracker mod+ Hybrid has multiple operating modes that satisfy most hydronic systems. It changes the System Setpoint based on outdoor temperature (Outdoor Reset). The TempTracker mod+ Hybrid varies the temperature of the circulating heating water in response to changes in the outdoor temperature. The heating water temperature is controlled through the modulation or sequencing of the stages.

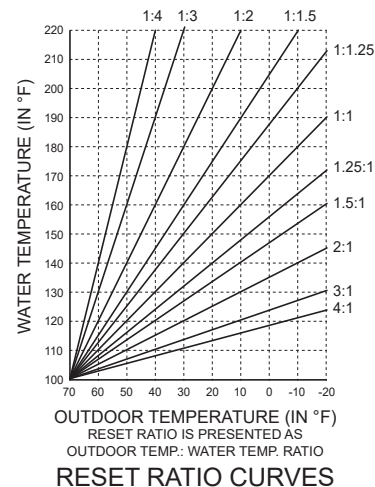


Figure 2. Outdoor Reset Concept

The TempTracker mod+ Hybrid also controls the system circulating pump with an adjustable Outdoor Cutoff. When the outdoor temperature is above the Outdoor Cutoff, the pump is off and no heating water is circulated through the system. When the outdoor temperature drops below the Outdoor Cutoff, the system pump relay is activated and the heating water circulates through the system. The temperature of the heating water is controlled by the

Reset Ratio, Water Offset, and changes with Outdoor temperature.

Reset Ratio/Outdoor Reset

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

The starting point for most systems is the 1.00 (OD):1.00 (SYS) (Outdoor 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 (21°C) Outdoor Temperature and 100°F (38°C) Water Temperature. For example with a 1.00 (OD):1.00 (SYS) ratio, if the outdoor temperature is 50°F (10°C), this means the temperature has fallen 20°F (11°C) from the starting point of 70°F (21°C). Therefore, the heating water temperature will increase 20°F (11°C) to 120°F (49°C).

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 2.00 (OD):1.00 (SYS) (Outdoor:Water). This means the outdoor temperature would have to drop 2°F (1°C) to increase the water temperature 1°F (0.6°C). On the other hand, a poorly insulated building with insufficient radiation may need a Reset Ratio of 1.00 (OD):2.00 (SYS). This means that for each degree the outdoor temperature dropped the water temperature will increase 2 degrees. The TempTracker mod+ Hybrid has a full range of Reset Ratios to match any buildings heat loss characteristics.

A heating curve that relies not only on Outdoor temperature but also on the type of radiation will improve heat comfort. The following are suggested initial settings for different types of radiation based on average building insulation and heat loss. The contractor can fine tune these adjustments based on the specific building need.

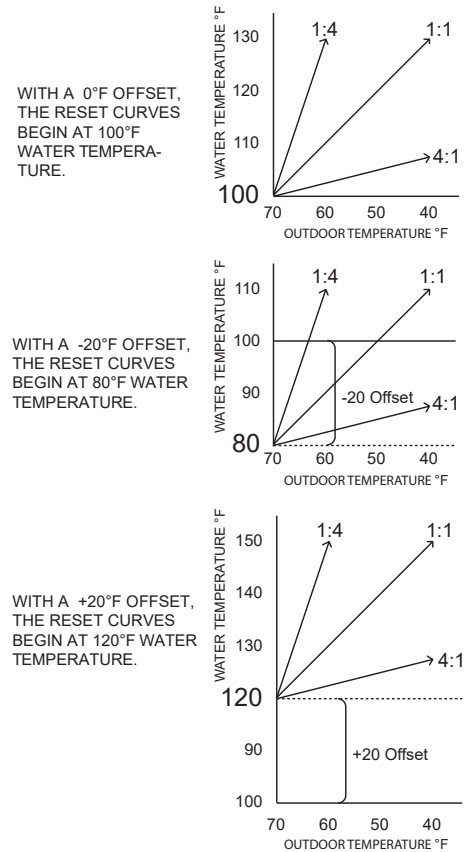


Figure 3. Reset Ratio/Outdoor Reset

Type of Radiation in Building	Reset Ratio	Offset
Radiators (Steel & Cast Iron)	1.00 (OD) : 1.00 (SYS)	0°F
Baseboard (Finned copper tube & Cast Iron)		
Radiant (High Mass/Concrete)	4.00 (OD) : 1.00 (SYS)	-10°F (-5.6°C)
Radiant (Low Mass/Joists)	2.00 (OD) : 1.00 (SYS)	
Fan Coils & Air Handlers	1.00 (OD) : 1.00 (SYS)	20°F (11.1°C)

Table A. Suggested Initial Settings

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6. TEMPTRACKER MOD+ HYBRID LAYOUT

Program Switch to restrict access to function changes. This switch is covered with Wiring Enclosure.

The digital display shows the system status, set point, lead stage <in brackets>, and status of each stage. To view and adjust settings, press the appropriate buttons.

LED indicates the associated relay status.

Buttons function is presented on Bottom Row of display.

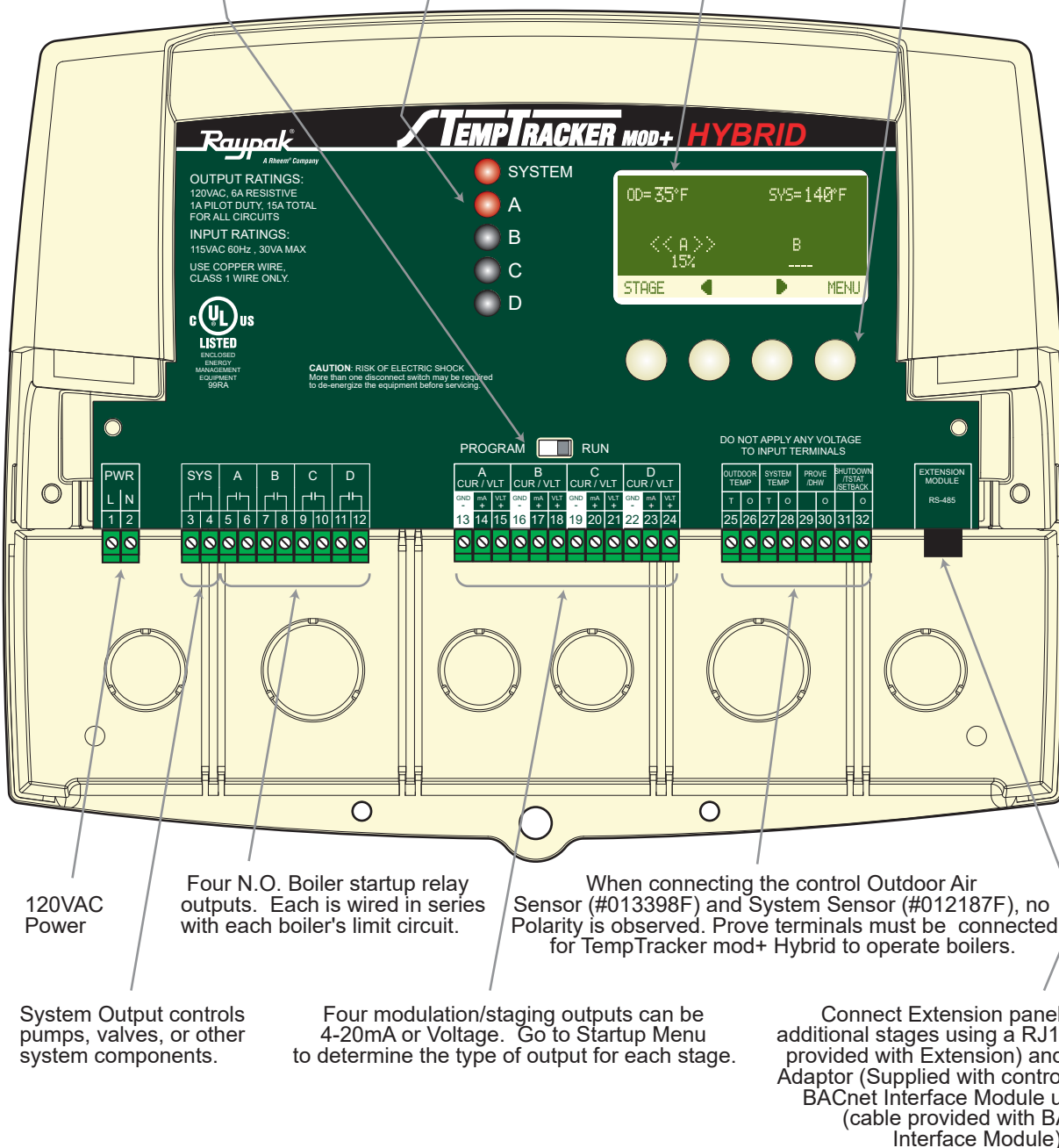


Figure 4. Complete TempTracker mod+ Hybrid Part Number 011922

7. TEMPTRACKER MOD+ EXTENSION LAYOUT

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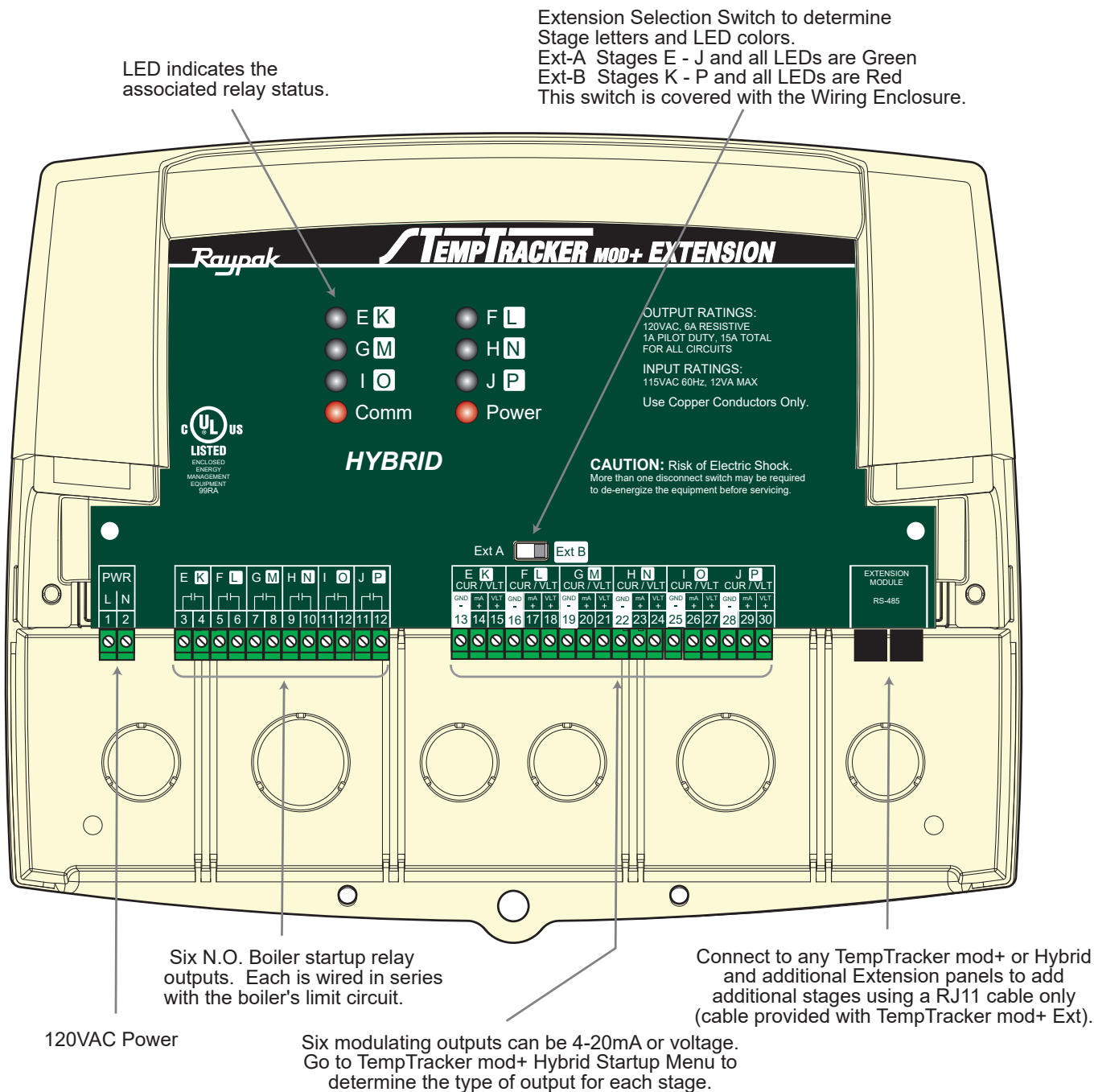


Figure 5. Complete TempTracker mod+ Extension Part Number 013179F

lead stage every selected time period from every hour to every 60 days.

Outdoor Reset

The TempTracker mod+ Hybrid has a hydronic outdoor temperature reset function. This allows the TempTracker mod+ Hybrid to change the setpoint based on outdoor temperature. Furthermore, additional settings have been added to fine tune this operation, like Offset, Minimum, and Maximum Water Temperature and night setback schedule.

System Output

This output can be used to activate a system pump, combustion air damper, or perform any other function that is required when any stage is active. It will energize whenever the outdoor temperature is below the Outdoor Cutoff setting. A System Prove input checks the status of components activated by the System output before stages can be activated.

Normal or Parallel Modulation

The TempTracker mod+ Hybrid can stage modulating boilers as needed. In Normal Modulation, it will allow the modulation to increase on the lead boiler until it reaches its modulation start point adjustment. Then, the TempTracker mod+ Hybrid will start the next boiler and so on. Moreover, the TempTracker mod+ Hybrid allows for a parallel mode that can modulate several boilers together as a one large boiler. This mode is useful when used with condensing boilers as they run more efficient at lower modulation. Thus, it is better to run several boilers at lower modulation than to run a single boiler at full fire.

Add up to 16 Boiler Stages (Optional)

As a stand-alone, the TempTracker mod+ Hybrid is designed to control four stages. However, it has the capability of expanding its control to two extension panels each with six boiler stages. Thus, the TempTracker mod+ Hybrid can control a total of up to 16 boiler stages.

Setback or Day/Night Scheduling

Two Setback modes are available for the TempTracker mod+ Hybrid:

- The Day/Night Scheduling provides an adjustable time-based schedule for the Setback (only available when Shutdown or Tstat is selected as the Setback/Shutdown Startup option). See "Shutdown/Tstat/Setback Mode" on page 26.
- The Setback mode uses an external signal to switch the operation of the TempTracker mod+ Hybrid in and out of setback mode (only available when Setback is selected as the Setback/Shutdown Startup option).

Remote Setpoint (EMS 4-20mA)

By connecting the control to the optional 4-20mA EMS Interface, the control shall be capable of accepting a remote setpoint.

8. FEATURES

The TempTracker mod+ Hybrid has been designed with Hydronic building heating, using both condensing and non-condensing boilers, as the primary purpose. As well, it is capable of controlling modulating or staging boilers. With this in mind, many of the TempTracker mod+ Hybrid features can be utilized to ease, enhance, and improve your system performance.

Condensing and Non-Condensing Boilers Can be Modulating or Multi-Stage.

The TempTracker mod+ Hybrid can operate both modulating and staging boilers. Just specify each of the Condensing and Non-Condensing boiler group type and the TempTracker mod+ Hybrid will activate the groups based on an adjustable set of criteria.

PID Type Logic

The TempTracker mod+ Hybrid's control algorithms allow it to look at the rate of change in the system. If the system temperature is changing quickly, the TempTracker mod+ Hybrid will react quickly to adjust the modulating stages' output. If the system temperature changes slowly, the TempTracker mod+ Hybrid will make slow and gradual output adjustments. Therefore, the TempTracker mod+ Hybrid adapts to specific system requirements and minimizes fluctuations around the setpoint.

Controls 0-10 V or 4-20 mA modulating Burners

Whenever any of the Condensing or Non-Condensing group type is set to Modulating, the TempTracker mod+ Hybrid will accurately control the output from 0 to 100% of modulation for each of these different types of motors. Moreover, a single TempTracker mod+ Hybrid can control multiple modulating burners each with a different modulating signal.

Controls On/Off, 2-Stage, 3-Stage, or 4-Stage Burners

Whenever one of the Condensing or Non-Condensing group Type is set to Staging, the TempTracker mod+ Hybrid will accurately sequence the stages using a PID logic. The sequencing group will have a set of adjustable parameters to help achieve better operation.

Digital Display of all System Settings

The TempTracker mod+ Hybrid's alphanumeric digital display names each system parameter in simple English and shows its precise value. The easy to follow menu system allows users to quickly make changes to any system setting without having to learn any specialized codes or keyboard commands.

Automatic Rotation among Stages

Rotating the lead stage of each group promotes even wear. The TempTracker mod+ Hybrid has three modes of rotation: Manual, Last On, or Time. The Time rotates the

BACnet MS/TP Communication

An optional BACnet Interface Module (#651735) can be used to connect the control to a BACnet MSTP network for remote access.

Make Sure You Have the Right Control

If you need the TempTracker mod+ Hybrid to do additional tasks that either are not listed or do not know how to configure them, contact your local Raypak representative.

Setting an Initial Program will ease the configuration of the TempTracker mod+ Hybrid and will give the opportunity to utilize many of the energy saving features while giving comfortable heat when needed.

The program should consist of the following:

- Selecting the features that your system can utilize.
- Installation: Install the Control, switches and sensors. See "Installation" on page 11.
- Setting the System Startup. See "Startup Settings" on page 18.
- Setting the System Operating Settings. See "Operating Settings" on page 30.
- Setting the Stages. See "Modulating Boiler Operating Settings" on page 34 and also see "Staging Boiler Operating Settings" on page 35.
- Adjusting Reset Ratio and Water Offset (In Reset Mode Only). See "Reset Ratio" on page 30.
- If using BACnet MSTP communication, then connect the BACnet Interface Module to the TempTracker mod+ Hybrid. Then connect the BACnet Interface Module to the BMS system. Configure the control's

BACnet settings. See "BACnet MSTP Startup Menu" on page 45.

9. INSTALLATION

Each of the TempTracker mod+ Hybrid or Extension consists of three primary enclosure components.

- The Enclosure Display Module: contains the control electronic board, display, buttons, LEDs and electric wiring terminals. It has two screws to hold it to the base. A program configuration switch, used to adjust the control settings, is placed above the terminals.
- This switch is enclosed with the enclosure wiring cover for security. Wiring terminals are of the plug-in type to ease installation and removal.
- The Enclosure Base: contains the holes to mount and hold the control against the wall or any flat surface. All other enclosure components mount on the base. The bottom section of the Enclosure Base contains the wiring chamber with knockouts on the bottom to ease installation.
- The Enclosure Wiring Cover: seals the wires from the external environment. It has two screws to hold it the base and a hole to secure a lock on the wiring enclosure. A plastic web that separates the wiring chamber into high and low volt sections has been provided.

Mounting the Enclosure

- Select a location near the equipment to be controlled.
- The surface should be flat and sufficiently wide and strong to hold the TempTracker mod+ Hybrid or the Extension.
- Keep the control away from extreme heat, cold, or

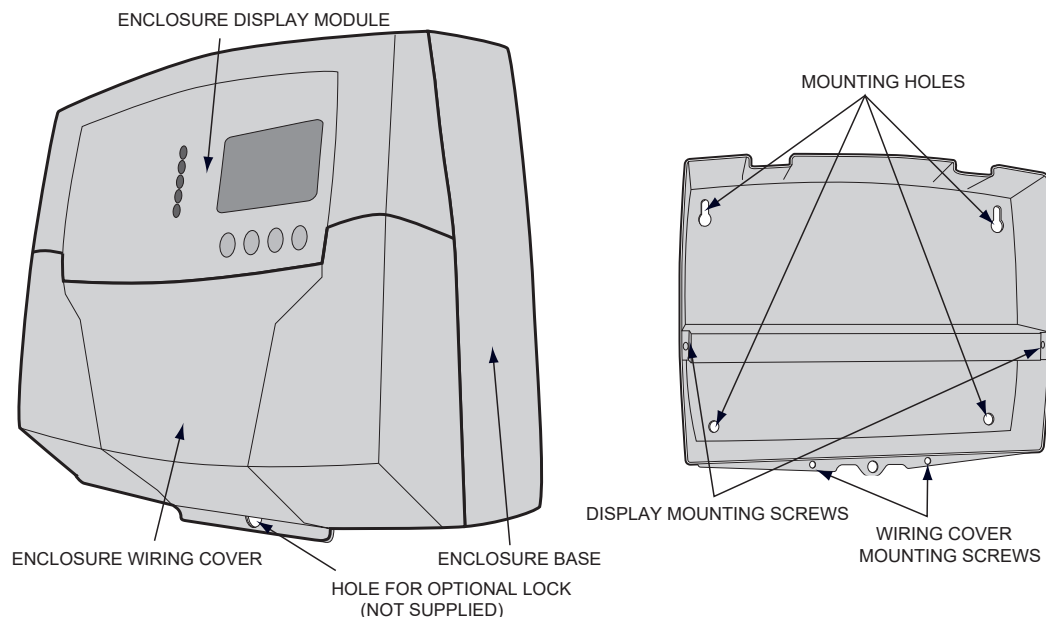


Figure 6. Enclosure Features

humidity. Ambient operating temperature is from 20°F to 120°F (-7°C to 49°C).

- Remove the Enclosure Wiring Cover from the control enclosure by removing the two bottom screws.
- Remove the Enclosure Display Module by removing the enclosure middle screws.
- Screw the Enclosure Base to the surface through the upper and lower mounting holes on the back of the enclosure.
- Replace the Enclosure Display Module and replace the enclosure middle screws.
- Do not replace the enclosure wiring cover until all wiring is done.
- When purchasing a padlock for the enclosure, the maximum shank diameter should not exceed 1/4" (6.4 cm).

Install the Sensors

System Sensor Installation

⚠ WARNING: Use only the System and Outdoor Air sensors included with the control. Do not use boiler sensors as it will cause operational problems.

- Only use the System sensor (#012187F) provided with the unit.

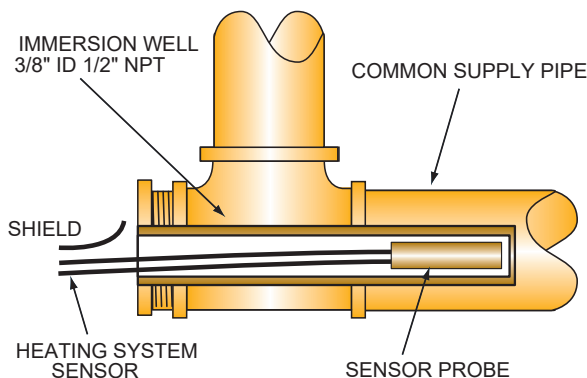


Figure 7. Immersion Heating System Sensor

NOTE: If the HSS can not sense the correct water temperature, the TempTracker mod+ Hybrid will not provide comfortable heat levels.

- The sensor wires can be extended up to 500' (152 m) using a shielded 2-conductor cable (Belden #8760 or equivalent). Do not ground the shield at the sensor but at the panel using one of the terminals marked with an "O".
- Do not run sensor wires in conduit with line voltage wiring.
- Install a 3/8" ID 1/2" NPT immersion well.
- If installing the system sensor on the supply, insert the sensor in a well with heat paste approximately 5'

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feet past the boiler loop outlet on the common supply header but before any major takeoffs. The sensor must be located where it sees the output of all the boiler stages. If a boiler is piped so that the sensor does not see its output, the TempTracker mod+ Hybrid will not sequence the boilers correctly.

- The sensor can also be installed on the return to the boilers after all major returns and before any boiler. However, when setting the reset ratio and the offset, the user must consider the temperature drop across the building loop.

Outdoor Sensor Installation

- Only use the Raypak Outdoor Air Sensor group included with the unit (#013398F).

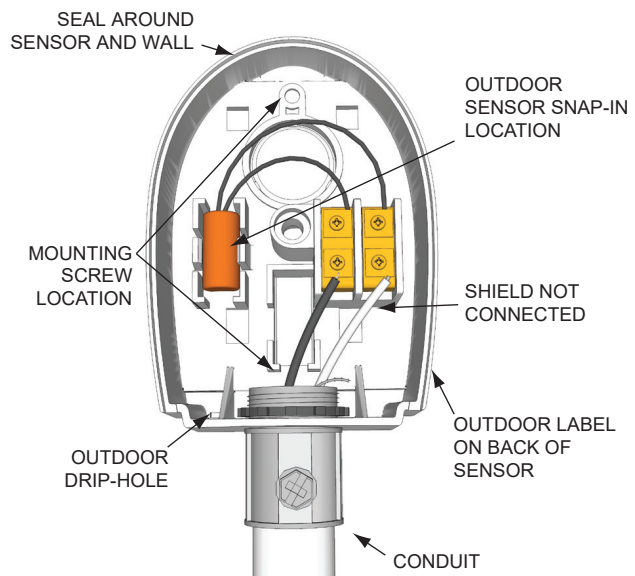


Figure 8. Outdoor Sensor

- 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 approximately 10 ft (3 m) above ground level.
- Adhere the Outdoor Label provided to the back of the sensor base.
- Use the Enclosure Base bottom knockout for the conduit. Use the locknut to hold the conduit and enclosure base together. Screw the cover to the base.
- If screws are used to affix the enclosure to the wall, make sure to seal around the sensor and wall except from the bottom.
- The sensor wires can be extended up to 500' (152 m) using shielded 2-conductor cable (#18/2). Do not ground the shield at the sensor but at the control using the terminal marked with an "O".

- Do not run sensor wires in conduit with line voltage wiring.

NOTE: Determining the proper location of the Outdoor Sensor is very important. The TempTracker mod+ Hybrid 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 (OD).

Wiring

- All wiring must enter the enclosure through the bottom knockouts.
- Class 1 voltage wiring must utilize a different knockout and conduit from any Class 2 voltage wiring.

Wiring the Power

(Terminals 1, 2)

- Bring the 120VAC 60Hz power wires through the bottom left knockout of the enclosure.
- Connect the hot line to terminal marked L.
- Connect the neutral line to the terminal marked N.
- Raypak recommends installing a surge suppressor on the power source to the TempTracker mod+ Hybrid.

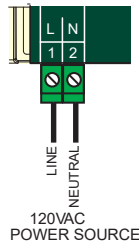


Figure 9. Wiring the Power

⚠ WARNING: Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring. Raypak recommends installing a surge suppressor on the power source to the TempTracker mod+ Hybrid.

Wiring the Sensors

⚠ WARNING: Connect the shield at the control terminal end and cut the shield wire at the sensor end. To avoid operational problems, use only the System and Outdoor Air sensors included with the control.

System Sensor Wiring (Terminals 27, 28)

- A TempTracker mod+ Hybrid must be connected to a System temperature sensor (#012187F) located in the common header. The sensor must be inserted in a 3/8" ID well using heat paste.
- Temperature sensor wires can be extended up to 500' by splicing its wires with a shielded 2-conductor cable (Belden #8760 or equivalent (#18/2)).

Temperature sensors have no polarity. Connect the two wires from the sensor to the TempTracker mod+ Hybrid terminals marked SYSTEM TEMP 27, 28.

- Connect the sensor shield to the circled terminal 28 with one of the sensor wires.

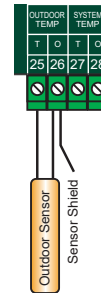


Figure 10. System Sensor Wiring

Outdoor Sensor Wiring (Terminals 25, 26)

- The TempTracker mod+ Hybrid will vary the system Setpoint based on outdoor temperature. In addition, the Outdoor Air Sensor group (#013398F) is used as an Outdoor Cutoff. The TempTracker mod+ Hybrid will disable all boilers when the outdoor temperature is above the adjustable Outdoor Cutoff temperature.
- For an outdoor sensor use the outdoor sensor provided.
- The sensor wires can be extended up to 500' using shielded 2-conductor cable (Belden #8760 or equivalent (#18/2)).
- Temperature sensors have no polarity. Connect the wires from the outdoor sensor to the TempTracker mod+ Hybrid terminals marked OUTDOOR TEMP - 25, 26.
- Connect the shield to the circled terminal 26 with one of the sensor wires.

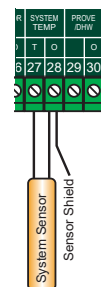


Figure 11. Outdoor Sensor Wiring

Wiring the Shutdown, Tstat, or Setback (Terminals 31, 32)

- The Shutdown will be available when selected as the Shutdown/Tstat/Setback mode from the Startup menu. See "Shutdown/Tstat/Setback Mode" on page 26. This will provide the user with an adjustable Day/Night Schedule. See "Day / Night Schedule" on page 36.

- The Shutdown feature can be used whenever it is

desirable to turn off the TempTracker mod+ Hybrid stage outputs from a remote location or another controller (i.e. EMS input).

- The Tstat option, when selected from the Shutdown/Tstat/Setback startup menu, offer the capability of controlling the operation of the TempTracker mod+ Hybrid based on a thermostat input. This will provide the user with a adjustable Day/Night Schedule.
- The thermostat will send the TempTracker mod+ Hybrid a call for heat by shorting terminals 31 and 32.
- When the Shutdown input is enabled by closing the dry contact, or when the Tstat input is disabled by opening the dry-contact, all active modulating boilers will immediately modulate down to low for the Soft-Off period, then turn off. All staging boilers will turn off immediately.
- The System Output relay will remain active until the System Run-On Delay expires and then it will turn off.
- When Setback is selected in the Startup, a BMS/EMS or external clock can provide a Setback signal using these input terminals. See "Shutdown/Tstat/Setback Mode" on page 26. No Day/Night Schedule will be available when Setback is selected from the Shutdown/Tstat/Setback mode in the Startup menu.
- Bring the two wires from the dry contact to the terminals marked SHUTDOWN/TSTAT/SETBACK-31,32.
- The signal must be a dry contact only. No voltage can be placed across the SHUTDOWN/TSTAT/SETBACK terminals.

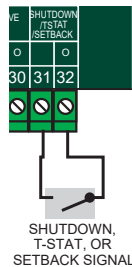


Figure 12. Wiring the Shutdown, Tstat, or Setback

Wiring the Prove

(Terminals 29, 30)

- The Prove feature is provided to check system component operation and must be selected in the Startup Menu from the Prove/DHW Sharing menu. See "Prove/Indirect Domestic Hot Water (DHW) Priority" on page 26.
- A typical use of this feature is to check for pump flow or combustion air damper status before firing any boiler.
- If the PROVE input is open on a call for heat, the TempTracker mod+ Hybrid will enable only the

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System Output. All boiler outputs will be off when the PROVE input is open.

- A factory-installed jumper provides the System Prove signal. Do not remove the jumper unless it will be replaced by a System Prove signal or these terminals are to be used for DHW call input.
- Bring the two wires from the dry contact to the terminals marked PROVE - 29, 30.
- Prove Input terminals can accept a dry-contact signal only. No voltage can be placed across these terminals.

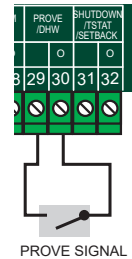


Figure 13. Wiring the Prove

WARNING: The PROVE input cannot be used as a safety limit. All equipment must have its own certified limit and safety controls as required by local codes. If Prove is selected in the startup menu, no boiler stage will start unless Prove terminals are shorted. DO NOT remove the PROVE jumper supplied unless replacing it with a Prove signal.

Wiring the Indirect Domestic Hot Water (DHW) Call

(Terminals 29, 30)

- DHW can be used to raise system Setpoint to the DHW Setpoint as well as manage the System Pump according to the DHW Priority setting. One of the DHW options must be selected from the Prove/DHW Sharing Startup menu. See "Prove/Indirect Domestic Hot Water (DHW) Priority" on page 26.
- Wire an aquastat or a control to provide dry-contact closure on the DHW Call - 29, 30 terminals.
- Remove the jumper on the DHW terminals for proper operation.
- DHW Call terminals can accept dry contact signals only. No voltage can be placed across these terminals.

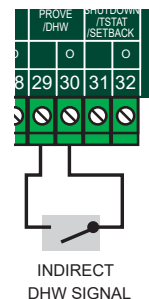


Figure 14. Wiring DHW Call

Wiring the System Output

(Terminals 3, 4)

- The SYS output relay will energize and remain constantly energized whenever the outdoor temperature is below the Outdoor Cutoff.
- When the outdoor temperature rises 2°F (1°C) above the Outdoor Cutoff, the SYS output will remain energized for the period set by the System Run-On then de-energize. See "System Run-On" on page 33.
- In addition, the System output will energize during summer DHW calls when DHW No Priority is selected. See "Prove/Indirect Domestic Hot Water (DHW) Priority" on page 26.
- The SYS output has one Normally Open (N.O.) relay contact rated for (1/8 HP).
- The N.O. contacts are dry contacts only. They do not source any voltage.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.

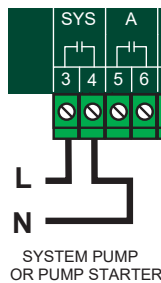


Figure 15. Wiring the System Output

Wiring the Boilers

- When wiring Condensing and Non-Condensing boilers make sure that Condensing boilers utilize the first stages and Non-Condensing boilers will utilize the following stages. That is, if the installation had two Condensing Modulating boilers and two Non-Condensing Staging On/Off boilers, Stage A and B will be used by the Condensing boilers while C and D will be used by the Non-Condensing boilers.

Wiring Boiler Activation or On/Off Staging Boilers

(A Terminals 5, 6), (B Terminals 7, 8), ...

- Each boiler output has a Normally Open (N.O.) dry-contact relay. They do not source any power.
- Wire the N.O. relay contacts in series with the unit's limit circuit.
- When connecting to On/Off boilers, each stage relay output will be connected to a single boiler.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.

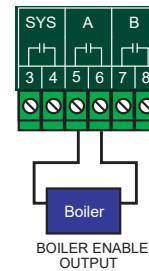


Figure 16. Wiring Boiler Activation or On/Off Staging Boilers

NOTE: Some modulating boilers may not require the use of these outputs.

Wiring Multi-Stage Boilers

(For Staging Boiler Types Only) See page 19

- Each multi-stage boiler must use only one of the N.O. relays and the voltage output for that stage. The TempTracker mod+ Hybrid will sequence the boiler stages using the 0-10V output signal.
- Note that on the display of the TempTracker mod+ Hybrid each staging boiler will consist of a single letter.
- Each stage output has one Normally Open (N.O.) relay contact that does not source any power.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.

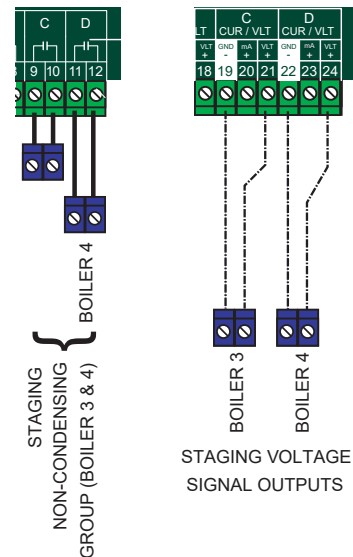
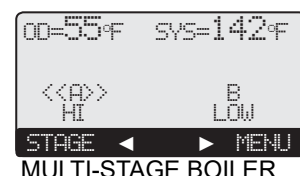


Figure 17. Wiring Multi-Stage Boilers



EACH BOILER "A" OR "B" HAS MULTIPLE STAGES

Figure 18. Wiring Multi-Stage Boiler Display

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Wiring to Modulating Boilers

⚠ WARNING: The Modulating Output Type must be set to match the boiler modulating signal prior to wiring the boiler signal to avoid control or equipment damage.

The TempTracker mod+ Hybrid can modulate any combination of current or voltage boiler signals. The Modulating Output Type must be set to match the boiler modulating signal before connecting any output wires to avoid damaging components. See "Modulating Output Type" on page 25. Some modulating boilers may require the use of the stage output relay in addition to the modulating output.

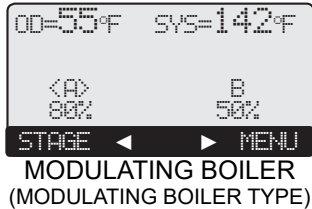


Figure 19. Wiring to Modulating Boilers

Wiring the 4-20mA Modulating Boilers

(A Terminals 13, 14), (B Terminals 16, 17),...

- The TempTracker mod+ Hybrid can operate up to four 4-20 mA modulating motors.
- The Extension can operate up to six 4-20 mA modulating motors.
- The TempTracker mod+ Hybrid and the Extension sources excitation voltage for the 4-20mA signal.
- Wire the (-) from the boiler modulating motor to the (GND) terminal on the TempTracker mod+ Hybrid. That is for boiler A, the modulating (GND) terminal will be 13.
- Wire the (+) from the boiler modulating motor to the (mA+) terminal on the TempTracker mod+ Hybrid. That is for boiler A, the modulating (mA+) terminal will be 14.

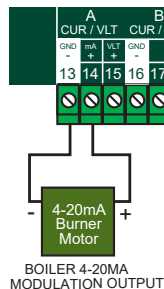


Figure 20. Wiring the 4-20mA Modulating Boilers

Wiring the Voltage Modulating or Staging Boilers

(A Terminals 13, 15), (B Terminals 16, 18),...

- The TempTracker mod+ Hybrid can operate up to four 0-10V modulating motors.
- The Extension can operate up to six 0-10V modulating motors.
- Wire the (GND) from the boiler modulating motor to the (GND) terminal on the TempTracker mod+ Hybrid. That is for boiler D, the modulating (GND) terminal will be 22.
- Wire the (VLT+) from the boiler modulating motor to the (VLT+) terminal on the TempTracker mod+ Hybrid. That is for boiler D, the modulating (VLT+) terminal will be 23.

On staged boilers, the modulating signal must connect to a stage interface card (sales option B-60), which will translate the signal to stage closure on the boiler.

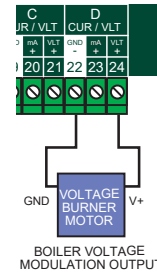


Figure 21. Wiring Voltage Modulating or Staging Boilers

Connecting to the Extensions and 4-20mA EMS Interface

- The TempTracker mod+ Hybrid is equipped with a RJ45 socket and a RJ45 to RJ11 Adaptor to connect to extension panels (#013179F) and 4-20mA EMS Interfaces (#012019). The Extension is equipped with two RJ11 sockets and a RJ11 cable to connect to TempTracker mod+ Hybrid and an additional Extension. Use the RJ45 to RJ11 Adaptor on the TempTracker mod+ Hybrid.
- The order in which the control, the extensions, and the interface are wired is not observed.
- Set each Extension to a different letter (EXT-A or EXT-B). The TempTracker mod+ Hybrid will assign the stage letters based on the extension letter selected.
- Extension A will operate stages (E - J) and all the LEDs will be Green. However, Extension B will operate stages (K - P) and all the LEDs will be Red.
- Configure the Modulating and Sequencing Output Types after connecting the Extension panels to be able to configure their outputs. See "Boiler Type" on page 19.

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- Only the 6-wire RJ11 cable supplied with the extension must be used for proper operation.
- RJ11 cables must be of a 6-wire with 6-pin terminals.

NOTE: To set the Extension to a specific letter, remove the wiring cover and switch the Ext A/Ext B to the desired letter. DO NOT set both extensions to the same letter to avoid errors.

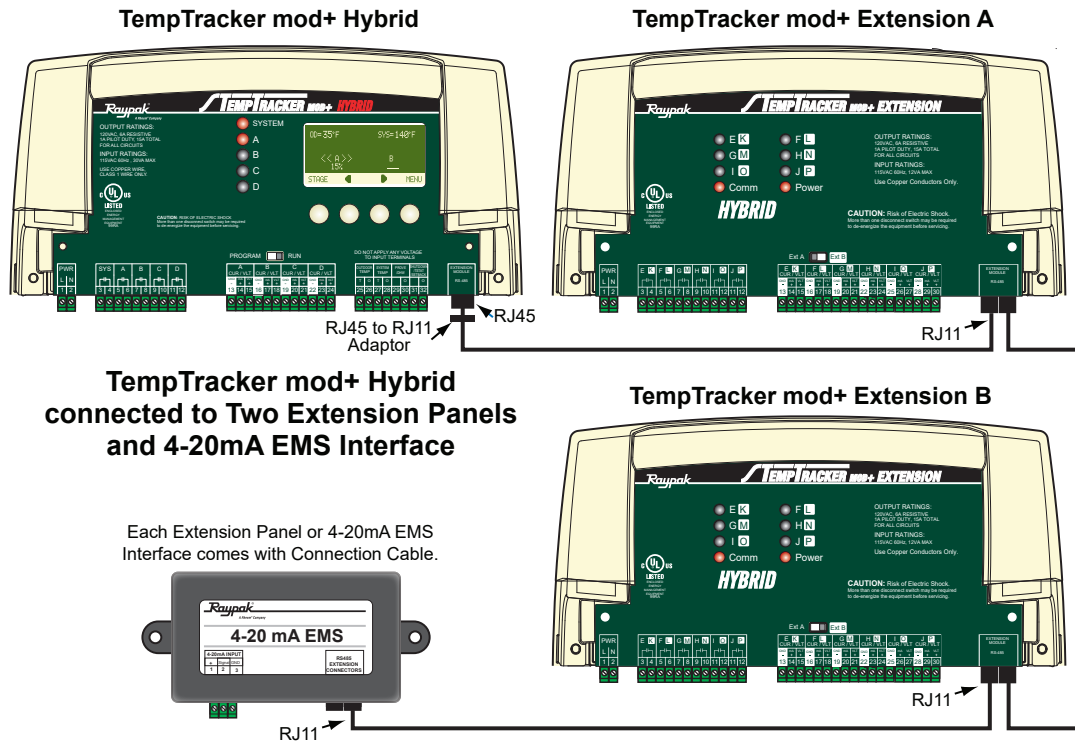
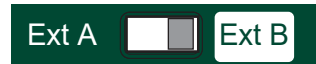


Figure 22. Connecting to the Extensions and 4-20mA EMS Interface

Connecting to BACnet Interface Module

- The TempTracker mod+ Hybrid can communicate to BACnet MSTP networks when used the BACnet Interface Module (#651735). The module must be purchased separately.
- The BACnet Interface Module comes with an RJ45 cable.
- Both the TempTracker mod+ Hybrid and the BACnet Interface Module (#651735) are equipped with a

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RJ45 socket (RS485) to connect to communicate to each other.

- The Interface BACnet Module must be wired to the BACnet MSTP network using the RS485 terminals A, GND, and B.
- If both an extension panel and the BACnet Interface Module are to be used, connect the RJ11 socket on the BACnet Interface Module to the extension.
- Set the BACnet parameters. See "BACnet MSTP Startup Menu" on page 45.

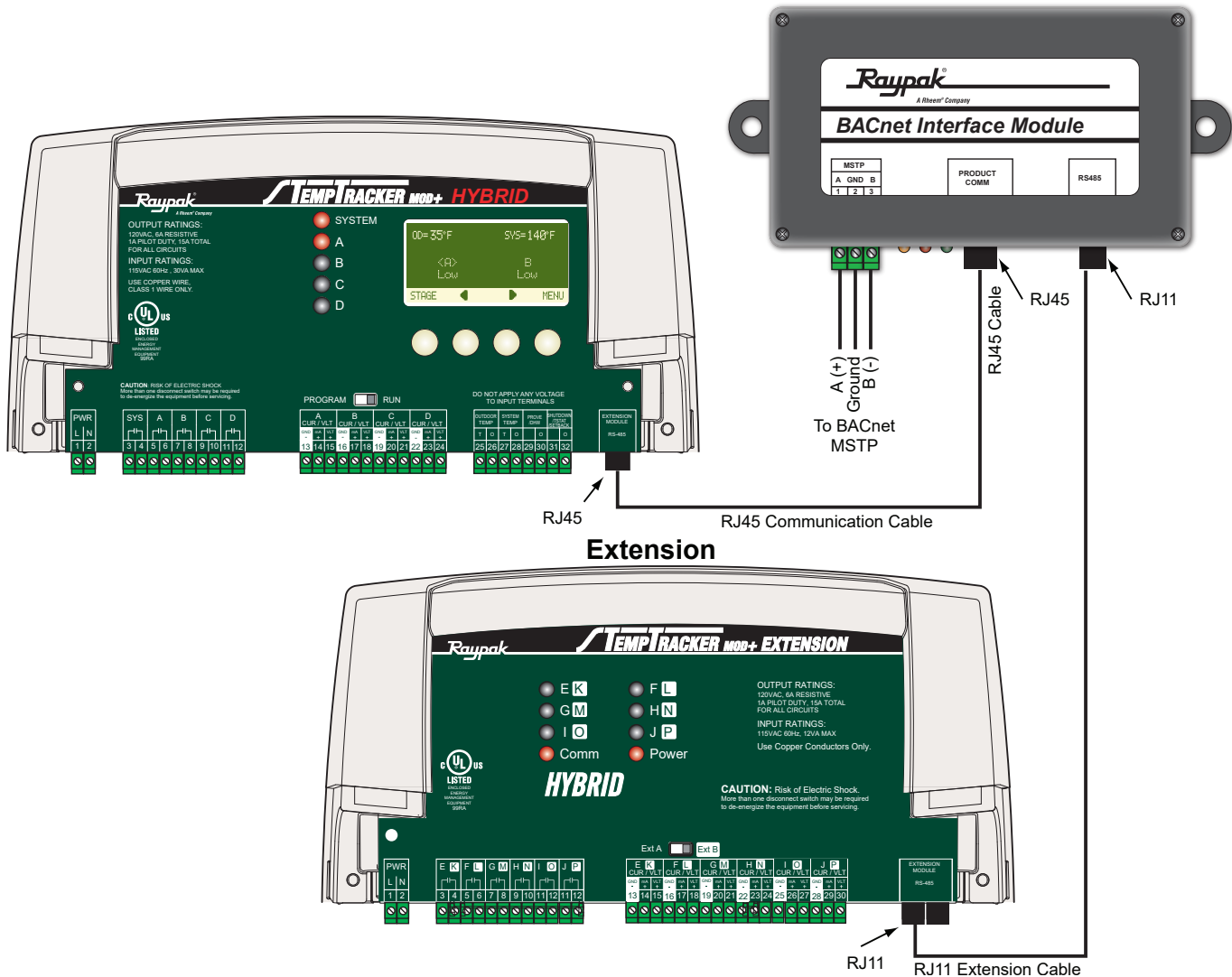


Figure 23. Connecting to BACnet Interface Module

10. STARTUP SETTINGS

Program Change Switch Setting

To be able to change the TempTracker mod+ Hybrid settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security.



Figure 24. Program Change Switch Setting

Startup Sequence

Button: MENU/<System Startup>

- When powered, the TempTracker mod+ Hybrid performs a self diagnostics-test.

UNCONTROLLED DOCUMENT IF PRINTED

- On the first power up, the System Startup screen will appear after the initialization is complete. If it doesn't, the TempTracker mod+ Hybrid has already been configured.
- The System Startup menu sets the main parameters that relate to the heating application. These settings must be set by the installer.



Figure 25. Startup Sequence

Boiler Type

Modulation, Staging, Hybrid (Default: Modulation)

Button: MENU/<System Startup>/.../Boiler Type

- The same Raypak control can operate modulating boilers, staging boilers, or a combination of both types.
- The Modulation option will operate a variety of modulating boilers.
- The Staging option will operate a variety of On/Off or multi-stage boilers.
- The Hybrid option will sequence two groups of boilers, condensing and non-condensing. Each group could be of a different boiler type (Modulation or Staging). See "HYBRID Startup Settings" on page 22. Each Multi-Stage boiler will use a single output relay. The staging will take place using the voltage output signal.
- If BACnet is to be used, each of the Boiler Type modes will have a different set of BACnet variables. See "Hybrid - Outdoor Reset - BACnet Variable List" on page 47.

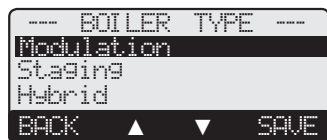


Figure 26. Boiler Type

Sensor Type

Reset °F, Reset °C, Setpoint °F, Setpoint °C, 4-20mA EMS (Default: Reset °F)

(Setpoint Options Not Available with Hybrid Boiler Type)

Button: MENU/<System Startup>/.../Sensor Type

- If Reset °F is selected, all temperatures and settings will be displayed in degrees Fahrenheit and the control will use Reset Ratios to adjust the system setpoint.

- If Reset °C is selected, all temperatures and settings will be displayed in degrees Celsius and the control will use Reset Ratios to adjust the system setpoint.
- If Setpoint °F is selected, all temperatures and settings will be displayed in degrees Fahrenheit and the control will have an adjustable system setpoint.
- If Setpoint °C is selected, all temperatures and settings will be displayed in degrees Celsius and the control will have an adjustable system setpoint.
- The 4-20mA EMS option is only available to the Hybrid Boiler Type option. To use 4-20mA EMS with Staging and Modulating Boiler Types, select one of the Setpoint options and the EMS Input Mode menu will follow to offer the 4-20mA EMS option.
- The use of the 4-20mA EMS option requires the purchase of the 4-20mA EMS Interface (#012019). It gives the TempTracker mod+ Hybrid the capability of accepting a remote 4-20mA signal from a BMS or EMS system as the target setpoint.
- If BACnet is to be used, each of the Sensor Type modes will have a different set of BACnet variables. See "Hybrid - Outdoor Reset - BACnet Variable List" on page 47.

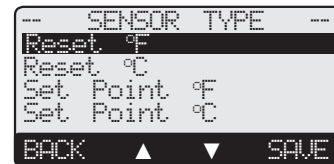


Figure 27. Sensor Type

EMS Input Mode

Disable, Enable (Default: Disable)

(Available after Setpoint with Staging or Modulation Boiler Types)

Button: MENU/<System Startup>/.../Boiler Type/Sensor Type / EMS Input Mode

- It allows the TempTracker mod+ Hybrid to utilize the 4-20mA EMS Interface (#012019) to accept a remote 4-20mA signal from a BMS or EMS system as the target setpoint.



Figure 28. EMS Input Mode

11. HYBRID STARTUP MENU

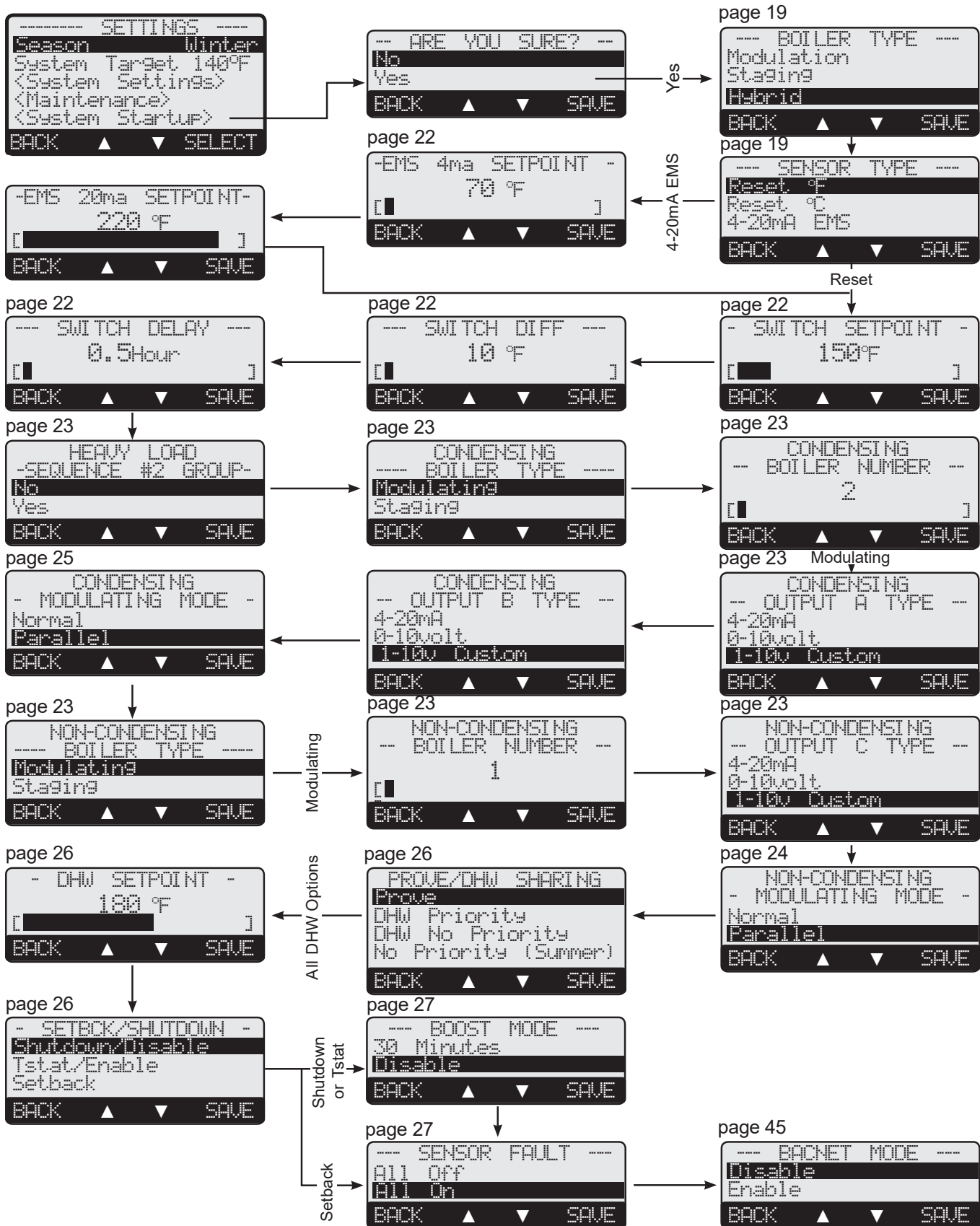


Figure 29. HYBRID Startup Menu

12. MODULATING & STAGING STARTUP MENU

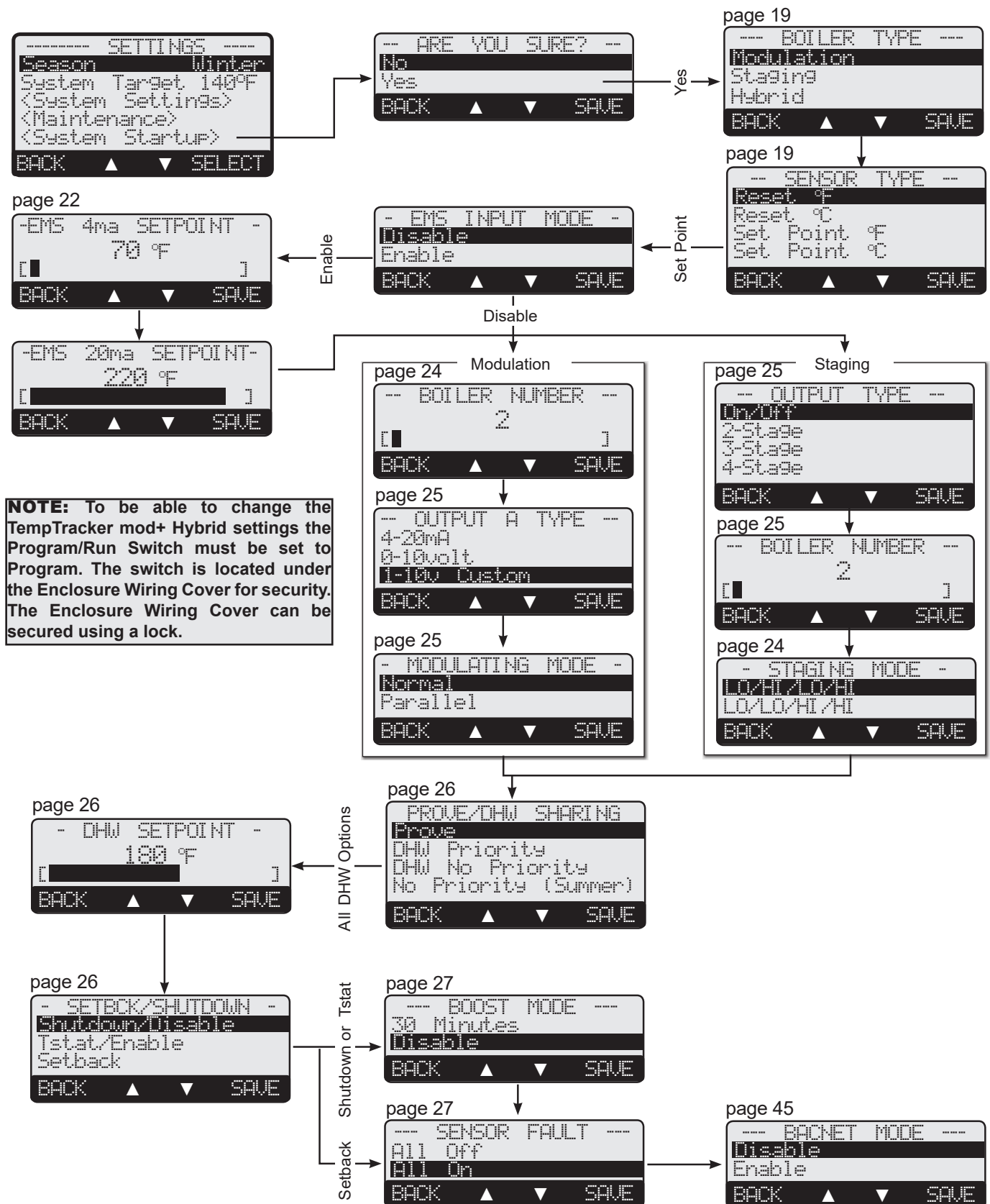


Figure 30. Modulating and Staging Startup Menu

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EMS 4mA and 20mA Setpoints

4mA: can be set from 50°F/ 10°C to 200°F/ 93°C (Default: 70°F/ 21°C)

20mA: can be set from 70°F/ 21°C to 220°F/104°C (Default: 220°F/ 104°C)

Button: MENU/<System Startup>/.../Sensor Type / EMS Input Mode/EMS 4mA Setpoint

- With the use of the 4-20mA EMS Interface (#012019), the TempTracker mod+ Hybrid will be able to receive a 4-20mA signal as a setpoint from a BMS or an EMS system as the target setpoint.
- The 4mA and 20mA Setpoint menus will follow the selection of the 4-20mA EMS sensor type option or EMS input Mode.
- There must be at least a 20°F differential between the 4mA and 20mA temperature settings.
- Connect the 4-20mA EMS Control Interface to the TempTracker mod+ RS485 connection.
- Any signal below 2.4mA or above 21.6mA will start an EMS shutdown. The display will indicate that by displaying the message "Shutdown by EMS".

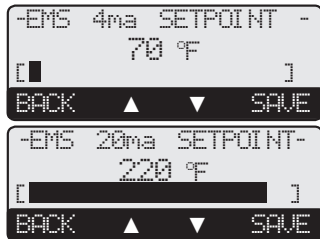


Figure 31. EMS 4mA and 20mA Setpoints

HYBRID Startup Settings

See "Hybrid Logic Overview" on page 5

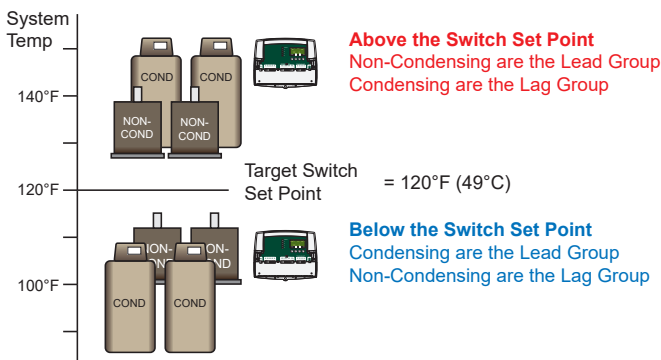


Figure 32. HYBRID Startup Settings

Switch Setpoint

From 0°F/ -18°C to 200°F/ 94°C (Default: 150°F/ 66°C)

Button: MENU/<System Startup>/.../Sensor Type/ Switch Setpoint

It is the setpoint at which the TempTracker mod+ Hybrid will switch between the Condensing Boiler Group and Non-Condensing Boiler Group.

- The Condensing Boiler group will be the lead group when the Target Temperature is below the Target Switch Setpoint. However, the Non-Condensing Group will be the lead group when the Target Temperature is above the Target Switch Setpoint.



Figure 33. Switch Setpoint

Switch Differential

Adjustable from 5°F/ 3°C to 20°F/ 11°C (Default: 10°F/ 6°C)

Button: MENU/<System Startup>/.../Switch Setpoint/ Switch Diff

- The Switch Differential controls the group switching. It allows the Calculated Target to drop a specified number of degrees below the Switch Setpoint before changing the lead group over.
- The default value is a good start to avoid oscillation between Condensing and Non-Condensing Boiler groups, particularly if no Switch Delay was set. See next setting.



Figure 34. Switch Differential

Switch Delay

Adjustable from 0.0 to 12.0 Hours (Default: 0.5 hours)

Button: MENU/<System Startup>/.../Switch Setpoint/ Switch Diff/Switch Delay

- The Switch Delay is an additional layer of assurance used to reduce the intermittent change of the lead group.
- To switch the lead group when the temperature is dropping, the sensor temperature must remain below the Switch Setpoint less the Switch Differential for the complete Switch Delay period before the switching of the lead group.
- I.e., if the Switch Setpoint was set to 135°F (57°C), and the Switch Differential was set to 5°F (2.8°C), then the Target Temperature must drop below 130°F (54°C) for the complete Switch Delay period for the lead group to change from Non-Condensing to Condensing.

- To switch the lead group when the temperature is rising, the Target Temperature must rise above the Switch Setpoint for the complete Switch Delay period before the switching of the lead group could take effect.



Figure 35. Switch Delay

Heavy Load Sequence 2nd Group

Yes, No (Default: No)

Button: MENU/<System Startup>/.../Switch Delay/Heavy Load Seq#2 Group

- This option makes the second group of boilers act as a backup in heavy load conditions. Thus, allowing them to start after all lead group boilers have run at their maximum capacity.
- If the system was designed to operate both groups of boilers in heavy load conditions, then select Yes.
- Selecting No will only allow the lead group to operate. The secondary group will remain off even if the system cannot reach the desired setpoint.



Figure 36. Heavy Load Sequence 2nd Group

Condensing and Non-Condensing Boiler Type

Modulating, Staging (Default: Modulating)

Button: MENU/<System Startup>/.../Heavy Load Seq#2 Group/Condensing Boiler Type

- Select the appropriate boiler type from the list. Each of the types will be followed by a related additional configuration settings to adjust.



Figure 37. Boiler Type

Condensing and Non-Condensing Boiler Number

Adjustable from 1 to 15 (Default: 1)

Button: MENU/<System Startup>/.../Condensing Boiler Type/ Condensing Boiler Number

- Select the number of condensing boilers. These boilers will occupy the first letters of the wiring stages on the TempTracker mod+ Hybrid starting with

Stage-A.

- Then, select the number of non-condensing boilers later in the Startup menu. See "HYBRID Startup Menu" on page 20.
- Note that, each Multi-Stage boiler requires the use of single output stage relay.

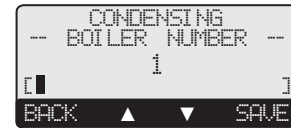


Figure 38. Boiler Number

HYBRID Modulating Boiler Settings

Modulating Output Type

4-20mA, 0-10V, 1-10V (Custom) Outputs (Default: 1-10V Custom)

Button: MENU/<System Startup>/.../Condensing Boiler Number/Output A Type

- If either of the Condensing or Non-Condensing Boiler groups was set to Modulating as the Boiler Type, the TempTracker mod+ Hybrid will offer the capability of controlling a variety of modulating signals. Each boiler can be configured to have a different modulating signal.
- The modulating output for each boiler can be configured to 4-20mA operation (Current) or any of the 0-10V voltage options. Check the boiler to determine its signal requirements.
- There are two 0-10V modulating options; a 0-10V and a 1-10V custom. The 0-10V starts the boiler at 50% then modulate up or down based on the need. The minimum modulation for any of these boilers will be the Ignition %. See "Ignition %" on page 42.
- The 1-10V Custom option gives the user the capability of adjusting the voltage level at which the boiler starts using the Ignition %. It shall be used on any Raypak 0-10V modulating boiler. The Ignition % will be the level at which the control will output 1VDC.
- When using the Extension, connect it to the TempTracker mod+ Hybrid prior to configuring the Output Type. Otherwise, the TempTracker mod+ Hybrid might not recognize the Extension stages.



Figure 39. Modulating Output Type

⚠ WARNING: Make sure that boiler modulation wiring matches the signal selected. Warranty will not cover failed components caused by improper wiring. See "Wiring the Boilers" on page 15.

Modulating Mode

Normal, Parallel (Default: Normal)

Button: MENU/<System Startup>/.../Output A Type/Condensing Modulating Mode

- Some modulating boilers perform better at higher modulation. For these units, it is advantageous to run one unit at high modulation than several units at lower modulation. If the units used are of this type, select Normal. This is the recommended setting for boilers with low turndown ratios.
- Most condensing boilers that run more efficiently at lower modulation. If it is more energy efficient to run several units at lower modulation than one at high, select Parallel. This is typically used on condensing boilers or boilers with high turndown ratios.
- For best Parallel performance, set the Modulation Start % to be equivalent to the lowest firing rate of the boiler multiplied by 2. That is, if the lowest firing of the boiler was 20%, set your Modulation Start% to 40%. See "Modulation Start %" on page 42.
- Set the Lag Delay to 0 for better parallel performance. See "Lag Delay" on page 35.

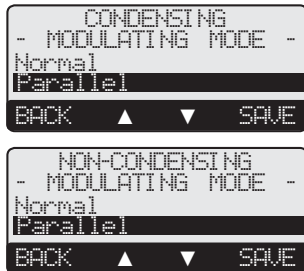


Figure 40. Modulating Mode

HYBRID Staging Boiler Settings

Staging Output Type

On/Off, 2-Stage, 3-Stage, 4-Stage Outputs (Default: On/Off)

Button: MENU/<System Startup>/.../Non-Condensing Output Type

- The TempTracker mod+ Hybrid can sequence multi-stage boiler starting with a single On/Off and up to a 4-stages. Just select the number of stages per boiler from this menu option.
- For each Hybrid multi-stage boiler a single output relay will be used in addition to the 0-10V output signal.
- The number selected applies to all sequencing boilers within that group whether it is Condensing or Non-Condensing.

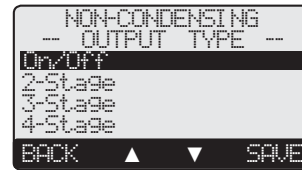


Figure 41. Staging Output Type

⚠ WARNING: A single Hybrid Multi-Stage boiler will use **ONLY** one output relay for activation and the 0-10V output signal for staging.

Staging Mode

Lo/Hi/Lo/Hi, Lo/Lo/Hi/Hi (Default: Lo/Hi/Lo/Hi)

Button: MENU/<System Startup>/.../Non-Condensing Output Type/Non-Cond Staging Mode

- During low load conditions, some boilers run more efficient when the lower stages are energized alone than with the higher stages. For these types of boilers select Lo/Lo/Hi/Hi. Then, the TempTracker mod+ Hybrid will sequence the lower stages of all boilers set to Auto before sequencing the higher stages.
- For the rest of the boiler types, the Lo/Hi/Lo/Hi should allow the staging of the lower stage of the lead boiler followed by the higher stage of the same boiler. Then when more stages are needed, it will fire the lower stage of the lag boiler followed by the higher stages.



Figure 42. Staging Mode

Modulating Boiler Settings

Boiler Number

Adjustable from 1 to 15 (Default: 1)

Button: MENU/<System Startup>/Boiler Type.../Boiler Number

- Select the number of modulating boilers.

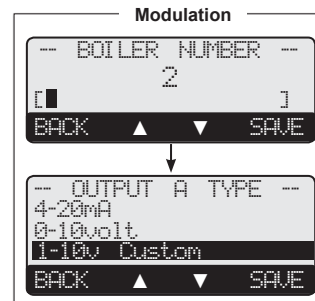


Figure 43. Boiler Number and Modulating Output Type

Modulating Output Type

4-20mA, 0-10V, 1-10V (Custom) Outputs (Default: 1-10V Custom)

Button: *MENU/<System Startup>/.../Boiler Number/Output A Type*

- The TempTracker mod+ Hybrid will offer the capability of controlling a variety of modulating signals. Each boiler can be configured to have a different modulating signal. Check the boiler to determine its signal requirements.
- The 4-20mA modulating option, starts the boiler at 50%. then modulate up or down based on the need. The minimum modulation for any of these boilers will be the Ignition %. See "Ignition %" on page 42.
- There are two 0-10V modulating options; a 0-10V and 1-10V Custom. The 0-10V starts the boiler at 50%. then modulate up or down based on the need. The minimum modulation for any of these boilers will be the Ignition %. See "Ignition %" on page 42.
- The 1-10V Custom option gives the user the capability of adjusting the voltage level at which the boiler starts using the Ignition %. It shall be used on any Raypak 0-10V modulating boiler. The Ignition % will be the level at which the control will output 1VDC.
- When using the Extension, connect it to the TempTracker mod+ Hybrid prior to configuring the Output Type. Otherwise, the TempTracker mod+ Hybrid might not recognize the Extension stages.

⚠ WARNING: Make sure that boiler modulation wiring matches the signal selected. Warranty will not cover failed components caused by improper wiring. See "Wiring the Boilers" on page 15.

Modulating Mode

Normal, Parallel (Default: Normal)

Button: *MENU/<System Startup>/.../Output A Type/Modulating Mode*

- Some modulating boilers perform better at higher modulation. For these units, it is advantageous to run one unit at high modulation than several units at lower modulation. If the units used are of this type, select Normal. This is the recommended setting for typical steel and cast iron boilers or boilers with low turndown ratios.
- There are many condensing boilers that run more efficiently at lower modulation. If it is more energy efficient to run several units at lower modulation than one at high, select Parallel. This is typically used on condensing boilers or boilers with high turndown ratios.
- For best Parallel performance, set the Modulation Start % to be equivalent to the lowest firing rate of

the boiler multiplied by 2. That is, if the lowest firing of the boiler was 20%, set your Modulation Start% to 40%. See "Modulation Start %" on page 42.

- Set the Lag Delay to 0 for better parallel performance. See "Lag Delay" on page 35.



Figure 44. Modulating Mode

Staging Boiler Settings

Staging Output Type

On/Off, 2-Stage, 3-Stage, 4-Stage Outputs (Default: On/Off)

Button: *MENU/<System Startup>/.../Output Type*

- The TempTracker mod+ Hybrid can sequence any type of multi-stage boiler starting with a single On/Off and up to a four 4-stages. Just select the number of stages per boiler from this menu option.
- Each boiler must be connected to one of the relay outputs. In addition to the stage relay the corresponding 0-10V output signal must be used to provide staging.

Boiler Number

Adjustable from 1 to 15 (Default: 1)

Button: *MENU/<System Startup>/Boiler Type.../Boiler Number*

- Select the number of staging boilers. This number multiplied by the number of stages for each boiler will determine the total number of stages required.

Staging Mode

Lo/Hi/Lo/Hi, Lo/Lo/Hi/Hi (Default: Lo/Hi/Lo/Hi)

Button: *MENU/<System Startup>/.../Output Type/Staging Mode*

- During low load conditions, some boilers run more efficient when the lower stages are energized alone than with the higher stages. For these types of boilers select Lo/Lo/Hi/Hi. Then, the TempTracker mod+ Hybrid will sequence the lower stages of all boilers set to Auto before sequencing the higher stages.
- For the rest of the boiler types, the Lo/Hi/Lo/Hi should allow the staging of the lower stage of the lead boiler followed by the higher stage of the same boiler. Then when more stages are needed, it will fire the lower stage of the lag boiler followed by the higher stage of the lag boiler.

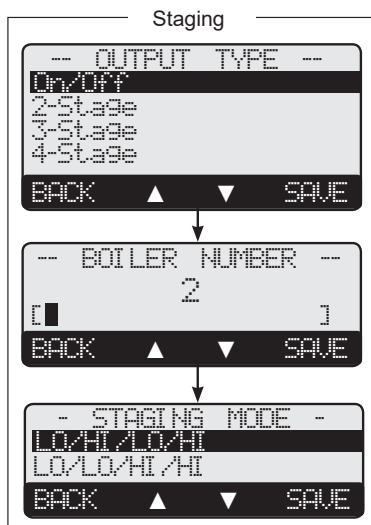


Figure 45. Staging Mode

WARNING: Make sure that boiler wiring matches the Boiler Type selected. Warranty will not cover failed components caused by improper wiring. See "Wiring the Boilers" on page 15.

Prove/Indirect Domestic Hot Water (DHW) Priority

Prove, DHW Priority, DHW No Priority, No Priority (Summer) (Default: Prove)

Button: MENU/<System Startup>/.../Prove-DHW Sharing

- This setting determines the functionality of input terminals 29 and 30.
- When Prove is selected, the TempTracker mod+ Hybrid will not start any boiler unless the Prove terminals are shorted/closed. However, it will allow the System relay to operate normally.
- There are three DHW Priority options. In all the options, a DHW call will raise the calculated water temperature to the DHW Setpoint (see next setting).
- The Domestic Hot Water Priority option de-energizes the System relay during domestic hot water calls for a period of one hour. If after the priority period the DHW call did not expire, the System relay will energize providing heat to the building and the temperature target will remain at the DHW Setpoint. After the DHW call ends, the setpoint will drop to satisfy the reset ratio or setpoint.
- Domestic Hot Water No Priority option allows the System relay to remain energized during a domestic hot water call (aquastat call on terminals 29 and 30). However, in Summer, Shutdown, No Tstat call for heat, or when the outdoor temperature is above Outdoor Cutoff, a DHW call will energize the System relay. After the DHW call terminates, the System

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relay will continue to run for the System Run-On period before turning off.

- Domestic Hot Water No Priority (Summer) behaves the same as the DHW No Priority. The only difference is that in Summer, Shutdown, No Tstat call for heat, or when outdoor temperature is above Outdoor Cutoff, a DHW call WILL NOT energize the System relay except for the Run-On delay after the DHW call ends.

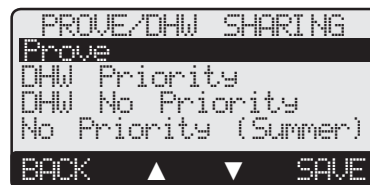


Figure 46. Prove/Indirect DHW Priority

Indirect Domestic Hot Water Setpoint

(Available with any of the DHW Priority options)

Adjustable from 140°F/ 60°C to 200°F/ 93°C (Default: 180°F/ 82°C)

Button: MENU/<System Startup>/.../Prove-Setpoint

- On a DHW call, the TempTracker mod+ Hybrid will raise the target temperature to the DHW Setpoint until the DHW call expires.



Figure 47. Indirect Domestic Hot Water Setpoint

Shutdown/Tstat/Setback Mode

Shutdown Input, Tstat Input, Setback Input (Default: Shutdown/Disable)

Button: MENU/<System Startup>/.../Setback/Shutdown

- This menu determines the functionality of terminals 31 and 32.
- The TempTracker mod+ Hybrid has two levels of heat, a Normal/Day and a Setback/Night. The Normal/Day is good for when buildings are occupied and people are active. The Setback/Night holds a lower system temperature for night periods or when buildings are unoccupied.
- When Shutdown or Tstat is selected, the Day/Night Schedules will be available in the operating menu. See next settings. Terminals 31 and 32 will function as a Shutdown (Turn off boilers when shorted) or as a Tstat (Turn off boilers when opened). However, a call for indirect DHW will bring the boilers on.
- When Setback is selected, the External Signal option will switch the TempTracker mod+ Hybrid to Setback mode when terminals 31 and 32 are shorted. This

allows an external device or control to provide the setback signal. No scheduling or boost menu options will be available with Setback.



Figure 48. Shutdown/Tstat/Setback Mode

Boost Mode

(Not Available in Setback Mode)

30 Minutes, Disabled (Default: Disable)

Button: MENU/<System Startup>/.../Boost Mode

- The morning Boost is designed to return the building to comfortable ambient temperatures after the cooler Night (Setback) period. The control will accomplish this by running elevated water temperatures (will add Setback setting to calculated water temperature) for 30 minutes before the start of the Day schedule setting. That is, if the normal day setpoint at a specific outdoor was 145°F (63°C) and the Setback setting was 20°F (11°C), the boost will raise the system calculated temperature to 165°F for 30 minutes before the start of the Day Schedule setting.
- If no Boost is needed, then simply select Disabled from the Boost Menu.
- Boost is only available if Shutdown or Tstat is selected as an option. See previous setting Sensor Fault All Off, All On Default: All On Button: MENU/<System Startup>/.../Sensor Fault.



Figure 49. Boost Mode

Sensor Fault

All Off, All On Default: All On

Button: MENU/<System Startup>/.../Sensor

- The Sensor Fault will determine the operating status of all output stages that has their Mode set to Auto when a sensor reads Short or Open.
- When All-Off is selected, the control will turn all boilers Off when the System sensor reads Short or Open. However, when the Outdoor sensor reads Short or Open, the control will try to maintain the Minimum Water Temperature.
- When All-On is selected and the Boiler Type was set to other than Hybrid, the control will turn all boilers On to a 100% when the System sensor reads Short or Open and the outdoor temperature is below Outdoor

Cutoff. However, when the Outdoor sensor reads Short or Open, the control will try to maintain the Maximum Water Temperature.

- When All-On is selected and the Boiler Type was set to Hybrid, the control will turn all Non-Condensing boilers On to full fire when the System sensor reads Short or Open and the outdoor temperature is below Outdoor Cutoff. During that time all Condensing boilers will turn Off. When the Outdoor sensor reads Short or Open, the control will try to maintain the Maximum Water Temperature.



Figure 50. Sensor Fault

NOTE: A good practice after performing any Startup menu modification is to check all operating settings and adjustments to match the new settings.

Setting the Control to Factory Defaults

To Reset the TempTracker mod+ Hybrid control to its original factory defaults, power down the control. Hold down the two right most buttons while powering the control back up until the TOTAL CLEAR STARTED screen appears. The Display will direct you to the Startup menu to program the control after the defaults are loaded.

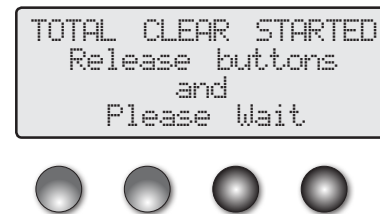


Figure 51. Setting the Control to Factory Defaults

NOTE: Do not turn off power to control until all Startup settings have been made. Otherwise, the next power-up will be set to many Startup factory settings that may not fit your application.

13. HYBRID OPERATING MENU

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NOTE: To be able to change the TempTracker mod+ Hybrid settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be secured using a lock.

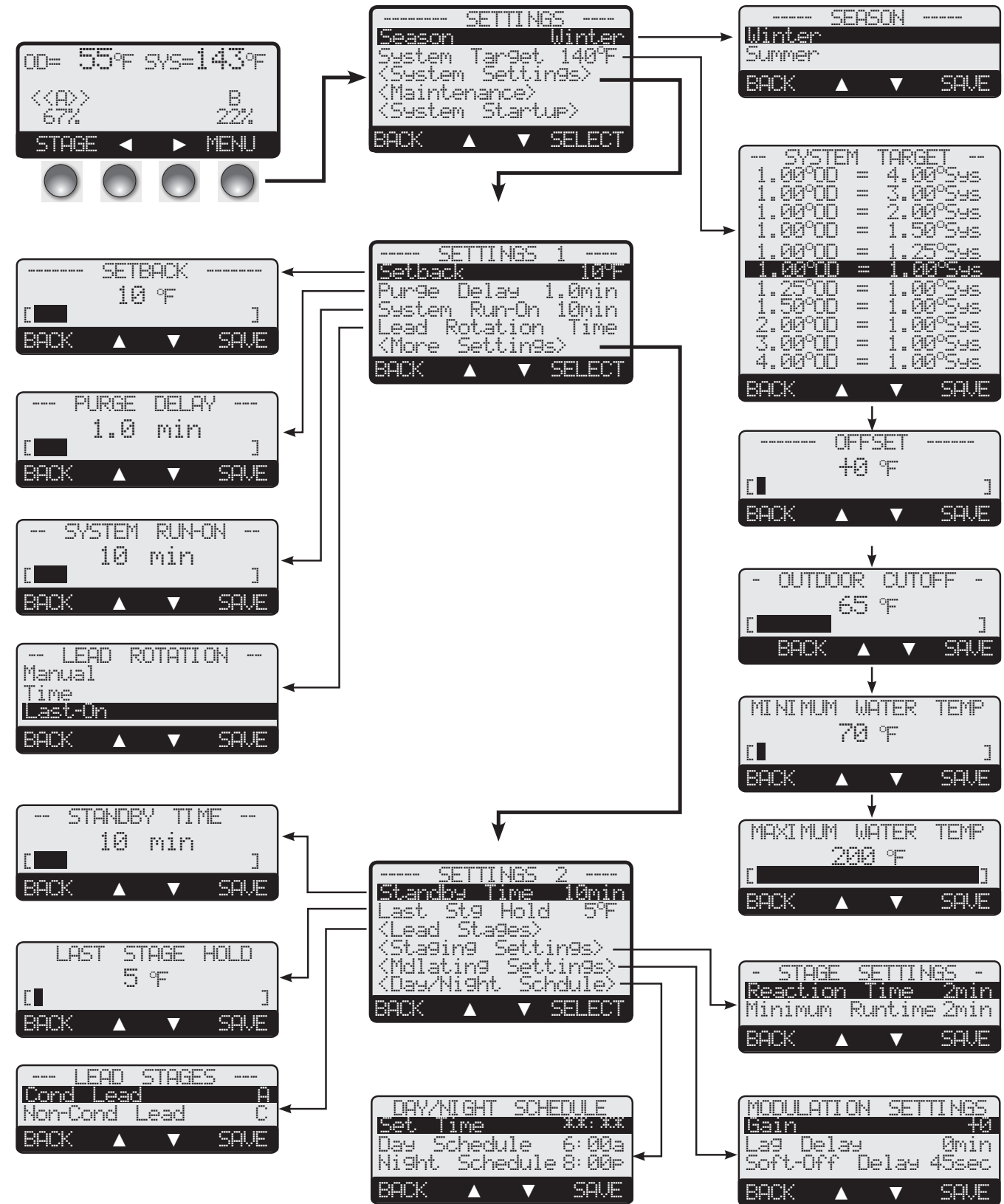


Figure 52. HYBRID Operating Menu
UNCONTROLLED DOCUMENT IF PRINTED

14. MODULATING AND STAGING OPERATING MENU

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NOTE: To be able to change the TempTracker mod+Hybrid settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be secured using a lock.

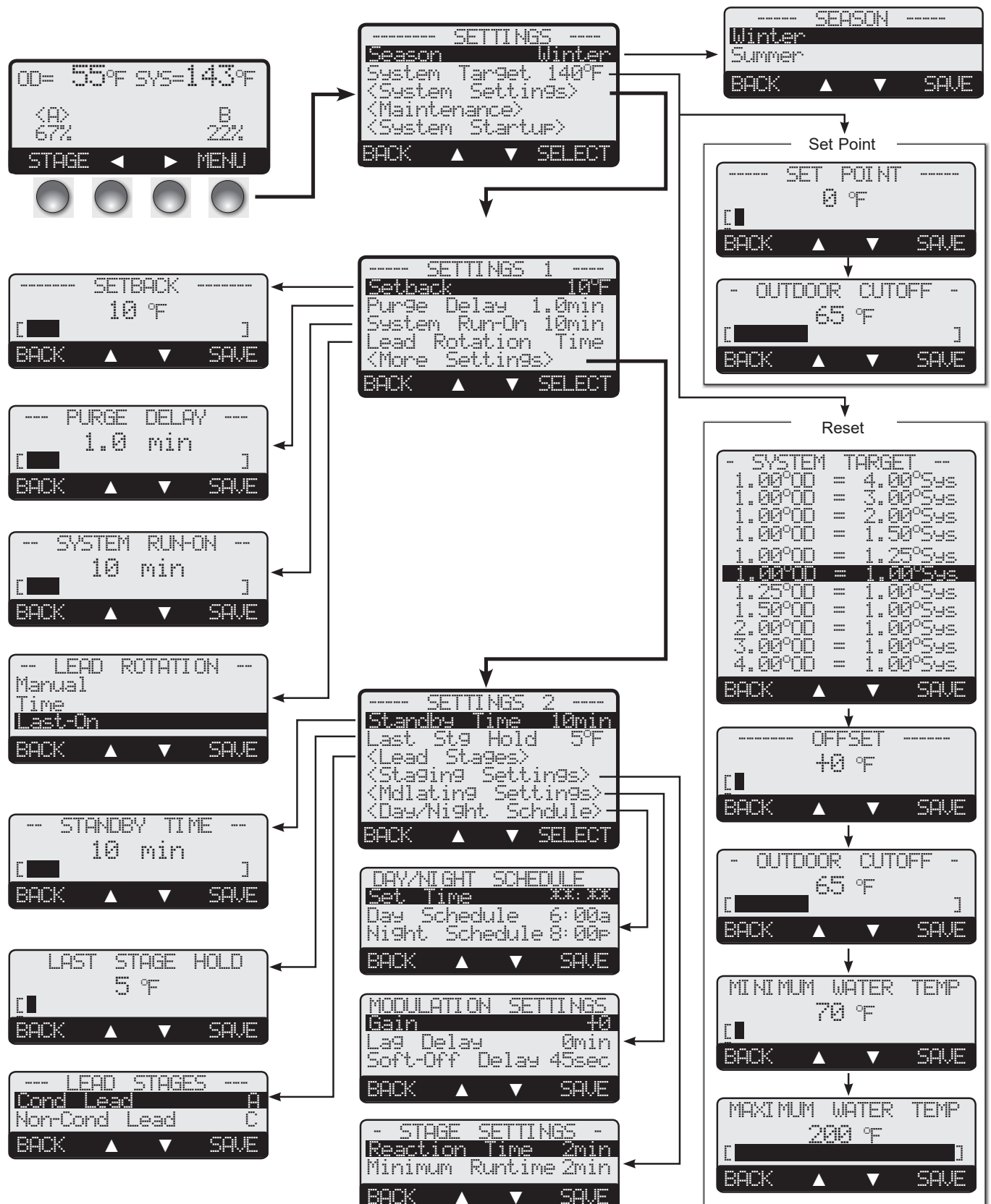


Figure 53. Modulating and Staging Operating Menu
UNCONTROLLED DOCUMENT IF PRINTED

the setpoint depends on the Modulation Mode, System Settings, and Stage Settings.

15. OPERATING SETTINGS

Program Change Switch Setting

To be able to change the TempTracker mod+ Hybrid settings, the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security.



Figure 54. Program Change Switch Setting

Season

Winter, Summer (Default: Winter)

Button: MENU/Season

- The TempTracker mod+ Hybrid will turn all boiler relays off when it is in Summer setting. However, an indirect DHW call will bring boilers back on when needed. The Message Display Line will display Summer to show the status.
- In Winter, the TempTracker mod+ Hybrid will activate the System relay whenever the Outdoor temperature (OD) falls below the Outdoor Cutoff setting. The Message Display Line will not show any season information when in Winter.
- When the heating season is over, it is a good practice to switch the TempTracker mod+ Hybrid to Summer setting. This will allow the control to sequence the boilers on an indirect DHW call.



Figure 55. Season

NOTE: DO NOT turn power off to the TempTracker mod+ Hybrid when heating season is over. If you do so, the battery will run down and will have to be replaced. Instead, switch to Summer.

Setpoint

(Only Available under Modulating or Staging Setpoint Mode)

Adjustable from 50°F/ 10°C to 220°F/ 104°C, On (Default: 140°F/ 60°C)

Button: MENU/System Target/Set point

- The Setpoint is the temperature the TempTracker mod+ Hybrid will use to control the system.
- If the EMS Input Mode was Enabled, the setpoint will be available as a read-only value.
- The TempTracker mod+ Hybrid will stage or modulate of the boilers to maintain the system temperature around the Setpoint. The amount of fluctuate around



Figure 56. Setpoint

Reset Ratio

Adjustable 1.00°OD : 4.00°Sys to 4.00°OD : 1.00°Sys (Default: 1.00°OD : 1.00°Sys)

Button: MENU/System Target

- The Reset Ratio determines how the System water temperature (SYS) will vary with Outdoor temperature (OD). With any of the ratios, the colder it becomes outside, the hotter the temperature of the system water. See "Outdoor Reset Concept" on page 6.
- With a 1.00 (OD):4.00 (SYS) ratio, the System water temperature (SYS) will increase rapidly as the outside temperature falls, hitting the maximum of 240°F (116°C) at 24°F (-4°C) outside temperature. With a 4.00 (OD):1.00 (SYS) ratio, the System water temperature (SYS) will increase slowly as the outside temperature falls. Even at -30°F (-34°C), the system water will only be 125°F (52°C), and at 24°F (-4°C) outside, the system water will be 112°F (44°C). Such a low Reset Ratio might be used with radiant floor heating applications.
- With most baseboard heating applications, a 1.00 (OD):1.00 (SYS) setting is a good place to start. With a 1.00 (OD):1.00 (SYS) 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 low in cold weather, move the ratio to a higher selection. That is, if 1.00 (OD):1.00 (SYS) was initially selected, change the selection to 1.00 (OD):1.25 (SYS). If the building temperatures are too warm in cold weather, move the ratio to a lower selection. That is, if 1.00 (OD):1.00 (SYS) was initially selected, change the selection to 1.25 (OD):1.00 (SYS).

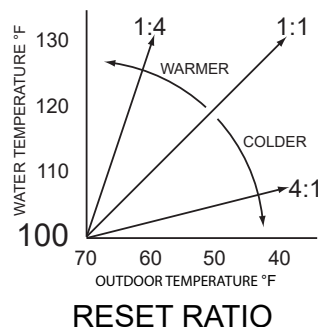


Figure 57. Reset Ratio Graph

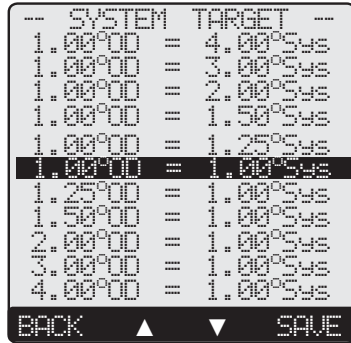


Figure 58. Reset Ratio Display

Offset

Adjustable from 50°F / 28°C to -50°F / -28°C (Default: 0°F / 0°C)

Button: MENU/System Target/Offset

- The Offset adjust the starting points of the Reset Ratio curve. This means that, regardless of the Outdoor temperature (OD) or the Reset Ratio that has been selected, when the Offset setting is changed, that change is directly added to or subtracted from the calculated temperature. For example, if the Setpoint was 130°F (54°C) and the Offset was changed from 0°F/C to 10°F (5.6°C), an increase of 10°F (5.6°C), then the Setpoint temperature would increase to 140°F (60°C).
- The Offset setting does not change the ratio selection. What the Offset does is add or subtract a constant temperature value. See "Outdoor Reset Concept" on page 6.
- If required: Adjust the Water Offset in mild weather. If the ambient building temperatures are too warm in mild weather, decrease the offset. If the ambient building temperatures are too cold in mild weather, increase the Water Offset.
- The rule of thumb for baseboard radiation is to change the offset 4°F (2.2°C) for every 1°F (0.6°C) you wish to change the building temperature. In radiant heat applications, change the offset 1°F or 2°F (0.6–1.1°C) for every 1°F (0.6°C) you wish to change the building temperature.

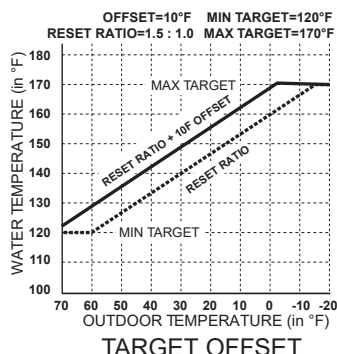


Figure 59. Target Offset



Figure 60. Offset

Outdoor Cutoff Temperature

Adjustable: Off, from 20°F / -7°C to 100°F / 38°C, On (Default: 65°F / 18°C)

Button: MENU/System Target/Offset/Outdoor Cutoff

- The control will turn heating off if the outside temperature rises above the Outdoor Cutoff. This setting shall not affect any indirect DHW requirement.
- The Outdoor Cutoff screen will automatically appear after setting the Offset.
- When the outdoor temperature falls to the adjustable Outdoor Cutoff temperature, the TempTracker mod+ Hybrid will operate the boilers to hold the calculated temperature.
- When the outdoor temperature rises to the Outdoor Cutoff plus a 2°F (0.6°C) differential, the TempTracker mod+ Hybrid will turn all boilers off. The System relay will remain energized for the Run-On delay then de-energize.
- The Outdoor Cutoff can be set from 20°F to 100°F (-7°C to 38°C). In addition, it can be set to ON or OFF. In the ON position, the System Relay will run regardless of the Outdoor temperature (OD) and the burner stages will be active to hold the calculated water temperature. (Note: The lowest water temperature the TempTracker mod+ Hybrid will circulate is 70°F (21°C). If the Outdoor Cutoff is turned ON and the Season is set to Winter, the TempTracker mod+ Hybrid will circulate at least 70°F (21°C) water even in the hottest of weather.) In the OFF position, the system pump will always be off and all burner stages will be off.



Figure 61. Outdoor Cutoff Temperature

Minimum Water Temp

Adjustable from 50°F/ 10°C to 180°F/ 82°C (Hybrid Default: 70°F/ 21°C) (Staging or Modulation Default: 120°F/ 49°C)

Button: MENU/System Target/Offset/Outdoor Cutoff/Minimum Water Temp

- The Minimum Water Temperature must be set to the boiler manufacturer's specification. The TempTracker mod+ Hybrid will calculate the Setpoint based on the Outdoor temperature (OD), the Reset Ratio, and the Offset value. The TempTracker mod+ Hybrid will control all boilers to hold either the Setpoint temperature, or the Minimum Water Temperature, whichever is higher.
- The Minimum Water Temperature must be at least 20°F (11°C) lower than the Maximum Temperature (see next setting).



Figure 62. Minimum Water Temp

Maximum Water Temp

Adjustable 70°F/ 21°C - 220°F/ 104°C (Default: 200°F/ 93°C)

Button: MENU/System Target/Offset/.../Maximum Water Temperature

- This is the highest temperature heating water the TempTracker mod+ Hybrid will circulate through the heating system.
- When using a radiation system, it should be set according to the tubing or floor manufacturer's specification.
- The Maximum Temperature must be at least 20°F (11°C) higher than the Minimum Temperature. (See previous setting).



Figure 63. Maximum Water Temp

System Settings

Button: MENU/<System Settings>

Settings 1 and Settings 2 menus provide access to adjusting and fine-tuning the system for enhanced comfort and better fuel savings. The TempTracker mod+ Hybrid behaves differently based on the selected modes. See "Startup Settings" on page 18.

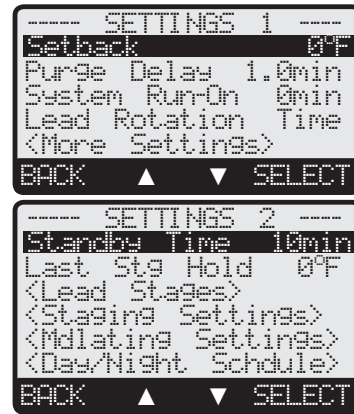


Figure 64. System Settings

NOTE: To be able to change the TempTracker mod+ Hybrid settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be secured using a lock.



Setback

Adjustable from 0°F/ 0°C to 75°F/ 42°C (Default: 10°F/ 6°C)

Button: MENU/<System Settings>/Setback

- The Setback feature can be used to provide the TempTracker mod+ Hybrid with a lower temperature Setpoint when less load is required.
- The lower Setpoint will appear on the main display indicating this condition.
- For example, if the calculated temperature is 180°F (82°C) and the Setback is 20°F (11°C), then when in Setback or Night Schedule, the TempTracker mod+ Hybrid will hold a Setpoint of 160°F = 180°F - 20°F (71°C = 82°C - 11°C). See "Day / Night Schedule" on page 36.
- A typical use for the Setback is to provide less system temperature to a building during the Night Schedule or on the weekends when people are asleep or when the building is not occupied, but heat is still needed.
- The amount of Setback selected is subtracted from the Setpoint when a Setback Input Signal is received or the Night Time schedule setting started.
- If Setback is selected as the Shutdown/Tstat/Setback Mode (See "Shutdown/Tstat/Setback Mode" on page 26.), the Setback will not be activated unless a Short dry-contact signal is received on terminals (31 and 32).
- If Shutdown or Tstat is selected as the Shutdown/Tstat/Setback Mode (See "Shutdown/Tstat/Setback Mode" on page 26.), the Setback will be activated only during the Night Schedule.



Figure 65. Setback

NOTE: When using Soft-Off and Last Stage Hold, the last boiler stage will not turn off until both parameters have elapsed. In this case, Soft-Off will start after the Last Stage Hold.

Purge Delay

Adjustable from 0.0 min to 10.0 min (Default: 1.0 min)

Button: MENU/<System Settings>/Purge Delay

- Many boilers go through a purge cycle before they are brought on line. When the TempTracker mod+ Hybrid activates a boiler, it does not start to calculate its output until the Purge Delay is over. This allows the boiler to fully come online and begin producing.
- The Purge Delay helps prevent short cycling of any newly activated burner. Once the burner is activated, it MUST run through the entire Purge Delay period.
- The minimum Purge Delay setting MUST be set to the time required by the boiler manufacturer. Time entry is in 0.1 of a minute (i.e. 1.5 minute will equal 90 seconds.)
- The Message Display Line will display Purge Delay and the remaining time.



Figure 66. Purge Delay

NOTE: Set Purge Delay as per boiler manufacturer recommendation.

System Run-On

Adjustable from 0 min to 360 min (Default: 10 min)

Button: MENU/<System Settings>/System run-On

- A common use for the System Run-On is to control a system pump in a heating system. The extra time helps transfer the boiler residual heat to the heating system.
- The System relay will energize whenever the outdoor temperature is below the Outdoor Cutoff and the Shutdown is Open or the Tstat is closed. When the Outdoor temperature rises 2°F (1.1°C) above the Outdoor Cutoff or the control is switched to Summer and after the last burner relay has de-energized, the System relay will remain energized for the System Run-On period.

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The System Run-On time should be set based on the size and type of the boilers and pumps used. In general, when setting the System Run-On consult the boiler and pump manufacturers for the best setting.

- When the System relay is in the Run-On period, the Message Display Line will indicate that status and the remaining time.



Figure 67. System Run-On

Lead Boiler Rotation

Adjustable Manual, Time (1 hr to 60 Days), Last-On (Default: Last-On)

Button: MENU/<System Settings>/Lead Rotation

- Last-On refers to whichever boiler was the last one to be activated in the previous firing cycle.
- The Lead Boiler is the first boiler brought on when an output is needed.
- The Lead Boiler can be rotated automatically every specified time period, manually, or based on Last-On. Time rotation is recommended.
- The Lead Group Lead Boiler is shown in bracket layers on the main display. The Lag Group lead Boiler is shown in a single bracket. See "Boiler Status" on page 40.
- Only boilers which are set to Auto Mode can be Lead. Therefore, not all the boilers may be available when manually selecting a new Lead Boiler.

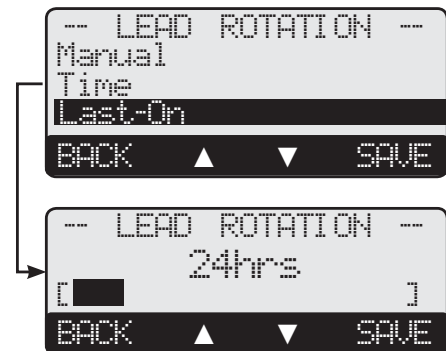


Figure 68. Lead Boiler Rotation

Standby Time

Adjustable from 1 min to 60 min (Default: 10 min)

Button: MENU/<System Settings>/<More Settings>/Standby Time

- Standby boilers are used for backup or extreme load conditions only. A Standby boiler can never be a Lead Boiler.
- The Standby Time only applies to boilers set to Standby.
- A boiler can be set to be a Standby boiler using the Stage Menu. See "Mode" on page 41.
- A Standby boiler can only be activated after all the boilers in Auto Mode have run at 100% modulation for the full Standby Time.
- The full Standby Time must always elapse regardless of what happens to the system temperature. Therefore, shorter Standby Times will result in smoother setpoint operation in extreme conditions. On the other hand, longer Standby Times may prevent a Standby boiler from firing if the other boilers can eventually meet the load, or if the load decreases.



Figure 69. Standby Time

Last Stage Hold

Adjustable from 0F°/ 0C° to 30F°/ 17C° (Default: 5F°/ 3C°)

Button: MENU/<System Settings>/<More Settings>/Last Stg Hold

- The Last Stage Hold prevents short cycling of the Lead Stage during low demand periods.
- In these conditions, the system might require less output than the lowest lead Stage. When the TempTracker mod+ Hybrid brings on the Lead Stage, the Setpoint is quickly exceeded, and the TempTracker mod+ Hybrid turns the Lead Stage off.
- To prolong the run time during this type of condition, use the Last Stage Hold setting to let the system temperature exceed the Setpoint by the number of degrees selected.
- For example, with a Setpoint of 160°F (71°C) and a Last Stage Hold setting of 10°F (6°C), the Lead Stage boiler will de-energize after the Setpoint exceeds 170°F (160°F + 10°F) [77°C = 71°C + 6°C].
- In many cases, it is better to overshoot slightly than to short cycle a boiler.

When Soft-Off is set to other than 0 seconds, the Lead Boiler will need to remain at or exceed the Last Stage Hold for the Soft-Off period before turning off.



Figure 70. Last Stage Hold

Lead Stages

Condensing Lead, Non-Condensing Lead (Default: 1st boiler in the Group)

Button: MENU/<System Settings>/<More Settings>/Lead Stages

- In addition to having a lead group, each group of boilers, Condensing Group and Non-Condensing Group, will have its own lead boiler that can be selected from this menu.
- After assigning the lead boiler for each group, the lead will rotate based on the Lead Rotation option selected. See "Lead Boiler Rotation" on page 33.
- The Lead Group Lead Boiler can be identified by the two brackets <<A>>.
- The Lag Group Lead Boiler can be identified by the one bracket <C>.



Figure 71. Lead Stages

Modulating Boiler Operating Settings

Gain

Adjustable from -10 to +10 (Default: 0)

Button: MENU/<System Settings>/<More Settings>/<Modulating Settings>/Gain

- The Gain adjusts the aggressiveness of the modulating PID logic. It controls how much modulation is changed when the system temperature is different from the Setpoint.
- A Gain of 0 is a good starting point for all systems.
- If during normal load conditions, the system temperature tends to oscillate significantly, decrease the Gain by two numbers (for example, from 0 to -2). Wait for at least 15 minutes before evaluating how the change has affected the system.
- If during normal load conditions the system temperature tends to remain consistently below the Setpoint (or consistently above the Setpoint), increase the Gain by two numbers (for example, from

0 to 2). Wait for at least 15 minutes before evaluating how the change has affected the system.

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Figure 72. Gain

Lag Delay

Adjustable from 0min to 60min Default: 0min

Button: MENU/<System Settings>/<More Settings>/<Modulating Settings>/Lag Delay

- The Lag Delay requires the lead stage to remain at 100% modulation for the full period of the Lag Delay before the lag stage can be activated. For example, if the Lag Delay was set to 10 minutes, the Lead Stage must remain at 100% modulation for the full ten minutes before the lag stage could be activated. The Message Display Line will display Lag Delay and the remaining time.
- The Lag Delay is useful in installations where one unit should usually have enough output to hold the load unless it fails or load conditions become extreme.
- The Lag Delay overrides the Modulation Start % selected for each stage. Regardless of that setting, the previous stage must reach and stay at 100% before the lag stage can be activated.
- The full Lag Delay must elapse regardless of what happens to the system temperature. Therefore, set the Lag Delay to 0 minutes to achieve smooth operation.
- Note that if Parallel was selected as the Modulation Mode (See "Modulating Logic Overview" on page 6), this value must be set to 0 minutes to avoid having the lead boiler going to 100% modulation prior to firing the lag boiler.



Figure 73. Lag Delay

Soft-Off Delay

Adjustable from 0sec to 60sec Default: 10 sec

Button: MENU/<System Settings>/<More Settings>/<Modulating Settings>/Soft-Off Delay

- When a boiler is no longer needed, the Soft-Off keeps that boiler in Low Fire prior to turning it off.
- The display will show a percent that is equal to the Ignition % for the stage in Soft-Off delay. That number will blink for the Soft-Off delay period.
- If during the Soft-Off delay period the TempTracker mod+ Hybrid needed that stage to turn back on, the stage will be released from the Soft-Off delay and resume normal operation.
- On a Shutdown initiation or Tstat termination any stage that was On will go into Soft-Off delay before fully turning off.



Figure 74. Soft-Off Delay

Staging Boiler Operating Settings

Reaction Time

Adjustable from 1 to 10 minutes (Default: 2 minutes)

Button: MENU/<System Settings>/<More Settings>/<Stage Settings>/Reaction Time

- It is the amount of time it takes a single stage to affect the system.
- After the control turns on a stage trying to meet the setpoint, it will not turn on another stage until the Reaction Time has elapsed.
- To determine the optimum time, start with a hot system. Then, turn on a single stage and calculate how long it takes until the system temperature begins to respond to that stage. That period should be set as the Reaction Time.



Figure 75. Reaction Time Settings

Day / Night Schedule

(Available when "Shutdown or Tstat" is selected from the Shutdown/Tstat/ Setback Startup menu option only)

Button: MENU/<System Settings>/<More Settings>/Day/Night Schedule

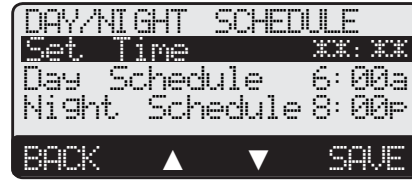


Figure 77. Day / Night Schedule

- The TempTracker mod+ Hybrid has two levels of heat. The Day (Normal) level is used when a building is occupied and people are active.

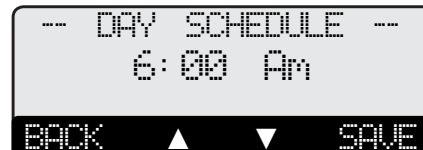


Figure 78. Day Schedule

- The Night (Setback) level is used when a building is not occupied, or when people are sleeping. This setting reduces the calculated temperature by the Setback setting. See "Setback" on page 30. If the Day calculated water temperature was 150°F (66°C) and the Setback was 20°F (11°C), the Night Schedule will run at (150°F - 20°F) = 130°F [(66°C - 11°C) = 55°C].
- If the Boost feature is being used, it uses the Day Schedule as the Boost ending point. See "Boost Mode" on page 27. That is, if the Day Schedule is set to start at 6:00AM, the Boost will start 30 minutes prior to the Day setting at 5:30AM. The TempTracker mod+ Hybrid will then raise the calculated water temperature by the Setback amount. Using the previous example, at 5:30AM the TempTracker mod+ Hybrid will raise the calculated water to 170°F = (150°F + 20°F) [77°C = (66°F + 11°F) until 6:00AM.

Minimum Runtime

Adjustable from 1 to 60 minutes (Default: 2 minutes)

Button: MENU/<System Settings>/<More Settings>/<Stage Settings>/Min Runtime

- This is the minimum amount of time any stage will run.
- For the lowest stage of a unit, the Minimum Runtime starts after the purge cycle.
- The Runtime does not apply to the last stage online. The Last Stage Hold applies in that case.
- Initially, set the Minimum Runtime to half the Reaction Time.
- If the system tends to overshoot, reduce the Minimum Runtime. However, if boilers tend to short cycle, increase the Minimum Runtime.



Figure 76. Minimum Runtime

Avoiding Conflicting Boiler Limits

The temperature limits set on the boilers MUST be set considerably higher than the TempTracker mod+ Hybrid's Setpoint for the reasons detailed below.

- The TempTracker mod+ Hybrid sensor is located in a common header some distance from the boilers.
- As the temperature rises in the header and before reaching the sensor location, energy is dissipated. Therefore, the temperature in the header could be lower than that registered by boiler sensors.
- In addition to the normal drop experienced between the boiler's temperature and that read by the TempTracker mod+ Hybrid sensor, the Last Stage Hold setting must be accounted for. The boiler limit must be set above the Setpoint PLUS the Last Stage Hold PLUS the normal drop experienced in the piping.
- Using the previous example of a 10°F (6°C) Last Stage Hold with a 160°F (71°C) Setpoint, the boilers' limits must be set enough over 170°F (77°C) to prevent the boilers' internal limits being reached. In this situation, the boiler high limit should be set higher than 180°F (82°C) to prevent erratic operation.

⚠ WARNING: The temperature limits set on the boilers must be higher than the TempTracker mod+ Hybrid Max Water Temp. Read the left section for details that will prevent erratic system operation.

Set Time

Button: MENU/<System Settings>/<More Settings>/Set Time

- Adjust the time by selecting Set Time from the menu and then scrolling through the hours then select Save. If the hours are to be set to PM, scroll through the AM hours to reach the PM hours. Then, scroll through the minutes then select Save.



Figure 79. Set Time

NOTE: Remember that the battery is the backup for the Time. If no power is supplied to the TempTracker mod+ Hybrid and there was no battery or the battery had no power, time values will be lost and will need to be reset.

Maintenance

Button: MENU/<Maintenance>

The Maintenance menu gives access to sensor and modulating output trimming. In addition, you'll have access to view the Startup configuration settings.



Figure 80. Maintenance

NOTE: To be able to change the TempTracker mod+ Hybrid settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be secured using a lock.



System & Outdoor Sensor Trim

Adjustable from -5F°/ -3C° to +5F°/ +3C° (Default: 0°F/C)

Button: MENU/<Maintenance>/System Trim

Button: MENU/<Maintenance>/Outdoor Trim

- The Raypak thermistor type sensors are very accurate, and normally require no calibration. Sometimes it may be desirable to make small adjustments to the displayed value for either the Outdoor temperature (OD) or the System temperature (SYS). The Trim setting is used to adjust the displayed value.



Figure 81. System Sensor Trim

- Do not use the Trim setting to make the Outdoor temperature sensor match that reported on the radio or TV. Outdoor temperature can vary widely over a broadcast range. Only trim the outdoor sensor based on an accurate thermometer reading taken where the sensor is located.



Figure 82. Outdoor Sensor Trim

Output Modulation Trim

(Available for modulating boilers only)

Adjustable from -1.0 to +1.0 (Default: 0.0)

Button: MENU/<Maintenance>/Output Trim

- Each of the modulating stages controlled has a separate Output Trim setting.
- Output Trim acts as an adjustment to a stage output percent to match the burner motor.
- After adjusting the Output Trim, test the operation to make sure the results match your expectation.



Figure 83. Output Modulation Trim

NOTE: DO NOT use the Output Trim for a Stage unless it is absolutely necessary. Test burner operation and modulation output matching after adjusting the Output Trim.

Configuration

Button: MENU/<Maintenance>/<Configuration>

- This menu option provides a consolidated view of the TempTracker mod+ Hybrid's Startup and Stage settings.

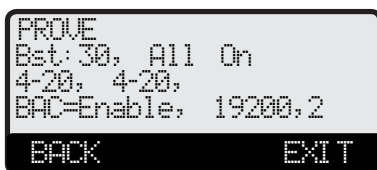


Figure 84. Configuration

Display

The TempTracker mod+ Hybrid display layout provides a variety of information that gives an immediate picture of the operation status. The display shows two boilers at a time. When extensions are present, the two middle buttons (◀ ▶) scroll the screen to view additional boilers. Moreover, all the information displayed can be viewed in brightly or dimly lit rooms.

The buttons' functionality changes based on the screen and menu level. The buttons' functionality is displayed on a dark background on the screen bottom line.

(◀ ▶) Horizontal arrows are to scroll through the available stages.

(▲ ▼) Vertical arrows are to scroll through the menu functions when in menus or to change settings when in a setting screen.

- The Top line displays the Outdoor and System sensor values.
- The second line displays all messages pertaining to the operation or status. See "Display Messages" on page 39.
- The third line will list the boiler stages. Additional stages can be scrolled to using the two middle buttons. The lead boiler letter will be bracketed. See "Lead Boiler Rotation" on page 33. The lead boiler in the lead group will have two sets of brackets.
- The fourth line lists each boiler modulation or sequencing status. See "Boiler Status" on page 40.

APPROVED



Outdoor and System
Temperature
Messages
} Boilers and
} Their Status
Button Functions



Buttons

Figure 85. Display Layout

Display Messages

The TempTracker mod+ Hybrid display layout reserved the second line for message indications. The following is a list of the most common Message Display Line information:

Message Display	Message Information
Boost To 170°F (77°C)	The Boost has started 30 minutes before the Day Schedule setting and the Boost temperature is 170°F (77°C). See "Boost Mode" on page 27.
DHW Call (180°F / 82°C)	There is an indirect DHW call. The TempTracker mod+ Hybrid will raise the system Setpoint to the indicated temperature. DHW increases calculated temperature to the DHW Setpoint. See "Indirect Domestic Hot Water Setpoint" on page 26.
Holding Until 150°F (66°C)	The Lead boiler is in Last Stage Hold. This example shows that the lead stage will turn off when system temperature reaches 150°F (66°C). See "Last Stage Hold" on page 34.
Interface Module Error	There is no communication to the BACnet Module Interface while the BACnet Mode is set to Enable. See "BACnet Mode" on page 45.
Lag Delay: 123	The lead boiler is at 100% and the remaining purge time to start the lag boiler in seconds is 123. See "Lag Delay" on page 35.
Outdoor Cutoff	The outdoor temperature is above the Outdoor Cutoff setting. No boilers will be active for heating. See "Outdoor Cutoff Temperature" on page 31.
Prove Failure	After boilers have run for some time, Prove signal has ended. All boilers set to Auto or Standby will de-energize. However, the System relay will remain energized. See "Prove/Indirect Domestic Hot Water (DHW) Priority" on page 26 and "Wiring the Prove" on page 14.
Purge Delay: 23	A boiler is in purge cycle and the remaining purge time in seconds is 23. See "Purge Delay" on page 33.
Setback to: 130°F (54°C)	The Night Schedule or Setback input is active. Current Setback temperature is 130°F (54°C). See "Setback" on page 32. See "Day / Night Schedule" on page 36.
Shutdown Active	The Shutdown Terminals are Shorted. No boilers will be active. See "Shutdown/Tstat/Setback Mode" on page 26. Also see "Wiring the Shutdown, Tstat, or Setback" on page 13.
Summer	The control is set to Summer. No heat is active. See "Season" on page 30.
Switch in: 00:30	The switch from one group to the other will take place after 30 minutes. See "Switch Delay" on page 22.
System Run-On: 46	The System relay is ON for the System Run-On Delay. This example shows that it will remain in System Run-On for an additional 46 seconds before turning off. See "System Run-On" on page 33.
Tstat Call	The Tstat Terminals are Shorted. Boilers will be active. See "Shutdown/Tstat/Setback Mode" on page 26.
Waiting for Prove	The System relay is ON and the prove terminals are open before the lead boiler relay can energize. See "Prove/Indirect Domestic Hot Water (DHW) Priority" on page 26.

Figure 86. Display Messages

16. BOILER STAGE MENU

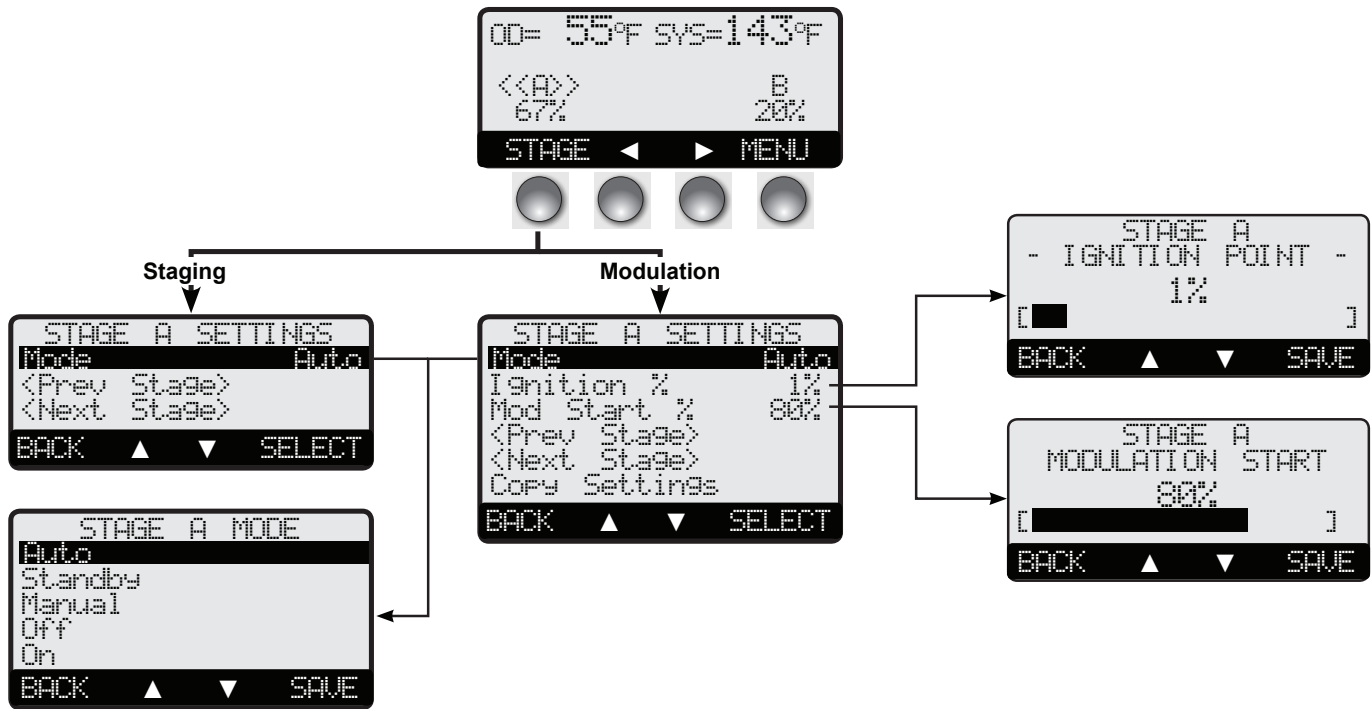


Figure 87. Boiler Stage Menu

Boiler Status

The TempTracker mod+ Hybrid boiler status gives immediate access to each boiler stages or modulation.

- --- Boiler is off due to no call for heat.
- <<A>> A is the lead boiler in the lead Hybrid group. See "Lead Stages" on page 34.
- <C> C is the lead boiler in the lag Hybrid group or the lead boiler in Staging or Modulating Boiler Type. See "Lead Stages" on page 34.
- C/E Extension panel is NOT communicating back to the TempTracker mod+ Hybrid. See "Connecting to the Extensions and 4-20mA EMS Interface" on page 16.
- mON All boiler stages are set to ON.
- mOFF All boiler stages are set to OFF.

Display Modulating Boiler Status

- 97% Boiler is modulating at the indicated percentage.
- m95% Boiler Stage Mode is set to Manual Modulation to the specified percent. See "Mode" on page 38.
- h50% Boiler is in post purge for 30 seconds.

Display Staging Boiler Status

- High Boiler highest firing stage is active. The boiler Mode is set to either Auto or Standby.
- Med Boiler Middle stage on a 3-stage boiler is active. The boiler Mode is set to either Auto or Standby.
- Mhigh Boiler Middle stage on a 3-stage boiler is active. The boiler Mode is set to either Auto or Standby.
- Mlow Boiler Middle Low stage on a 4-stage boiler is active. The boiler Mode is set to either Auto or Standby.
- Low Boiler lowest firing stage is active. The boiler Mode is set to either Auto or Standby.

Table B. Boiler and Display Status

Boiler Stage Settings

Button: STAGE/

The Stage menu provides adjustment for each of the individually boiler operations.

- In most installations, all active boiler adjustments are the same, but each can be configured differently if desired.
- If the boilers are not set up properly, the TempTracker mod+ Hybrid operation may appear to be erratic.
- When the STAGE button is depressed, the Boiler A settings menu will be shown.
- Make all the appropriate settings for Boiler A (See below).
- After completing all the settings for Boiler A (See below), you have the option of copying these settings to all other modulating boilers. Everything but the Mode -- Auto/Standby/ Manual/Off/On -- will be copied.

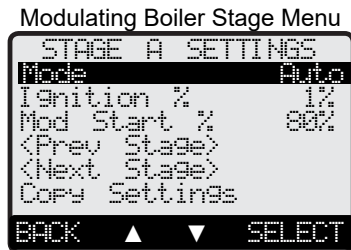


Figure 88. First Boiler

- Then select the <Next Stage> option from the menu to reach the Boiler B settings menu. Continue until all boilers have been set.

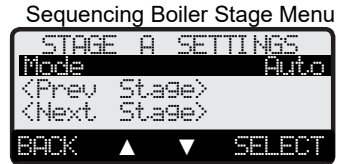


Figure 89. Setting Next

- If an Extension is connected to the TempTracker mod+ Hybrid and the stages have been set through the Startup menu, then scrolling through stages using the <Next Stage> and <Prev Stage> menu options will scroll through the Extension stages as well.

NOTE: To change the TempTracker mod+ Hybrid settings, the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be secured using a lock.

PROGRAM ☐ RUN

Mode

Auto, Standby, Manual, Off, On (Default: Auto)

Button: STAGE/Mode



Figure 90. Mode

- The TempTracker mod+ Hybrid only controls the modulation of boilers set to Auto or (after a delay) those set to Standby. None of the other settings is recommended for outputs connected to active boilers.
- Any stage without an active boiler or stage connected must be set to Off.
- **Table D** describes the MODE options:

Mode Option List	
Auto	The TempTracker mod+ Hybrid will control the boiler's operation to maintain the desired Setpoint. Only boilers set to Auto can be Lead boilers.
Standby	Standby boilers can only be activated when all boilers in Auto have been at 100% modulation or at High fire for the full Standby Time. Standby is generally used when you want a specific boiler to be available in extreme load conditions. Note that a Standby boiler Cannot be a Lead boiler.
Manual	Available For modulating boilers only. The Manual Mode should only be used when testing a boiler. Manual overrides the Prove input. For modulating boilers, the exact percent of modulation for a boiler can be set with the Manual mode. Once selected, the unit will immediately turn on and modulate to the selected percentage. See "Boiler Status" on page 40.
Off	Any stage output not connected to a physical stage should be set to Off. The Off Mode can also be used to disable units that are being serviced.
On	This mode should only be used when testing a boiler. This mode overrides the PROVE input, Season setting, Shutdown or Tstat status, and Sensor Fault status. Once set to On the boiler will immediately start firing at its highest rate.

(Modulating Boilers Only)

0-10VDC Adjustable from 1% to 50% (Default: 1%)

1-10VDC Custom Adjustable from 5% to 70% (Default: 25%)

Button: STAGE/Ignition %

- The Ignition % of a boiler is the lowest percent of modulation that boiler can achieve. That is for the 4-20mA and 0-10VDC if the Ignition % was set to 20%, the 0-10VDC terminals will output 2VDC. The 4-20mA terminals will output 7.2mA.
- The 1-10V custom boiler types will use the Ignition % when the boiler is activated. In this case, the Ignition % will be the level at which the control will output 1VDC.
- During the Soft-Off Delay, the boiler will remain at the Ignition % before turning Off.



Figure 91. Ignition %

Modulation Start %

(Modulating Boilers Only)

Adjustable from 0% to 100% (Default: 80%)

Button: STAGE/Mod Start %

- The Modulation Start determines at what modulation percent the previous boiler (lead boiler) should be for the lag boiler to be activated.
- For example, if the Modulation Start for Boiler B is set to 50%, then when Boiler A reaches 75% modulation (50% Mod Start % + 25% Ignition % = 75%), Boiler B will be brought on.
- When modulation is decreasing, the lag unit will remain on at the Ignition % modulation until the previous boiler reaches 40% of lag boiler's Modulation Start, or 2% above the Ignition Point, whichever is higher.
- Using the same example, as the load decreases, Boiler B will modulate down to its Ignition %. Boiler A will then modulate down to 30% (75% x 40%). Only then will Boiler B turn off.
- If the Lag Delay is set to anything other than 0, the lead boiler must reach 100% modulation before the lag boiler is activated. However, the Modulation Start % should still be set correctly, because it will be valid when modulation is decreasing. See "Lag Delay" on page 35.
- Raypak suggests that when Parallel is selected as the Modulation Mode to set the Modulation percent equal to or slightly higher than double the Ignition %. This way, the lag boiler will only start if the load is large enough for two

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boilers to run at the lowest modulation. See "Modulating Logic Overview" on page 6.



Figure 92. Modulation Start %

Copy Settings - Boiler A Only

(Modulating Boilers Only)

Button: STAGE/Copy Settings

- If all the active modulating boilers are to be set to the same Ignition % and Modulation %, they can be set for Boiler A and then copied to the other modulating boilers.
- It is still required to select the Mode for all other boilers as the Mode is NOT copied.



Figure 93. Copy Settings - Boiler A Only

NOTE: The Mode **MUST** be set for each boiler. The Copy Settings command will not set the Mode for the remaining boilers. Only Ignition % and Modulation Start % are copied.

17. TROUBLESHOOTING

Sensor Inputs

Temperature		Value (Ohms)
°F	°C	
OPEN		150000
-30	-34	117720
-20	-29	82823
-10	-23	59076
0	-18	42683
10	-12	31215
20	-7	23089
25	-4	19939
30	-1	17264
35	2	14985
40	4	13040
45	7	11374
50	10	9944
55	13	8714
60	16	7653
70	21	5941
80	27	4649
90	32	3667

Temperature		Value (Ohms)
°F	°C	
100	38	2914
110	43	2332
120	49	1879
130	54	1524
140	60	1243
150	66	1021
160	71	842
170	77	699
180	82	583
190	88	489
200	93	412
210	99	349
220	104	297
230	110	253
240	116	217
250	121	187
SHORT		100

Table C. Sensor Temp/Ohm

Display shows Sensor OPEN or SHORT

When the display shows sensor OPEN, short the control sensor input terminals. The display should change to read SHORT. This indicates that the sensor wires are not continuous. If the display does not SHORT, the TempTracker mod+ Hybrid may be damaged.

When the display shows sensor SHORT, remove the wires from the sensor terminals. The display should change to read OPEN. In this case, replace the sensor. Otherwise, if the display does not show OPEN, the TempTracker mod+ Hybrid may be damaged.

Display shows an Incorrect Temperature

Remove the wires from the sensor terminals. The display should change to read OPEN. If it does not, the TempTracker mod+ Hybrid may be damaged. Take an ohm reading across the detached sensor wires. The ohm reading should correspond to the Temperature Sensor Chart. If it does not, the sensor may be damaged.

Control Operation

No Heat

- **Season** - Make sure that the Season is set to Winter. See "Season" on page 30 and "Display Messages" on page 39.
- **Prove** - Even though, the system relay may be energized, the TempTracker mod+ Hybrid will not energize and stage relays unless the Prove is shorted. See "Display Messages" on page 39 and "Wiring the Prove" on page 14.
- **Shutdown** - The TempTracker mod+ Hybrid will deactivate stage outputs when the Shutdown terminals are shorted. See "Display Messages" on page 39 and "Wiring the Shutdown, Tstat, or Setback" on page 13.
- **Tstat** - The TempTracker mod+ Hybrid will deactivate stage outputs when the Tstat terminals are open. See "Display Messages" on page 39 and "Wiring the Shutdown, Tstat, or Setback" on page 13.
- **Sensor Fault** - When the Sensor Fault is set to All Off in the startup menu, the System sensor fault (in all Sensor Type modes) or the Outdoor sensor fault (in Reset mode) will de-energize all stage relays. See "Display Messages" on page 39 and "Sensor Fault" on page 27.
- **System or Outdoor Sensor** - If the System or Outdoor sensor reading was higher than the actual temperature, the TempTracker mod+ Hybrid might not bring any stage on. Check "Display shows an Incorrect Temperature" on page 43.
- **Outdoor Cutoff** - If the Outdoor cutoff was set too low, the building might be allowed to cool more than is desired. A comfortable setting is between 60°F to 65°F. See "Outdoor Cutoff Temperature" on page 31.

Too Much Heat

- **Indirect Domestic Hot Water call** - The TempTracker mod+ Hybrid will raise the temperature of the system to the DHW Setpoint on a DHW call, connected to terminals 29 and 30. Check to see if there is a call for DHW and the length of time it lasts.
- **Reset Ratio and Offset** - If excessive heat occurs only in certain weather conditions, adjust the Reset Ratio and Offset. See "Outdoor Reset Concept" on page 6. If excessive heat occurs year round, reduce the Offset.
- **Boiler Mode Settings** - The TempTracker mod+ Hybrid will only controls boilers their mode is set to Auto or Standby. Check if any boiler stage is set to Manual or On. See "Mode" on page 41.

- Control Settings - The Last Stage Hold will allow only the Lead boiler to stay on for an additional number of degrees. If the setting is too high, and only the Lead boiler is on, the system can over heat. Reduce the Last Stage Hold setting. See "Last Stage Hold" on page 34.

Too Little Heat

- Reset Ratio and Offset - If reduced heat occurs only in certain weather conditions, adjust the Reset Ratio and Offset (See "Outdoor Reset Concept" on page 6). If reduced heat occurs year round, increase the Offset.
- Setback and Day/Night Schedule - If reduced heat occurs only during specific hours, check the Day/Night Schedule and the Setback values. Then, reduce the Setback setting. See "Setback" on page 32.
- Boiler Mode Settings - The TempTracker mod+ Hybrid will only control boilers their mode is set to Auto or Standby. Check if any boiler stage is set to Manual, Off, or Standby. See "Mode" on page 41.

Boilers are Short-Cycling

- Lag Delay - Increase the Lag Delay only if modulating boilers tend to short-cycle.
- Minimum Runtime - Increase the Minimum Runtime only if staging boilers tend to short-cycle.
- Last Stage Hold - Increase the Last Stage Hold only if the lead boiler tends to short-cycle.

System is Overshooting or Undershooting

Modulating Boilers

- Gain - If when using modulating boilers the system is overshooting reduce the Gain. See "Gain" on page 34.
- Gain - If when using modulating boilers the system is undershooting increase the Gain.

Staging Boilers

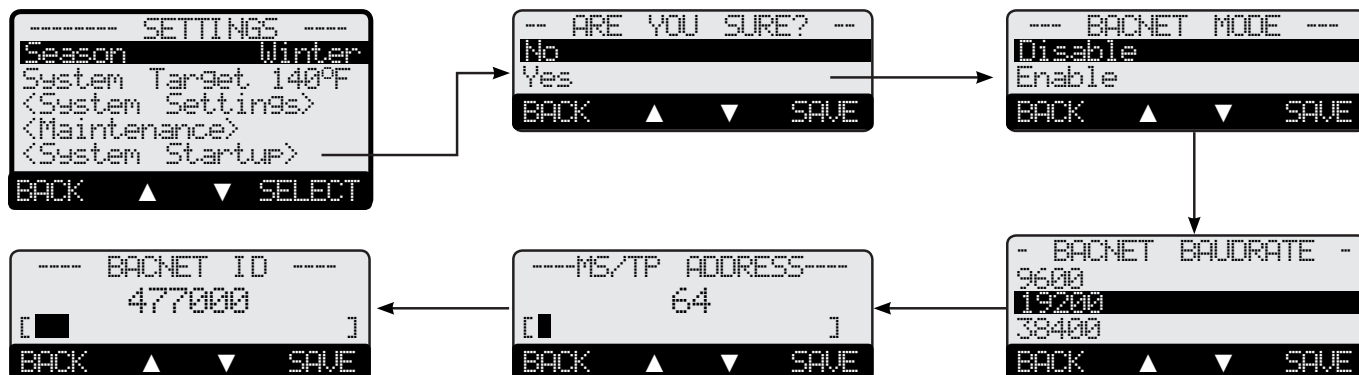
- Reaction Time - If when using staging boilers the system is overshooting increase the Reaction Time. As the stages will be turning on faster than they are affecting the system. If the system was undershooting for long periods, reduce the Reaction Time. See "Reaction Time" on page 35.
- Minimum Runtime - If when using staging boilers the system is overshooting reduce the Minimum Run Time. If the system was undershooting, increase the reaction time as it is turning off stages quicker than needed. See "Minimum Runtime" on page 36.

18. BACNET MSTP STARTUP MENU

When using the TempTracker mod+ Hybrid in a BACnet MS/TP network, the use of BACnet Interface Module is

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required (#651735). In addition, each of the Boiler Type and Sensor Type Startup menu option will offer a different list of BACnet variables. See "Boiler Type" on page 19, "Sensor Type" on page 19, and "Hybrid - Outdoor Reset - BACnet Variable List" on page 47.



BACnet Mode

Enable, Disable (Default: Disable)

Button: MENU/<System Startup>/... Sensor Fault/ BACnet Mode

- This menu option enables or disables the BACnet MSTP capability. When enabled, additional BACnet settings shall be available for further customizing.
- Note that if this option was enabled while no BACnet communication is present, the BACnet error message will supersede other messages. See "Display Messages" on page 39.

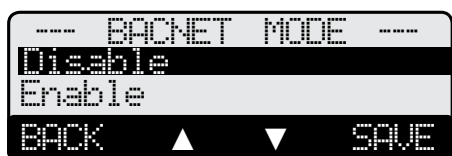


Figure 94. BACnet Mode

MS/TP Address

1 to 127 (Default: 64)

Button: MENU/<System Startup>/... /BACnet Mode/ BACnet Baudrate/ MSTP Address

- Each device on the MS/TP network must have a unique address.
- This is the MS/TP address on a RS485 network. Its MS/TP range is 1 though 127.
- The MS/TP address must be provided by the Network Administrator.



Figure 96. MS/TP Address

BACnet Baud Rate

9600, 19200, 38400 (Default: 19200)

Button: MENU/<System Startup>/... Sensor Fault/ BACnet Mode/BACnet Baudrate

- For the control to communicate over a BACnet MS/TP network, it must use the same Baud rate as the rest of the network. The control offers three Baud Rates.
- If communication was not successful, the baud rate could be the cause. Check with the network administrator for the network baud rate. Then match it on the control.



Figure 95. BACnet Baud Rate

BACnet ID

1 to 4,000,000 (Default: 477,000)

Button: MENU/<System Startup>/... / MSTP Address / BACnet ID

- The BACnet ID is a unique 32 bit number that identifies the control within the BACnet network. No two ID shall be the same even if dealing across networks.
- It must be provided by the BACnet Network Administrator.



Figure 97. BACnet ID

19. BACNET PICS STATEMENT

Product	Model Number	Protocol Revision	Software Version	Firmware Version
TempTracker mod+ Hybrid BACnet Control	Varies	1.5	2.0	2.0

Vendor	Vendor ID	Address and Phone
Raypak, Inc.	477	2151 Eastman Ave., Oxnard, CA 93030 - (805)278-5300

Product Description

TempTracker mod+ Hybrid control for hot water heating applications. (See <http://www.raypak.com> for more information)

BACnet Standardized Device Profile (Annex L)

Product	Device Profile
TempTracker mod+ Hybrid BACnet Control	BACnet Application Specific Controller (B-ASC)

Supported BIBBs (Annex K)

Supported BIBBs	BIBB Name
DS-RP-B	Data Sharing-ReadProperty-B
DS-WP-B	Data Sharing-WriteProperty-B
DM-DDB-B	Device Management-Dynamic Device Binding-B
DM-DOB-B	Device Management-Dynamic Object Binding-B
DM-DCC-B	Device Management-DeviceCommunicationControl-B

Standard Object Types Supported

Object Type	Creatable	Deletable
Analog Value	No	No
Binary Value		
Multi-State Value		
Device		

Data Link Layer Options (Annex J)

Product	Data Link	Options
TempTracker mod+ Hybrid BACnet Control	BACnet MS/TP	Baud Rates: 9600, 19200, 38400

Segmentation Capability

Segmentation Type	Supported	Window Size (MS/TP product limited to 1)
Able to transmit segmented messages	No	
Able to receive segmented messages		

Device Address Binding

Product	Static Binding Supported
TempTracker mod+ Hybrid BACnet Control	No

Character Sets

Product	Character Sets supported
TempTracker mod+ Hybrid BACnet Control	ANSI X3.4

20. HYBRID - OUTDOOR RESET - BACNET VARIABLE LIST

Hybrid Reset	Object ID	Object Type	Object Value	Object Name	Units	Value		Definition
						Min	Max	
Model	Device Object			MODEL				
Serial Number				SNUMBER				
Version				VERSION				
Operation Mode	100	MULTISTATE-VALUE		OPMODE		2	7	2=Modulation Reset, 3= Staging Reset, 4=Hybrid Reset, 5=Modulation Setpoint, 6=Staging Setpoint, 7=Hybrid EMS
Outdoor Temperature	200	ANALOG-VALUE	READ ONLY	ODTEMP	Degree F			32000=OPEN,3201=SHORT
System Temperature	300			SYSSSEN				
Output Status	400			OPTSTAT		0	0x1FFFF	Each Bit represents one of the possible 16 relays. Bit 0 represents Relay1, Bit 16 represents Relay16. 0 = Relay OFF, 1 = Relay ON
Control Status	500	MULTISTATE-VALUE		CSTAT			14	1=SHUTDOWN, 2=NO TSTAT CALL, 3=PROVE FAILURE, 4=SHUTDOWN BY EMS, 5=WAITING FOR PROVE, 6=SENSOR FAULT, 7=LAST STAGE HOLD, 8=DHW CALL, 9=SUMMER, 10=BOOST MODE, 11=SYSTEM RUNON, 12=SETBACK MODE, 13=OUTDOOR CUTOFF, 14=NORMAL
Season	600			SEA		1	2	1= Winter, 2= Summer
Reset Ratio	700			RR			11	1 =1.00 OD = 4.00 Sys, 2 =1.00 OD = 3.00 Sys, 3 =1.00 OD = 2.00 Sys, 4 =1.00 OD = 1.50 Sys, 5 =1.00 OD = 1.25 Sys, 6 =1.00 OD = 1.00 Sys, 7 =1.25 OD = 1.00 Sys,8 =1.50 OD = 1.00 Sys, 9 =2.00 OD = 1.00 Sys, 10 =3.00 OD = 1.00 Sys, 11 = 4.00 OD = 1.00 Sys
Offset	800	ANALOG-VALUE	READ/ WRITE	OFF		-50	50	Integer Values Only (-1.0,1.2...)
Outdoor Cutoff	900			CO		19	101	Integer Values Only (19,20,21...)
Min Water Temp	1000			MINW	Degree F	50	180	Integer Values Only (50,51,52...)
Max Water Temp	1100			MAXW		70	220	Integer Values Only (70,71,72...)
Setback	1200			SB		0	75	Integer Values Only (0,1,2...)
Purge Delay	1300			PDLY	Minutes	0.1	10	.1 thru .9 after Integer Values Only (1,2,3...)
System Runon	1400			RUNON	Minutes	0	360	Integer Values Only (0,1,2...)
Rotation Time	1500			RTTIME	Hours		1440	Hours since last rotation Integer Values Only (1,2,3...)
Standby Time	1600			STBYDLY	Minutes	1	60	Integer Values Only (1,2,3...)
Last Stage Hold	1700			LSTHOLD	Degree F	0	30	Integer Values Only (0,1,2...)
Con Lead Stage	1800	MULTISTATE-VALUE		CLEAD		1	16	Represent the current lead boiler for the condensing group
Non-Con Lead Stage	1900			NCLEAD			16	Represent the current lead boiler for the non-condensing group

Hybrid - Outdoor Reset - BACnet Variable List (continued)

APPROVED

Hybrid Reset	Object ID	Object Type	Object Value	Object Name	Units	Value		Definition	
						Min	Max		
Reaction Time	2000	ANALOG-VALUE	READ/ WRITE	RETIME	Minutes	1	10	Integer Values Only (1,2,3,...)	
Min Run Time	2100			MINRUN			60		
Gain	2200	GAIN		1		10			
Lag Delay	2300	LAGDLY		Minutes	0	60	Integer Values Only (0,1,2,...)		
Soft off	2400	SOFF	Seconds	Integer Values Only (0,1,2,...)					
Set Time	2500	ANALOG-VALUE	READ/ WRITE	PTIME	Minutes	1	1440	Time since midnight Integer Values Only (1,2,3,...)	
Day Schedule	2600			DSCHED				Minutes	Time since midnight Integer Values Only (1,2,3,...)
Night Schedule	2700			NSCHED				Minutes	Time since midnight Integer Values Only (1,2,3,...)
Calculated Target	2800			TARG	Degree F				
System Relay	2900	BINARY-VALUE	READ ONLY	SYSRLY		False	True		
Modulation Output A	3000	MODA		Percent	0	100			
Modulation Output B	3100	MODB							
Modulation Output C	3200	MODC							
Modulation Output D	3300	MODD							
Modulation Output E	3400	MODE							
Modulation Output F	3500	MODF							
Modulation Output G	3600	MODG							
Modulation Output H	3700	MODH							
Modulation Output I	3800	MODI							
Modulation Output J	3900	MODJ							
Modulation Output K	4000	MODK							
Modulation Output L	4100	MODL							
Modulation Output M	4200	MODM							
Modulation Output N	4300	MODN							
Modulation Output O	4400	MODO							
Modulation Output P	4500	MODP							

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21. MODULATION - OUTDOOR RESET - BACNET VARIABLE LIST

Modulation Reset		Object ID	Object Type	Object Value	Object Name	Units	Value		Definition	
							Min	Max		
Model	Device Object				MODEL					
Serial Number				SNUMBER						
Version				VERSION						
Operation Mode		100	MULTISTATE-VALUE		OPMODE		2	7	2=Modulation Reset, 3= Staging Reset, 4=Hybrid Reset, 5=Modulation Setpoint, 6=Staging Setpoint, 7=Hybrid EMS	
Outdoor Temperature		200	ANALOG-VALUE	READ ONLY	ODTEMP	Degree F			32000=OPEN,3201=SHORT	
System Temperature		300			SYSSEN					32000=OPEN,3201=SHORT
Output Status		400			OPTSTAT		0	0x1FFFF		Each Bit represents one of the possible 16 relays. Bit 0 represents Relay1, Bit 16 represents Relay16. 0 = Relay OFF, 1 = Relay ON
Control Status		500	MULTISTATE-VALUE		CSTAT			14	"1=SHUTDOWN, 2=NO TSTAT CALL, 3=PROVE FAILURE, 4=SHUTDOWN BY EMS, 5=WAITING FOR PROVE, 6=SENSOR FAULT, 7=LAST STAGE HOLD, 8=DHW CALL, 9=SUMMER, 10=BOOST MODE, 11=SYSTEM RUNON, 12=SETBACK MODE, 13=OUTDOOR CUTOFF, 14=NORMAL"	
		600			SEA		1	2	1= Winter, 2= Summer	
		700			RR			11	"1 =1.00 OD = 4.00 Sys, 2 =1.00 OD = 3.00 Sys, 3 =1.00 OD = 2.00 Sys, 4 =1.00 OD = 1.50 Sys, 5 =1.00 OD = 1.25 Sys, 6 =1.00 OD = 1.00 Sys, 7 =1.25 OD = 1.00 Sys,8 =1.50 OD = 1.00 Sys, 9 =2.00 OD = 1.00 Sys, 10 =3.00 OD = 1.00 Sys, 11 = 4.00 OD = 1.00 Sys"	
Offset		800	ANALOG-VALUE	READ/ WRITE	OFF		-50	50	Integer Values Only (-1,0,1,2...)	
Outdoor Cutoff		900			CO		19	101	Integer Values Only (19,20,21...)	
Min Water Temp		1000			MINW	Degree F	50	180	Integer Values Only (50,51,52...)	
Max Water Temp		1100			MAXW		70	220	Integer Values Only (70,71,72...)	
Setback		1200			SB		0	75	Integer Values Only (0,1,2...)	
Purge Delay		1300			PDLY	Minutes	0.1	10	.1 thru .9 after Integer Values Only (1,2,3...)	
System Runon		1400			RUNON		0	360	Integer Values Only (0,1,2...)	
Rotation Time		1500			RTTIME	Hours	1	1440	Hours since last rotation Integer Values Only (1,2,3...)	
Standby Time		1600			STBYDLY	Minutes		60	Integer Values Only (1,2,3...)	
Last Stage Hold		1700			LSTHOLD	Degree F	0	30	Integer Values Only (0,1,2...)	
Con Lead Stage		1800	CLEAD		1		Represent the current lead boiler for the condensing group			
Non-Con Lead Stage		1900	NCLEAD		1	16	Represent the current lead boiler for the non-condensing group			
Gain		2000			GAIN		1	10		

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APPROVED Modulation - Outdoor Reset - BACnet Variable list (continued)

Modulation Reset	Object ID	Object Type	Object Value	Object Name	Units		Value		Definition
					Minutes	Seconds	Min	Max	
Lag Delay	2100	ANALOG-VALUE	READ/ WRITE	LAGDLY			0	60	Integer Values Only (0,1,2,...)
Soft off	2200			SOFF					
Set Time	2300			PTIME					
Day Schedule	2400			DSCHED	Minutes		1	1440	Time since midnight Integer Values Only (0,1,2,...)
Night Schedule	2500			NSCHED					
Calculated Target	2600	BINARY-VALUE	READ ONLY	TARG	Degree F				
System Relay	2700			SYSRLY			False	True	
Modulation Output A	2800			MODA					
Modulation Output B	2900			MODB					
Modulation Output C	3000			MODC					
Modulation Output D	3100			MODD					
Modulation Output E	3200			MODE					
Modulation Output F	3300			MODF					
Modulation Output G	3400			MODG					
Modulation Output H	3500			MODH					
Modulation Output I	3600			MODI			0	100	
Modulation Output J	3700			MODJ					
Modulation Output K	3800			MODK					
Modulation Output L	3900			MODL					
Modulation Output M	4000			MODM					
Modulation Output N	4100			MODN					
Modulation Output O	4200			MODO					
Modulation Output P	4300			MODP					

22. STAGING - OUTDOOR RESET - BACNET VARIABLE LIST

Staging Reset		Object ID	Object Type	Object Value	Object Name	Units	Value		Definition	
							Min	Max		
Model		Device Object			MODEL					
Serial Number					SNUMBER					
Version					VERSION					
Operation Mode		100	MULTISTATE-VALUE		OPMODE		2	7	2=Modulation Reset, 3= Staging Reset, 4=Hybrid Reset, 5=Modulation Setpoint, 6=Staging Setpoint, 7=Hybrid EMS	
Outdoor Temperature		200	ANALOG-VALUE	READ ONLY	ODTEMP	Degree F			32000=OPEN,3201=SHORT	
System Temperature		300			SYSSEN					
Output Status		400			OPTSTAT		0	0x1FFFF	Each Bit represents one of the possible 16 relays. Bit 0 represents Relay1, Bit 16 represents Relay16. 0 = Relay OFF, 1 = Relay ON	
Control Status		500	MULTISTATE-VALUE	READ/ WRITE	CSTAT			14	"1=SHUTDOWN, 2=NO TSTAT CALL, 3=PROVE FAILURE, 4=SHUTDOWN BY EMS, 5=WAITING FOR PROVE, 6=SENSOR FAULT, 7=LAST STAGE HOLD, 8=DHW CALL, 9=SUMMER, 10=BOOST MODE, 11=SYSTEM RUNON, 12=SETBACK MODE, 13=OUTDOOR CUTOFF, 14=NORMAL"	
Season		600			SEA		1	2	1= Winter, 2= Summer	
Reset Ratio		700			RR			11	"1 =1.00 OD = 4.00 Sys, 2 =1.00 OD = 3.00 Sys, 3 =1.00 OD = 2.00 Sys, 4 =1.00 OD = 1.50 Sys, 5 =1.00 OD = 1.25 Sys, 6 =1.00 OD = 1.00 Sys, 7 =1.25 OD = 1.00 Sys, 8 =1.50 OD = 1.00 Sys, 9 =2.00 OD = 1.00 Sys, 10 =3.00 OD = 1.00 Sys, 11 = 4.00 OD = 1.00 Sys"	
Offset		800	ANALOG-VALUE		OFF		-50	50	Integer Values Only (-1,0,1,2...)	
Outdoor Cutoff		900			CO		19	101	Integer Values Only (19,20,21 ...)	
Min Water Temp		1000			MINW	Degree F	50	180	Integer Values Only (50,51,52 ...)	
Max Water Temp		1100			MAXW		70	220	Integer Values Only (70,71,72...)	
Setback		1200			SB		0	75	Integer Values Only (0,1,2...)	
Purge Delay		1300			PDLY	Minutes	0.1	10	.1 thru .9 after Integer Values Only (1,2,...)	
System Runon		1400			RUNON		0	360	Integer Values Only (0,1,2...)	
Rotation Time		1500			RTTIME	Hours	1	1440	Hours since last rotation Integer Values Only (1,2,3...)	
Standby Time		1600			STBYDLY	Minutes		60	Integer Values Only (1,2,3...)	
Last Stage Hold		1700			LSTHOLD	Degree F	0	30	Integer Values Only (0,1,2...)	

APPROVED Staging - Outdoor Reset - BACnet Variable list (continued)

Staging Reset	Object ID	Object Type	Object Value	Object Name	Units	Value		Definition	
						Min	Max		
Con Lead Stage	1800	MULTISTATE-VALUE		CLEAD		1	16	Represent the current lead boiler for the condensing group	
Non-Con Lead Stage	1900			NCLEAD				Represent the current lead boiler for the non-condensing group	
Reaction Time	2000	ANALOG-VALUE	READ/ WRITE	RETIME	Minutes	1	10	Integer Values Only (1,2,3,...)	
Min Run Time	2100			MINRUN			60	Integer Values Only (1,2,3,...)	
Set Time	2200	ANALOG-VALUE		PTIME	Minutes	1	1440	Time since midnight Integer Values Only (1,2,3,...)	
Day Schedule	2300			DSCHED					
Night Schedule	2400			NSCHED					
Calculated Target	2500			TARG	Degree F				
System Relay	2600	BINARY-VALUE	READ ONLY	SYSRLY		False	True		
Modulation Output A	2700	ANALOG-VALUE		MODA		Percent	0	100	
Modulation Output B	2800			MODB					
Modulation Output C	2900			MODC					
Modulation Output D	3000			MODD					
Modulation Output E	3100			MODE					
Modulation Output F	3200			MODF					
Modulation Output G	3300			MODG					
Modulation Output H	3400			MODH					
Modulation Output I	3500			MODI					
Modulation Output J	3600			MODJ					
Modulation Output K	3700			MODK					
Modulation Output L	3800			MODL					
Modulation Output M	3900			MODM					
Modulation Output N	4000			MODN					
Modulation Output O	4100			MODO					
Modulation Output P	4200			MODP					

23. MODULATION - SETPOINT - BACNET VARIABLE LIST

Modulation Setpoint		Object ID	Object Type	Object Value	Object Name	Units	Value		Definition
							Min	Max	
Model	Device Object			READ ONLY	MODEL				
Serial Number			SNUMBER						
Version			VERSION						
Operation Mode	100	MULTISTATE-VALUE	OPMODE		2		7	2=Modulation Reset, 3= Staging Reset, 4=Hybrid Reset, 5=Modulation Setpoint, 6=Staging Setpoint, 7=Hybrid EMS	
Outdoor Temperature	200	ANALOG-VALUE	ODTEMP					32000=OPEN,3201=SHORT	
System Temperature	300		SYSSEN	Degree F			32000=OPEN,3201=SHORT		
Output Status	400		OPTSTAT		0	0x1FFFF	Each Bit represents one of the possible 16 relays. Bit 0 represents Relay1, Bit 16 represents Relay16. 0 = Relay OFF, 1 = Relay ON		
Control Status	500	MULTISTATE-VALUE	CSTAT		1	14	"1=SHUTDOWN, 2=NO TSTAT CALL, 3=PROVE FAILURE, 4=SHUTDOWN BY EMS, 5=WAITING FOR PROVE, 6=SENSOR FAULT, 7=LAST STAGE HOLD, 8=DHW CALL, 9=SUMMER, 10=BOOST MODE, 11=SYSTEM RUNON, 12=SETBACK MODE, 13=OUTDOOR CUTOFF, 14=NORMAL"		
Season	600					1	2	1= Winter, 2= Summer	
Setpoint	700					70	250	Integer Values Only (70,71,72...)	
Outdoor Cutoff	800	ANALOG-VALUE	Degree F		19	101	Integer Values Only (19,20,21...)		
Setback	900					0	75	Integer Values Only (0,1,2...)	
Purge Delay	1000				0.1	10	.1 thru .9 after Integer Values Only (1,2,3...)		
System Runon	1100	ANALOG-VALUE	Minutes	0	360	Integer Values Only (0,1,2...)			
Rotation Time	1200				1	1440	Hours since last rotation Integer Values Only (1,2,3...)		
Standby Time	1300					60	Integer Values Only (1,2,3...)		
Last Stage Hold	1400				0	30	Integer Values Only (0,1,2...)		
Con Lead Stage	1500			MULTISTATE-VALUE		1	16	Represent the current lead boiler for the condensing group	
Non-Con Lead Stage	1600							Represent the current lead boiler for the non-condensing group	
Gain	1700							10	

Modulation - Setpoint - BACnet Variable list (continued)

Modulation Setpoint	Object ID	Object Type	Object Value	Object Name	Units	Value		Definition
						Min	Max	
Lag Delay	1800	ANALOG-VALUE	READ/ WRITE	LAGDLY	Minutes	0	60	Integer Values Only (0,1,2,...)
Soft off	1900			SOFF	Seconds			
Set Time	2000			PTIME	Minutes			
Day Schedule	2100			DSCHED				
Night Schedule	2200			NSCHED				
System Relay	2300	BINARY-VALUE	READ ONLY	SYSRLY		False	True	Time since midnight Integer Values Only (1,2,3,...)
Modulation Output A	2400	MODA		Percent	0	100		
Modulation Output B	2500	MODB						
Modulation Output C	2600	MODC						
Modulation Output D	2700	MODD						
Modulation Output E	2800	MODE						
Modulation Output F	2900	MODF						
Modulation Output G	3000	MODG						
Modulation Output H	3100	MODH						
Modulation Output I	3200	MODI						
Modulation Output J	3300	MODJ						
Modulation Output K	3400	MODK						
Modulation Output L	3500	MODL						
Modulation Output M	3600	MODM						
Modulation Output N	3700	MODN						
Modulation Output O	3800	MODO						
Modulation Output P	3900	MODP						
Modulation Output N	4000	MODN						
Modulation Output O	4100	MODO						
Modulation Output P	4200	MODP						

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24. STAGING - SETPOINT - BACNET VARIABLE LIST

Staging Setpoint	Object ID	Object Type	Object Value	Object Name	Units	Value		Definition
						Min	Max	
Model	Device Object			MODEL				
Serial Number				SNUMBER				
Version				VERSION				
Operation Mode	100	MULTISTATE-VALUE		OPMODE		2	7	2=Modulation Reset, 3= Staging Reset, 4=Hybrid Reset, 5=Modulation Setpoint, 6=Staging Setpoint, 7=Hybrid EMS
Outdoor Temperature	200			ODTEMP	Degree F			32000=OPEN,3201=SHORT
System Temperature	300			SYSSEN				32000=OPEN,3201=SHORT
Output Status	400	ANALOG-VALUE	READ ONLY	OPTSTAT		0	0x1FFFF	Each Bit represents one of the possible 16 relays. Bit 0 represents Relay1, Bit 16 represents Relay16. 0 = Relay OFF, 1 = Relay ON
Control Status	500	MULTISTATE-VALUE		CSTAT		1	14	"1=SHUTDOWN, 2=NO TSTAT CALL, 3=PROVE FAILURE, 4=SHUTDOWN BY EMS, 5=WAITING FOR PROVE, 6=SENSOR FAULT, 7=LAST STAGE HOLD, 8=DHW CALL, 9=SUMMER, 10=BOOST MODE, 11=SYSTEM RUNON, 12=SETBACK MODE, 13=OUTDOOR CUTOFF, 14=NORMAL"
Season	600	MULTISTATE-VALUE		SEA			2	1= Winter, 2= Summer
Setpoint	700			SETP		70	250	Integer Values Only (70,71,72...)
Outdoor Cutoff	800			CO	Degree F	19	101	Integer Values Only (19,20,21...)
Setback	900			SB		0	75	Integer Values Only (1,2,3...)
Purge Delay	1000			PDLY	Minutes	0.1	10	.1 thru .9 after Integer Values Only (1,2,3...)
System Runon	1100	ANALOG-VALUE		RUNON		0	360	Integer Values Only (0,1,2...)
Rotation Time	1200			RTTIME	Hours		1440	Hours since last rotation Integer Values Only (1,2,3...)
Standby Time	1300			STBYDLY	Minutes	1	60	Integer Values Only (1,2,3...)
Last Stage Hold	1400		READ/ WRITE	LSTHOLD	Degree F	0	30	Integer Values Only (0,1,2...)
Con Lead Stage	1500			CLEAD				Represent the current lead boiler for the condensing group
Non-Con Lead Stage	1600	MULTISTATE-VALUE		NCLEAD			16	Represent the current lead boiler for the non-condensing group
Reaction Time	1700			RETIME			10	Integer Values Only (1,2,3...)
Min Run Time	1800			MINRUN		1	60	Integer Values Only (1,2,3...)
Set Time	1900			PTIME	Minutes			Time since midnight Integer Values Only (1,2,3...)
Day Schedule	2000	ANALOG-VALUE		DSCHED			1440	Time since midnight Integer Values Only (1,2,3...)
Night Schedule	2100			NSCHED				Time since midnight Integer Values Only (1,2,3...)

APPROVED Staging - Setpoint - BACnet Variable list (continued)

Staging Setpoint	Object ID	Object Type	Object Value	Object Name	Units	Value		Definition
						Min	Max	
System Relay	2200	BINARY-VALUE	READ ONLY	SYSRLY		False	True	
Modulation Output A	2300	ANALOG-VALUE		MODA	Percent	0	100	
Modulation Output B	2400			MODB				
Modulation Output C	2500			MODC				
Modulation Output D	2600			MODD				
Modulation Output E	2700			MODE				
Modulation Output F	2800			MODF				
Modulation Output G	2900			MODG				
Modulation Output H	3000			MODH				
Modulation Output I	3100			MODI				
Modulation Output J	3200			MODJ				
Modulation Output K	3300			MODK				
Modulation Output L	3400			MODL				
Modulation Output M	3500			MODM				
Modulation Output N	3600			MODN				
Modulation Output O	3700			MODO				
Modulation Output P	3800			MODP				

25. PIPING AND WIRING DIAGRAMS

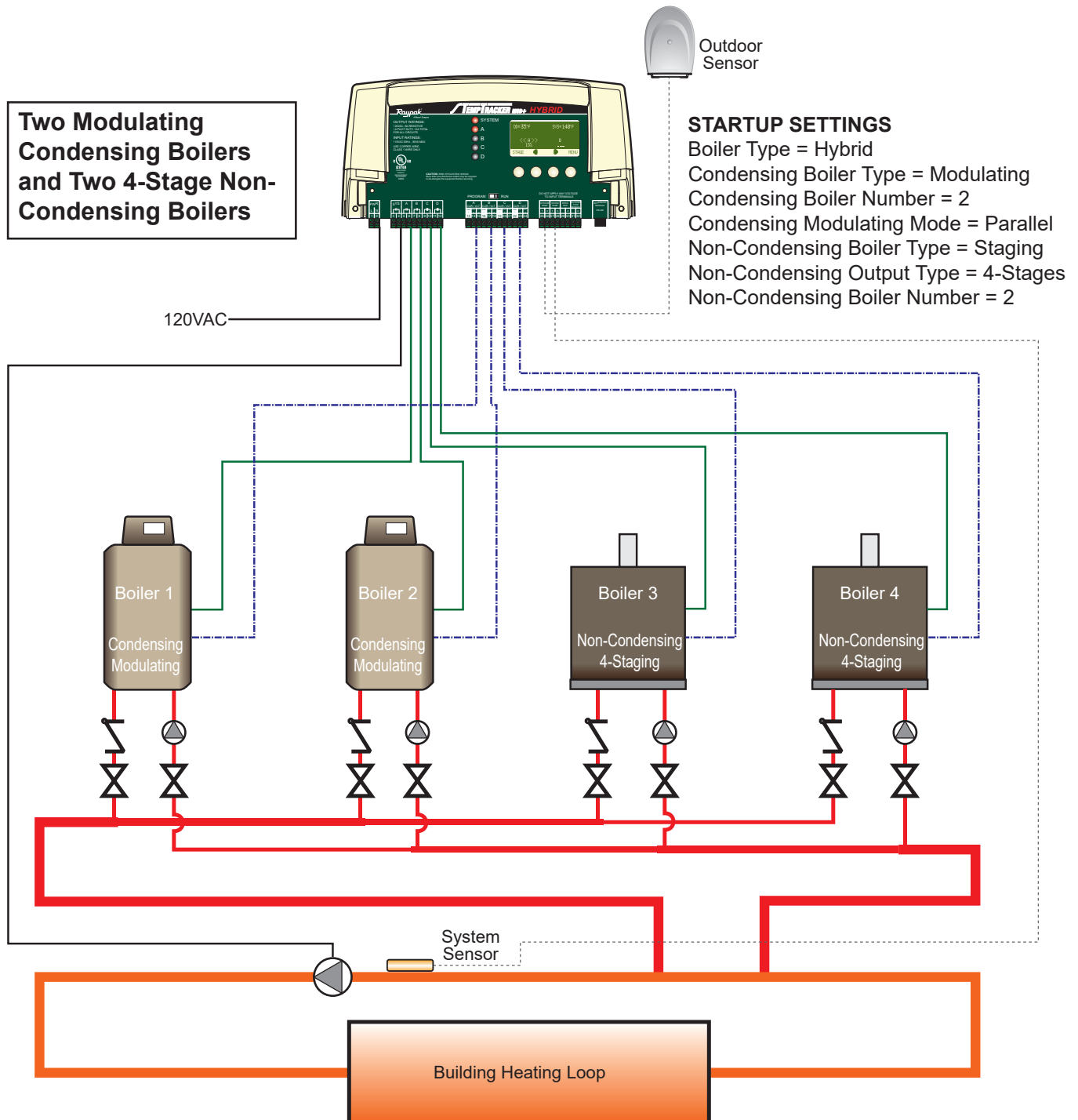
Hybrid Piping Diagram

System:

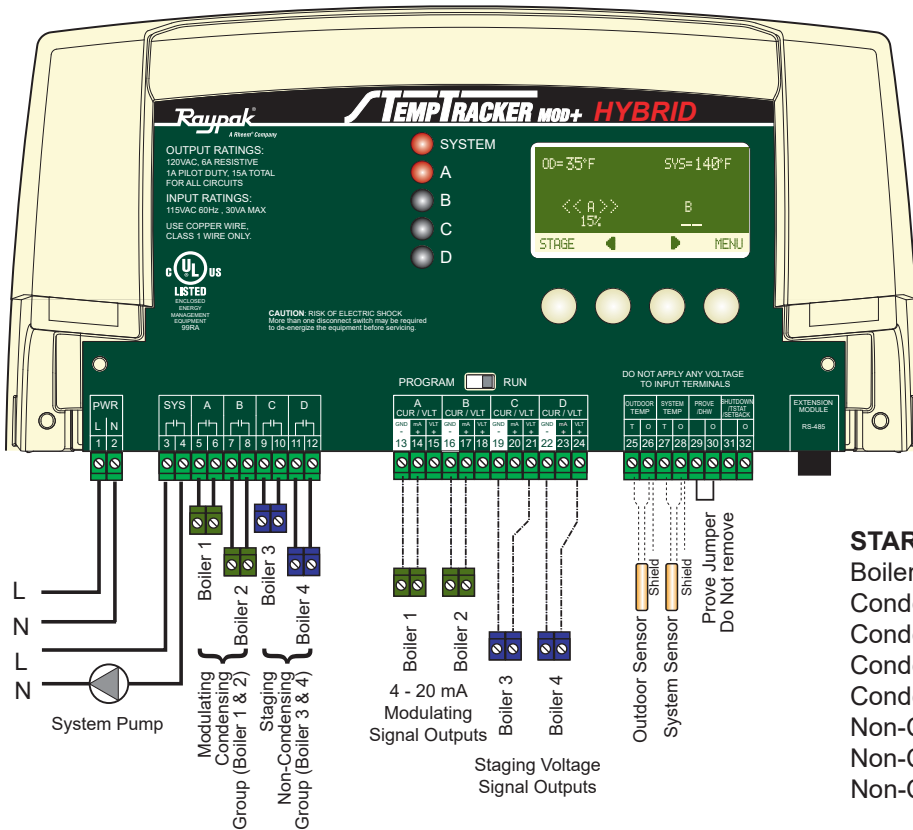
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The TempTracker mod+ Hybrid operates four modulating boilers and two 4-stage Boilers. The boilers are piped in Reverse Return on the primary loop. The System output is controlling the System Pump.

Raypak, Inc. is aware that each installation is unique. Thus, Raypak, Inc. is not responsible for any installation related to any electrical or plumbing diagram generated by Raypak, Inc. The provided illustrations are to demonstrate Raypak, Inc.'s control operating concept only.



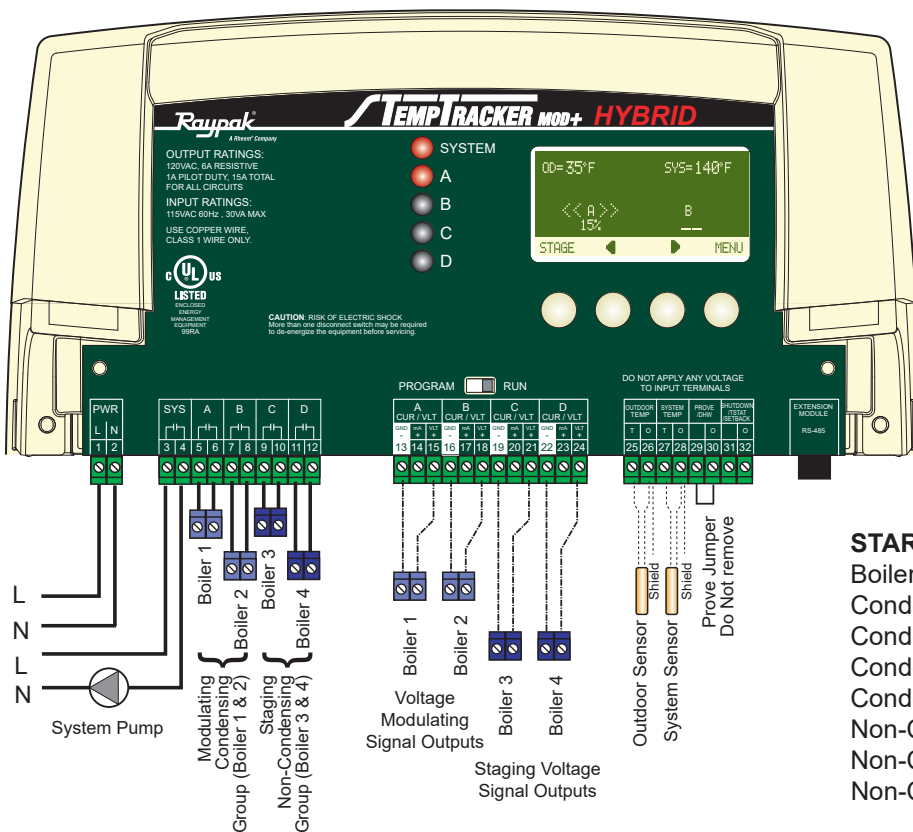
Hybrid Wiring Diagram



**Two 4-20mA Modulating
Condensing Boilers
and Two 4-Stage Non-
Condensing Boilers**

STARTUP SETTINGS

Boiler Type = Hybrid
Condensing Boiler Type = Modulating
Condensing Boiler Number = 2
Condensing Output Type = 4-20ma
Condensing Modulating Mode = Parallel
Non-Condensing Boiler Type = Staging
Non-Condensing Output Type = 4-Stages
Non-Condensing Boiler Number = 2



**Two Voltage Modulating
Condensing Boilers
and Two 4-Stage Non-
Condensing Boilers**

STARTUP SETTINGS

Boiler Type = Hybrid
Condensing Boiler Type = Modulating
Condensing Boiler Number = 2
Condensing Output Type = Any voltage
Condensing Modulating Mode = Parallel
Non-Condensing Boiler Type = Staging
Non-Condensing Output Type = 4-Stages
Non-Condensing Boiler Number = 2

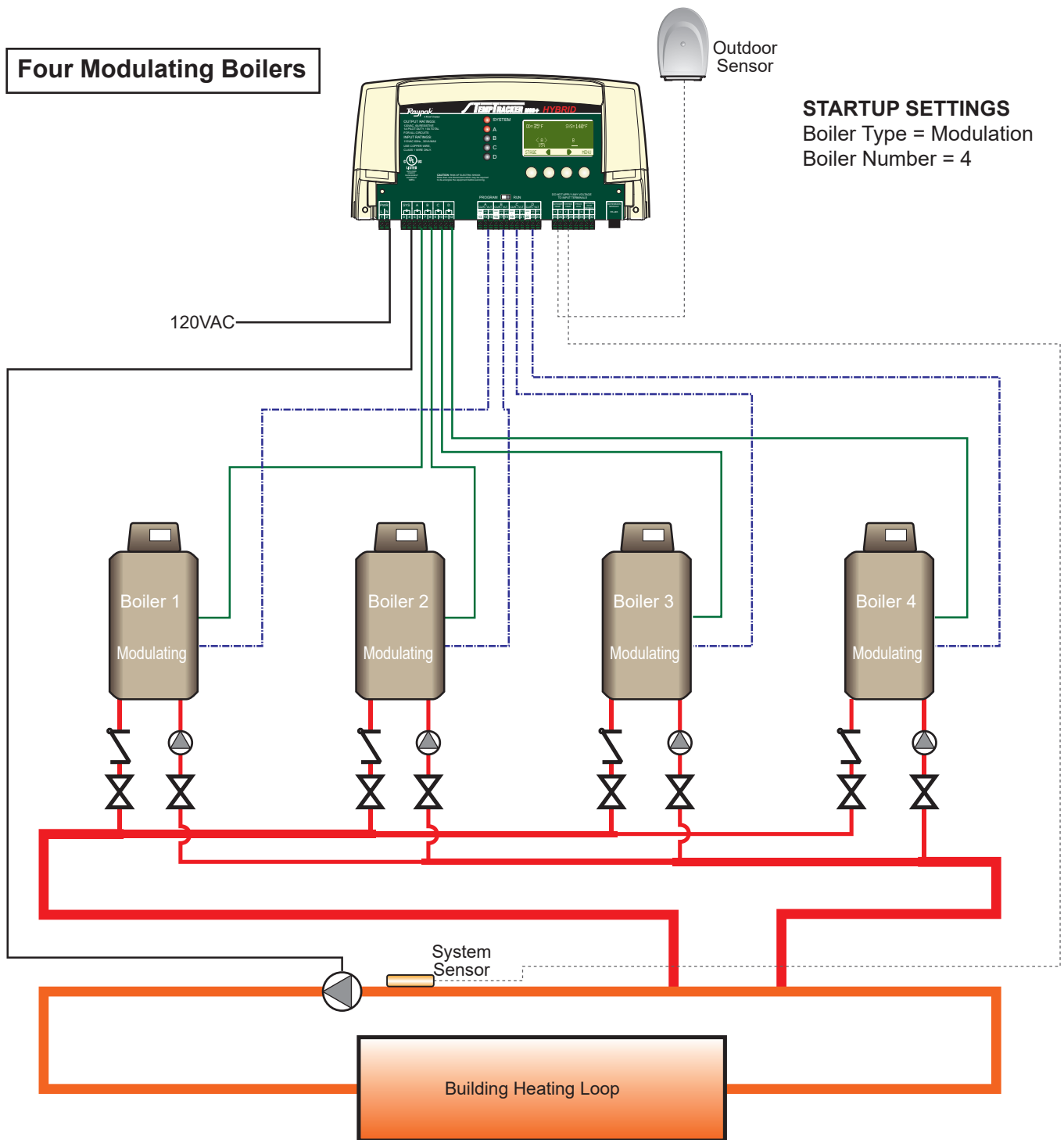
Modulating Piping Diagram

System:

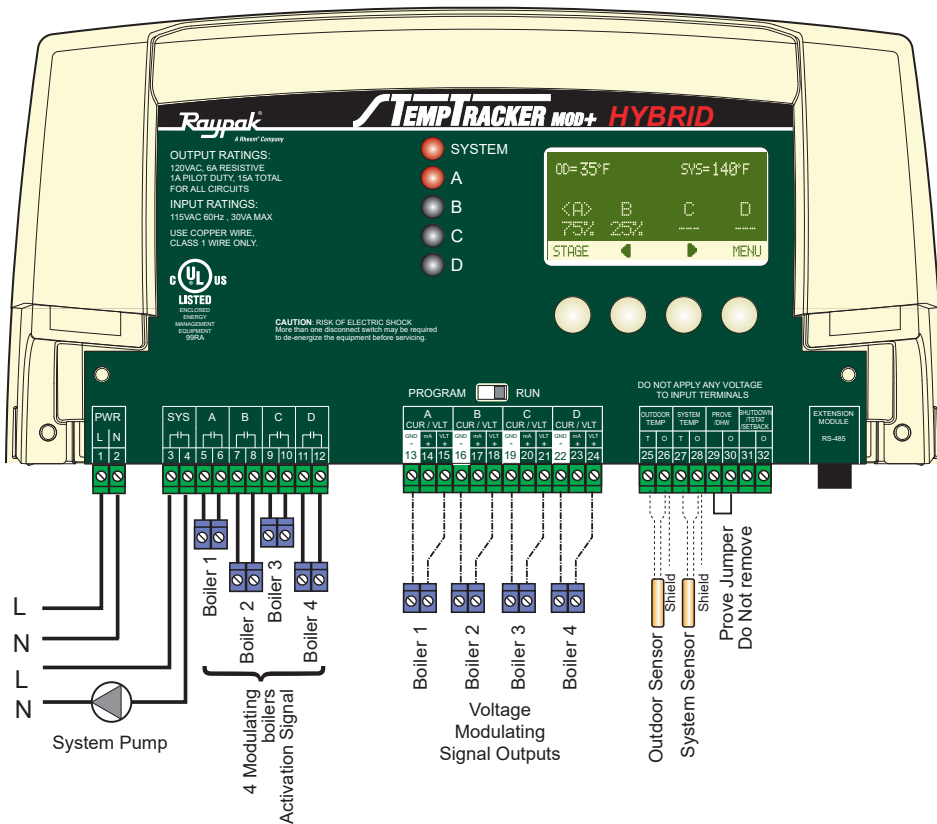
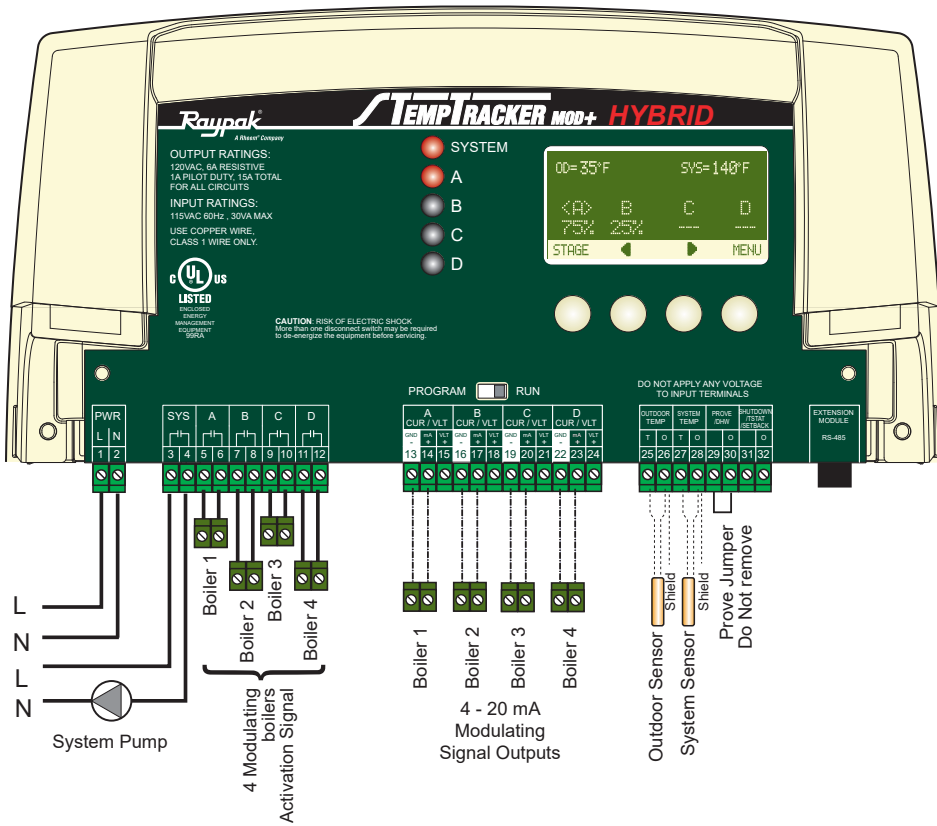
The TempTracker mod+ Hybrid operates four modulating boilers. The boilers are piped in Reverse Return on the primary loop. The System output is controlling the System Pump.

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Modulating Wiring Diagram



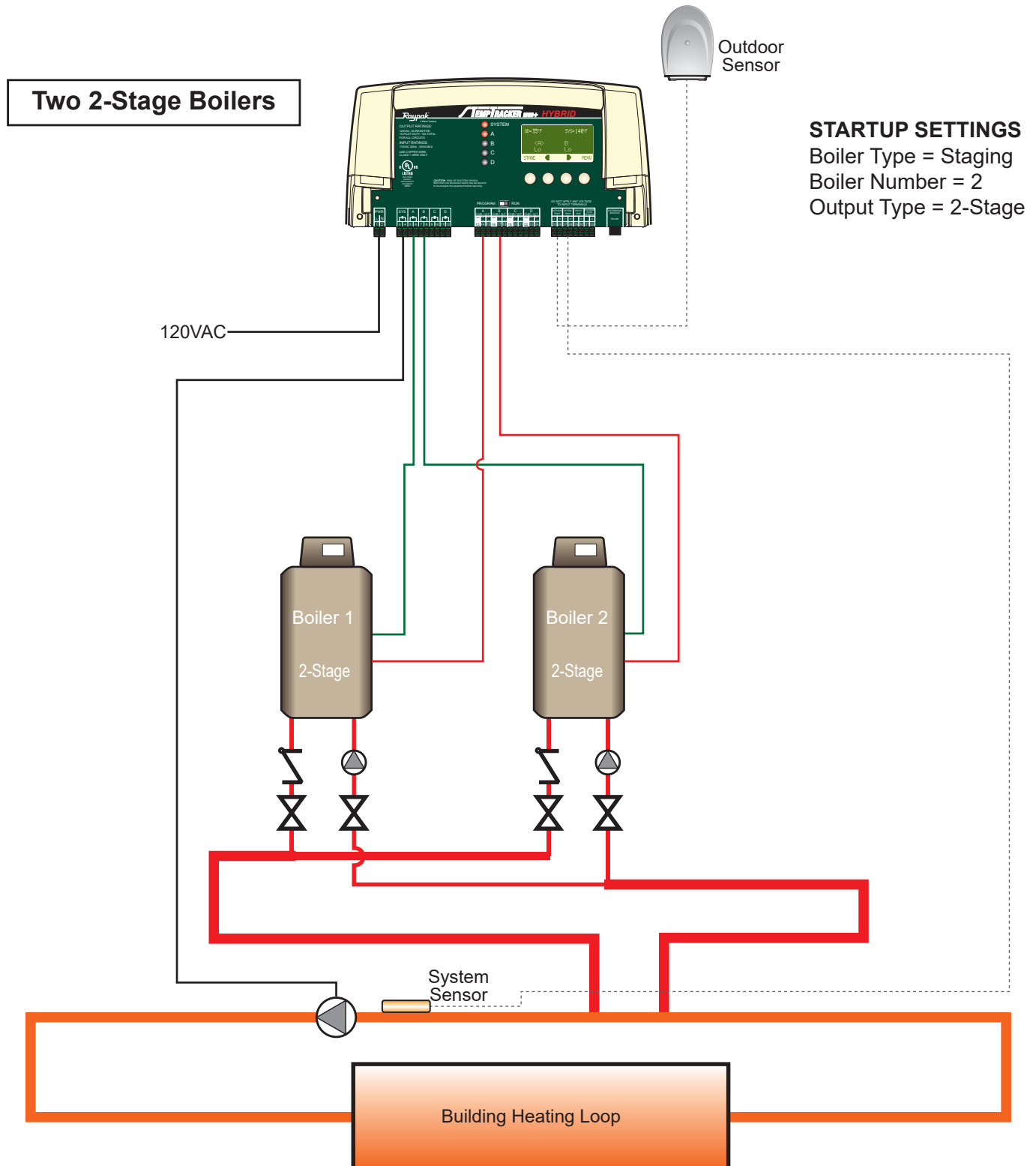
Staging Piping Diagram

System:

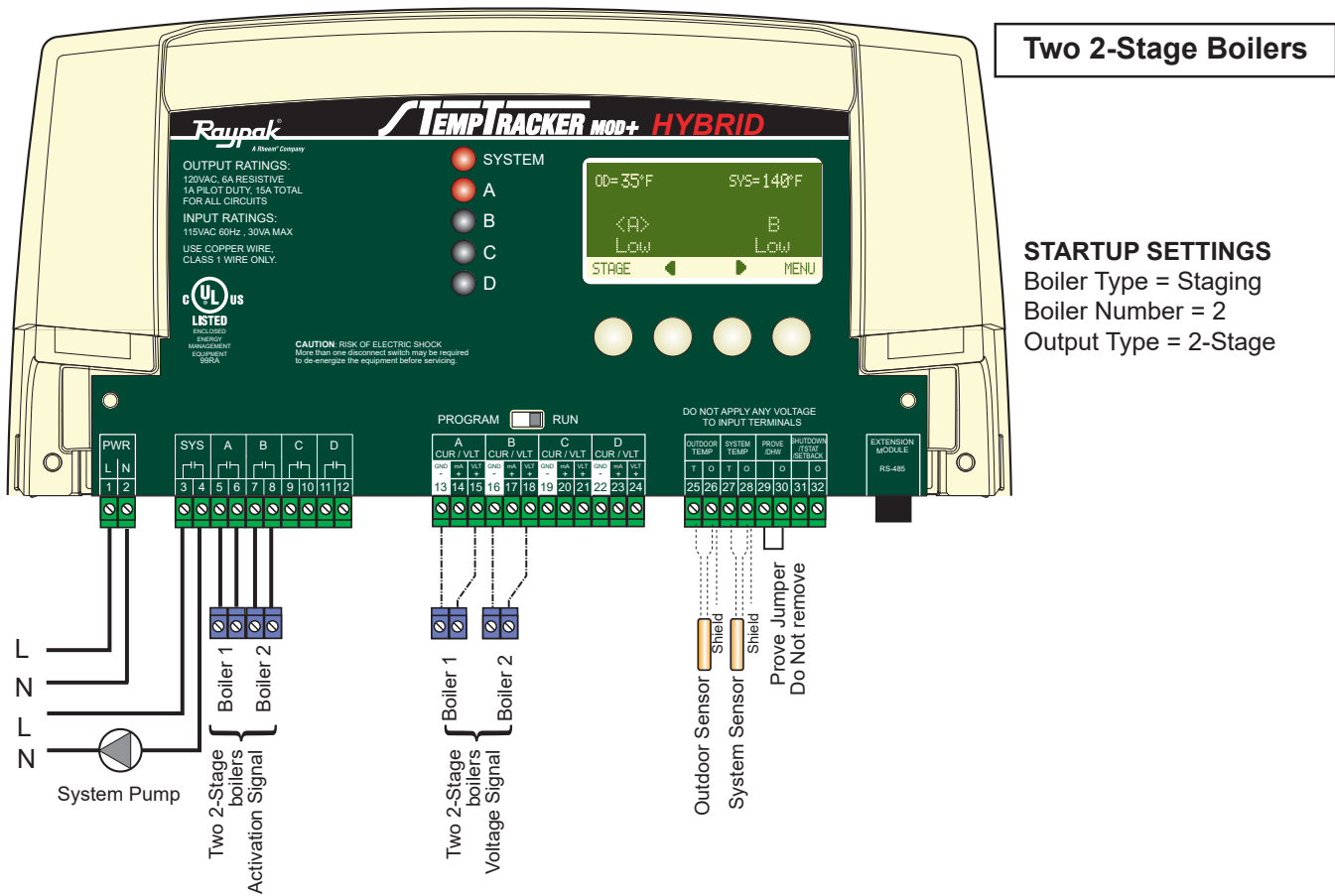
The TempTracker mod+ Hybrid operates two 2-stage Boilers. The boilers are piped in Reverse Return on the primary loop. The System output is controlling the System Pump.

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Staging Wiring Diagram



26. SPECIFICATIONS

General	
Item	Specification
Voltage Input:	120 VAC 60 Hz
Power Consumption	12 VA Max
Operating Temperature	20°F/-6°C to 130°F/54°C
Operating Humidity	20% to 80% non-condensing
Dimensions	11" W x 9" H x 3 ¾" D (28 x 23 x 9.5 cm)
Weight	2.5 pounds (1.1 kg)

TempTracker mod+ Hybrid	
Item	Specification
Switch Between Boiler Groups Mode	Using Target Temperature
Lead Stage Rotation	Time (1 to 1440 Hours (60 days)), Manual, Last-On
Pump Output	1 N.O. S.P.S.T
Modulating Boiler Modes	Auto, Manual, Standby, On, Off
Staging Boiler Modes	Auto, Standby, On, Off
Standby Time	1 to 60 minutes
Modulating Output Types	4-20mA and 0-10V
Sequencing Output Types	On/Off, 2-Stage, 3-Stage, or 4-Stage
Output Relay Ratings	1 Amp inductive (⅓ HP), 6 Amp resistive at 120 VAC 60 Hz, 15 A total for all circuits
Add-On Extension Panels	up two Extension Panels using RS485 (RJ45 or RJ11)
Ignition Point %	1 to 50%
Modulation Start Point %	0 to 100%
Modulation Modes	Normal or Parallel
Sequencing Modes	Lo/Hi/Lo/Hi or Lo/Lo/Hi/Hi
Temperature Display	Fahrenheit or Celsius
Display	Graphical Alphanumeric (up to 7 rows x 21 char. each)
LED	1 System Output relay, 4 Boiler Output relays
Control Sensor Ranges	Outdoor temperature sensor - minus 35°F/-37°C to 250°F/121°C Heating system sensor - minus 35°F/-37°C to 250°F/121°C
Outdoor Cutoff Range	20°F/-6°C to 100°F, ON and OFF
Setpoint Range	50°F/10°C to 220°F/104°C

Reset Ratio Range	(1:4) to (4:1) (Outdoor : System Water)
Offset Adjustment	minus -40°F/-22°C to plus 40°F/22°C
Minimum Water Temperature	50°F/10°C to 170°F/77°C
Maximum Water Temperature	90°F/32°C to 240°F/116°C
Indirect Domestic Hot Water	with Priority or without Priority
Pump Run-On	0 to 360 minutes
Purge Delay	0.0 to 10.0 minutes
Lag Delay	0 to 60 minutes
Last Stage Hold	0 to 30°F
Schedules	1 Day and 1 Night (Setback) setting per day
Night Setback	0°F/0°C to 75°F/42°C
Power Backup	Lithium coin battery, 100 days minimum 5 year replacement (Maintains Clock in power outages)
External Inputs	Shutdown, Tstat, and Setback Input, and Prove and DHW Call Input. (Dry Contacts Only)
Season	Winter and Summer

Extension*	
Item	Specification
Extension Numbering	Toggle Switch A (Stages E - J, LEDs are Green) or B (Stages K - P, LEDs are Red)
Boiler Outputs	(6) N.O. S.P.S.T.
Modulating Output Types	(6) 4-20mA and 0-10V
Output Relay Ratings	1 Amp inductive (⅓ HP), 6Amp resistive at 120 VAC 60 Hz, 15 A total for all circuits
Connection to TempTracker mod+ Hybrid and another extension	Two RS485 connections using 6 wire RJ11 cable (Cable is provided)

* Each Extension can add up to (6) additional boiler stages. A maximum of two Extensions can be used

APPROVED
NOTES