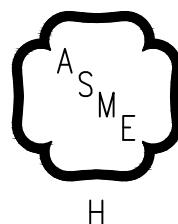


OPERATING INSTRUCTIONS FOR **K2™** CONDENSING HIGH EFFICIENCY DIRECT VENT **GAS - FIRED HOT WATER BOILER**



As an ENERGY STAR® Partner, U.S. Boiler Company has determined that the K2™ Series meets the ENERGY STAR® guidelines for energy efficiency established by the United States Environmental Protection Agency (EPA).

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury, or loss of life. For assistance or additional information, consult a qualified installer, service agency or the gas supplier. This boiler requires a special venting system. Read these instructions carefully before installing.

IMPORTANT INFORMATION - READ CAREFULLY

NOTE: The equipment shall be installed in accordance with those installation regulations enforced in the area where the installation is to be made. These regulations shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made.

All wiring on boilers installed in the USA shall be made in accordance with the National Electrical Code and/or local regulations.

All wiring on boilers installed in Canada shall be made in accordance with the Canadian Electrical Code and/or local regulations.

The City of New York requires a Licensed Master Plumber supervise the installation of this product.

The Massachusetts Board of Plumbers and Gas Fitters has approved the K2™ Series boiler. See the Massachusetts Board of Plumbers and Gas Fitters website, http://license.reg.state.ma.us/pubLic/pl_products/pb_pre_form.asp for the latest Approval Code or ask your local Sales Representative.

The Commonwealth of Massachusetts requires this product to be installed by a Licensed Plumber or Gas Fitter.

The following terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning product life.



DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury or property damage.



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

NOTICE

Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.



DANGER

Explosion Hazard. DO NOT store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.

If you smell gas vapors, DO NOT try to operate any appliance - DO NOT touch any electrical switch or use any phone in the building. Immediately, call the gas supplier from a remotely located phone. Follow the gas supplier's instructions or if the supplier is unavailable, contact the fire department.



WARNING

Asphyxiation Hazard. This boiler requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Read and understand the entire manual before attempting installation, start-up operation, or service. Installation and service must be performed only by an experienced, skilled, and knowledgeable installer or service agency.

This boiler must be properly vented.

This boiler needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air.

Asphyxiation Hazard. The interior of the venting system must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed venting system is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

Installation is not complete unless a safety relief valve is installed into the tapping located on left side of appliance or the supply piping. - See the Water Piping and Trim Section of the K2 Installation manual for details.

This boiler is supplied with safety devices which may cause the boiler to shut down and not re-start without service. If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.

Burn Hazard. This boiler contains very hot water under high pressure. Do not unscrew any pipe fittings nor attempt to disconnect any components of this boiler without positively assuring the water is cool and has no pressure. Always wear protective clothing and equipment when installing, starting up or servicing this boiler to prevent scald injuries. Do not rely on the pressure and temperature gauges to determine the temperature and pressure of the boiler. This boiler contains components which become very hot when the boiler is operating. Do not touch any components unless they are cool.

Respiratory Hazard. Boiler materials of construction, products of combustion and the fuel contain alumina, silica, heavy metals, carbon monoxide, nitrogen oxides, aldehydes and/or other toxic or harmful substances which can cause death or serious injury and which are known to the state of California to cause cancer, birth defects and other reproductive harm. Always use proper safety clothing, respirators and equipment when servicing or working nearby the appliance.

Failure to follow all instructions in the proper order can cause personal injury or death. Read all instructions, including all those contained in component manufacturers manuals which are provided with the boiler before installing, starting up, operating, maintaining or servicing.

All cover plates, enclosures and guards must be in place at all times.

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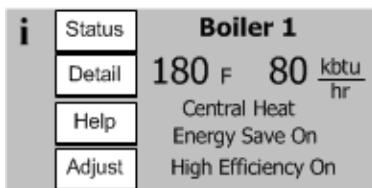
I. Operation

A. Overview

1. Sage2.2 Controller

The Sage2.2 Controller (Control) contains features and capabilities which help improve heating system operation, and efficiency. By including unique capabilities, the Control can do more, with less field wiring, and fewer aftermarket controls and components – improving the operation of both new and replacement boiler installations.

2. Advanced Touch Screen Display



Home Screen

Boiler status and setup selections are available from an easy to use, dual color, LCD Touch Screen Display. Over one hundred helpful information screens are provided to explain status information and setup functions. In the event of a fault condition the user is guided by “blinking” touch buttons to Help screens that explain the problem cause and corrective action. Operation evaluation and problem-solving is enhanced by historical capability including graphic trends, lockout history records as well as boiler and circulator cycle counts and run time hours.

3. Advanced Modulating Control

The Control modulates the boiler input by varying the fan speed. As the fan speed increases, so does the amount of fuel gas drawn into the blower. As a result, a fairly constant air-fuel ratio is maintained across all inputs. The Control determines the input needed by looking at both current and recent differences between the measured temperature and the setpoint temperature. As the measured temperature approaches the setpoint temperature, the fan will slow down and the input will drop. The Control also utilizes boiler return water and flue gas temperatures to adjust fan speed.

4. HeatMatch™ Software

When the boiler is installed with a Sage Zone Control Panel (Zone Control) into a multiple zone home the Control uses a patent pending HeatMatch Software to improve home comfort, increase component life and save energy. The Sage2.2 Controller with the Zone Control detects active (turned “on”) zones, totals btu/hrs expected and limits the boiler firing rate to “match” actual home demand. Instead of simply firing to 100% in response to a cold supply water temperature the Control combines heat matching with supply water temperature control. The result is longer run times, dramatic reduction in boiler excessive cycling and higher operating efficiency. Avoiding extra cycling saves customer fuel dollars (pre and post purge sends heat up stack) and saves wear and tear on the boiler. Lowering the boiler’s firing rate saves fuel dollars by increasing the amount of flue gas condensation, always the goal of condensing boiler installations.

5. Built-in Safety Control

The Control includes safety controls designed to ensure safe and reliable operation. In addition to flame safety controls the Control includes supply water temperature, differential water temperature, and stack temperature safety limits and stepped modulation responses. Boiler modulation is adjusted when required to help avoid loss of boiler operation due to exceeding limits. Additionally, the Control accepts the field installation of optional auxiliary safety limits.

6. Outdoor Air Reset

When selected the modulation rate setpoint is automatically adjusted based on outside air temperature, time of day and length of demand (boost) settings. Outdoor air “reset” setpoint saves fuel by adjusting the water temperature of a heating boiler lower as the outside air temperature increases.

7. Warm Weather Shutdown (WWSD)

Some boilers are used primarily for heating buildings, and the boilers can be automatically shutdown when the outdoor air temperature is warm. When outside air temperature is above the WWSD setpoint, this function will shut down the boiler, boiler and system pump.

8. Energy Management System (EMS) Interface

The control accepts a 4-20mA DC input from the EMS system for either direct modulation rate or setpoint.

A factory configured RS485 Modbus interface is available for Energy Management System (EMS) monitoring when not used for Multiple Boiler Sequencer Peer-To-Peer Network. Consult factory for points list or if this interface must be used in addition to the boiler Peer-to-Peer Network.

9. Circulator Control

The Control may be used to sequence the domestic hot water, boiler and system circulators. Service rated relay outputs are wired to a line voltage terminal block for easy field connection. Simple parameter selections allow all three pumps to respond properly to various hydronic piping arrangements including either a boiler or primary piped indirect water heater. Circulators are automatically run for a 20 second exercise period after not being used for longer than 7 days. Circulator exercise helps prevent pump rotor seizing.

10. Multiple Boiler Sequencer Peer-To-Peer Network

The Control includes state-of-the-art modulating lead-lag sequencer for up to eight (8) boilers capable of auto rotation, outdoor reset and peer-to-peer communication. The peer-peer network is truly “plug and play”. Communication is activated by simply connecting a RJ45 ethernet cable between boilers. The Control provides precise boiler coordination by sequencing boilers based on both header water temperature and boiler modulation rate. For example, the lead boiler can be configured to start a lag boiler after operating at 50% modulation rate for longer than an adjustable time. The boilers are modulated in “unison” (parallel) modulation rate to ensure even heat distribution.

I. Operation

B. Supply Water Temperature Regulation

1. Priority Demand

The Control accepts a call for heat (demand) from multiple places and responds according to its “Priority”. When more than 1 demand is present the higher priority demand is used to determine active boiler settings. For example, when Domestic Hot Water (DHW) has priority the setpoint, “Diff Above”, “Diff Below” and pump settings are taken from DHW selections. Active “Priority” is displayed on the “Boiler Status” screen.

Table 1: Order of Priority

Priority	Status Screen Display	Boiler Responding to:
1st	Sequencer Control	The boiler is connected to the peer-to-peer network. The boiler accepts demand from the Sequencer Master.
2nd	Domestic Hot Water	DHW call for heat is on and selected as the priority demand. DHW is always higher priority than Central Heat. It also has higher priority than the Sequencer Control when DHW priority is “enabled” and “Boiler Piped” IWH is selected.
3rd	Central Heat	Central Heat call for heat is on and there is no DHW demand or DHW priority time has expired.
4th	Auxiliary Heat	Auxiliary Heat call for heat is on and there is no Central Heat or DHW demand. (NOTE: May be user selected to be higher priority than Central Heat.)
5th	Frost Protection	Frost Protection is active and there is no other call for heat. Frost protection will be a higher priority than Sequencer Control if the Sequence Master has no active call for heat.
6th	Warm Weather Shutdown (WWSD)	WWSD is active and the boiler will not respond to central heat demands. DHW demand is not blocked by WWSD.
7th	Standby	There is no demand detected.

2. Setpoint Purpose

The Control starts and stops the boiler and modulates the boiler input from minimum (MBH) to maximum (MBH) in order to heat water up to the active setpoint. The setpoint is determined by the priority (Central Heat or Domestic Hot Water) and as described in the following paragraphs.

3. Central Heat Setpoint

Upon a Central Heat call for heat the setpoint is either the user entered Central Heat Setpoint, or is automatically adjusted by a thermostat’s “Sleep” or “Away” modes and/or Outdoor Air Reset or, an Energy Management System (EMS) supplied 4-20mAdc setpoint.

4. Auxiliary Heat Setpoint

Auxiliary Heat is a second heating demand that may be used to serve either lower temperature radiation or warmer heat demands such as fan coils. Upon an Auxiliary

Heat call for heat the setpoint is either the user entered Auxiliary Heat Setpoint or is automatically adjusted as a thermostat’s “sleep” or, Away Modes or, Outdoor Air Reset.

5. Outdoor Air Reset

If an outdoor temperature sensor is connected to the boiler and Outdoor Reset is enabled, the Central Heat setpoint will automatically adjust downwards as the outdoor temperature increases. When the water temperature is properly matched to heating needs there is minimal chance of room air temperature overshoot. Excessive heat is not sent to the room heating elements by “overheated” (supply water temperature maintained too high a setting) water. Reset control saves energy by reducing room over heating, reducing boiler temperature & increasing combustion efficiency and, reducing standby losses as a boiler and system piping cool down to ambient following room over heating.

6. Boost Time

When the Central Heat Setpoint is decreased by Outdoor Air Reset settings the Boost function can be enabled to increase the setpoint in the event that central heat demand is not satisfied for longer than the Boost Time minutes. The Boost feature increases the operating temperature setpoint by 10°F (5.6°C) every 20 minutes (field adjustable) the central heat demand is not satisfied. This process will continue until heat demand is satisfied (indoor air is at desired temperature). Once the heat demand is satisfied, the operating setpoint reverts to the value determined by the Outdoor Air Reset settings. If Boost Time is zero, then the boost function is not used.

7. Domestic Hot Water (DHW) Setpoint

Upon a DHW call for heat the setpoint is either the user entered DHW setpoint or the Thermostat’s “Sleep” or “Away” DHW setpoint. The optimal value of this setpoint is established based on the requirements of the indirect water heater.

8. Domestic Hot Water Priority (DHWP)

When domestic hot water priority is selected and there is a DHW call for heat, the system pump will be turned off (when “System Pump Run Pump for” parameter is set for “Central Heat Optional Priority”) and the DHW pump will be turned on. Additionally, if outdoor reset is active, the active setpoint is adjusted to the DHW Setpoint. Priority protection is provided to ensure central heat supply in the case of excessively long DHW call for heat.

9. “Setback” Setpoints

User adjustable Thermostat “Sleep” or “Away” Setback Setpoints are provided for Central Heat, Auxiliary Heat and DHW demands. The Setback setpoint is used when the EnviraCOM thermostat is in “leave” or “sleep” modes. When setback is “on” the thermostat setback setpoint shifts the reset curve to save energy while the home is in reduced room temperature mode. The Honeywell VisionPro IAQ (part number TH9421C1004) is a “setback” EnviraCOM enabled thermostat.

I. Operation

C. Boiler Protection Features

1. Supply Water Temperature High Limit

The control is equipped with internal operating control and high limit features. The control monitors a dual element temperature sensor that is mounted in the supply water manifold and provides UL353 and UL1998 internal safety algorithms. If supply water temperature increases above the active setpoint plus diff above, default 190°F (87.7°C) the boiler is cycled off. If the temperature exceeds 210°F (98.9°C), a manual reset hard lockout results. If the boiler is responding to the internal Multiple Boiler Control Sequencer, Header Sensor or an External EMS demand and the supply water temperature increases above 190°F (87.7°C) the control begins to reduce the blower maximum speed setting and if the temperature increases to 200°F (93°C) a forced recycle results. Additionally, if the supply temperature rises faster than the degrees Fahrenheit per second limit a soft lockout is activated.

2. High Differential Temperature Limit

The Control monitors the temperature difference between the return and supply sensors. If this difference exceeds 43°F (23.9°C) the control begins to reduce the maximum blower speed. If temperature difference exceeds 53°F (29.4°C) a forced boiler recycle results. If the temperature difference exceeds 63°F (35°C) the control will shut the unit down. The unit will restart automatically once the temperature difference has decreased and the minimum off time has expired.

3. Return Temperature Higher Than Supply Temperature (Inversion Limit)

The Control monitors the supply and return temperature sensors. If the return water temperature exceeds the supply water temperature for longer than a limit time delay the Control shuts down the boiler and delays restart. If the inverted temperature is detected more than five times the boiler manual reset Hard Lockout is set. This condition is the result of incorrectly attaching the supply and return piping.

4. External Limit

An external limit control can be installed on the low voltage terminal strip. Be sure to remove the jumper when adding an external limit control to the system. If the external limit opens, the boiler will shut down and an open limit indication and error code are provided. If the limit installed is a manual reset type, it will need to be reset before the boiler will operate.

5. Boiler Mounted Limit Devices

The control monitors individual limit devices: flow switch, thermal fuse and sump pressure switch. If any of these limits open the boiler will shut down and an open limit indication is provided. Additionally, the control monitors an air proving switch. During the boiler start sequence the control requires the air proving switch to be in the “open” position before the blower starts and in the “closed” position after the blower starts. If the air proving switch is not in the required position the start sequence is halted or the boiler is shut down and the open limit indication is provided. The air proving switch is only required to be closed during pre-purge. It is normal for the air proving switch to be open during run mode.

6. Stack High Limit

The Control monitors the flue gas temperature sensor located in the vent connector. If the flue temperature exceeds 194°F (90°C), the control begins to reduce the maximum blower speed. If the flue temperature exceeds 204°F (96°C), a forced boiler recycle results. If the flue temperature exceeds 214°F (101°C), the control activates a manual reset Hard Lockout.

7. Ignition Failure

The Control monitors ignition using a burner mounted flame sensor. In the event of an ignition failure, the control retries 5 times and then goes into soft lockout for one hour.

8. Central Heating System Frost Protection

When enabled, Frost Protection starts the boiler and system pump and fires the boiler when low outside air and low supply water temperatures are sensed. The Control provides the following control action when frost protection is enabled:

Table 2: Frost Protection

Device Started	Start Temperatures	Stop Temperatures
Boiler Pump	Outside Air < 0°F (-18°C) Supply Water < 45°F (7.2°C)	Outside Air > 4°F (-16°C) Supply Water > 50°F (10°C)
Boiler	Supply Water < 38°F (3.3°C)	Supply Water > 50°F (10°C)

FROST PROTECTION NOTE

The Control helps provide freeze protection for the boiler water. Boiler flue gas condensate drain is not protected from freezing. Since the Control only controls the system and boiler circulators individual zones are not protected. It is recommended that the boiler be installed in a location that is not exposed to freezing temperatures.

I. Operation

D. Multiple Boiler Control Sequencer

1. “Plug & Play” Multiple Boiler Control Sequencer

When multiple boilers are installed, the Control’s Sequencer may be used to coordinate and optimize the operation of up to eight (8) boilers. Boilers are connected into a “network” by simply “plugging in” standard ethernet cables into each boiler’s “Boiler-To-Boiler Communication” RJ45 connection.

2. Sequencer Master

A single Control is parameter selected to be the Sequencer Master. The call for heat, outdoor and header sensors, and common pumps are wired to the Sequencer Master “enabled” Control.

3. Lead/Slave Sequencing & Equalized Run Time

One boiler is a “Lead” boiler and the remaining networked boilers are “Slaves”. When demand is increasing, the Lead boiler is the first to start and the Slave boilers are started in sequential order (1,2,3,...) until the demand is satisfied. When demand is decreasing, the boilers are stopped in reverse order with the Lead boiler stopped last (...3,2,1). To equalize the run time the sequencer automatically rotates the Lead boiler after 24 hours of run time.

4. Improved Availability

The following features help improve the heat availability:

- a. Backup Header Sensor: In the event of a header sensor failure the lead boiler’s supply sensor is used by the Sequence Master to control firing rate. This feature allows continued coordinated sequencer control even after a header sensor failure.
- b. “Stand Alone” Operation Upon Sequence Master Failure: If the Sequence Master Control is powered down or disabled or if communication is lost between boilers, individual boilers may be setup to automatically resume control as a “stand alone” boiler.
- c. Slave Boiler Rate Adjustment: Each slave boiler continues to monitor supply, return and flue gas temperatures and modifies the Sequence Master’s firing rate demand to help avoid individual boiler faults, minimize boiler cycling and provide heat to the building efficiently.
- d. Slave Boiler Status Monitoring: The Sequence Master monitors slave boiler lockout status and automatically skip over disabled boilers when starting a new slave boiler.

5. Customized Sequences

Normally, boilers are started and stopped in numerical order. However, custom sequences may be established to optimize the heat delivery. For example, in order to minimize boiler cycling, a large boiler may be selected to run first during winter months and then selected to run last for the remainder of the year.

6. Multiple Demands

The Sequence Master responds to Central Heat, Auxiliary Heat, DHW and frost protection demands similar to the stand alone boiler. For example, when selected and DHW priority is active, the sequence master uses DHW setpoint, “Diff Above”, “Diff Below” and pump settings.

7. Shared or Isolated DHW Demand

When the Indirect Water Heater (IWH) parameter is set to “Primary Piped” the Sequence Master sequences all required boilers to satisfy the DHW setpoint (default 180°F (82.2°C)). When “Boiler Piped” is selected only the individual slave boiler, with the wired DHW demand and pump, fires to satisfy the DHW setpoint.

8. DHW Two boiler Start

When the Indirect Water Heater (IWH) parameter is set to “Primary Piped” and the DHW Two Boiler Start parameter is set to “Enabled” two boilers are started without delay in response to a DHW call for heat. This feature allows rapid recovery of large IWH’s and multiple IWH’s.

9. Optimized Boiler Modulation

Boiler firing rate is managed to increase smoothly as boilers are started. For example, when a second boiler is started the initial firing rate is 100%/2 or 50%, when the third boiler is started the firing rate starts at 200%/3 or 66%. After the initial start, the Sequence Master develops a unison firing rate demand based on it’s setpoint and sensed header temperature.

10. Innovative Condensing Boiler Control

During low loads, the Sequence Master limits firing rates to a ‘Base Load Common Rate’ to ensure modulating condensing boiler peak operating efficiency. Lower firing rates boost efficiency by helping increase the amount of flue gas water vapor condensation. The Control maintains a “Base Load Common Rate” until the last lag boiler is started. At this point, the “Base Load Common Rate” is released to allow boilers to modulated as required to meet heat load.

11. Advanced Boiler Sequencing

After there is a Call For Heat input, both header water temperature and boiler firing rate percent are used to start and stop the networked boilers. The control starts and stops boilers when the water temperature is outside the user selected “Diff Above” and “Diff Below” settings. Also, in order to minimize temperature deviations, the control adjusts the number of boilers running based on the firing rate. This combination allows the boilers to anticipate slow load changes before they disrupt water temperature yet still respond quickly to sudden load changes. These special sequencer features help reduce energy wasting system temperature swings and the resulting unnecessary boiler cycling.

12. Stop All Boilers

All boilers are stopped without delay if the Call for Heat input is removed or if the header temperature is higher than 195°F (90.6°C) (field adjustable).

X. Operation

E. Boiler Sequence of Operation

1. Normal Operation

Table 3: Boiler Sequence of Operation

Status Screen Display	Description
Boiler 1 <input checked="" type="checkbox"/> Supply 140 F Setpoint 140 F Rate 0% ▾ Priority: Standby Status: Standby	Priority: Standby Status: Standby (burner Off, circulator(s) Off) Boiler is not firing and there is no call for heat, priority equals standby. The boiler is ready to respond to a call for heat.
Boiler 1 <input checked="" type="checkbox"/> Supply 140 F Setpoint 140 F Rate 0% ▾ Priority: Central Heat Status: Standby	Priority: Central Heat Status: Standby (burner Off, circulator(s) On) Boiler is not firing. There is a Central Heat call for heat and the Supply temperature is greater than setpoint minus the "Diff Below".
Boiler 1 <input checked="" type="checkbox"/> Supply 132 F Setpoint 140 F Rate 98% ▾ Priority: Central Heat Status: Prepurge 10	Priority: Central Heat Status: Prepurge When supply temperature drops burner demand continues with following Status shown: Safe Startup: Flame circuit is tested. Drive purge: The blower is driven to the fan purge speed. Prepurge: After the blower reaches the fan purge speed setting the combustion chamber purge is conducted.
Boiler 1 <input checked="" type="checkbox"/> Supply 132 F Setpoint 140 F Rate 89% ▾ Priority: Central Heat Status: Direct Ignition	Priority: Central Heat Status: Direct ignition After purge time is complete the following Status is shown: Drive light-off: The blower is driven to light-off rate. Pre-Ignition Test: After the blower reaches light-off rate a safety relay test is conducted. Pre-ignition: Spark is energized and it is confirmed that no flame is present Direct Ignition: Spark and Main fuel valve are energized.
Boiler 1 <input checked="" type="checkbox"/> Supply 132 F Setpoint 140 F Rate 100% Priority: Central Heat Status: Running	Priority: Central Heat Status: Running (burner On, circulator(s) On) After flame is proven the sequence continues with run stabilization and low fire hold time. Once the field adjustable low fire hold time is completed normal boiler operation begins, modulation rate depending on temperature and setpoint selections.
Boiler 1 <input checked="" type="checkbox"/> Supply 132 F Setpoint 180 F Rate 100% Priority: Domestic Hot Water Status: Running	Priority: Domestic Hot Water Status: Running If the Central Heat call for heat is active and a Domestic Hot Water (DHW) call for heat received the DHW demand becomes the "priority" and the modulation rate, setpoint, "Diff Above" and "Diff Below" are based on DHW settings.
Boiler 1 <input checked="" type="checkbox"/> Supply 132 F Setpoint 140 F Rate 100% ▾ Priority: Standby Status: Post-purge 30	Priority: Standby Status: Post-purge (burner Off, circulator(s) Off) If there is no call for heat the main fuel valve is closed and the blower is driven to the fan post-purge speed. After the blower reaches the fan post-purge speed setting the combustion chamber purge is conducted.
Boiler 1 <input checked="" type="checkbox"/> Supply 132 F Setpoint 140 F Rate 100% ▾ Priority: Standby Status: Standby delay 30	Priority: Standby Status: Standby Delay Standby delay status is entered when a delay is needed before allowing the burner control to be available. For example, when Anti-Short Cycle time is selected Standby delay is entered after the Central Heat call for heat ends. Select "Help" button from the "Home Screen" to determine the cause of the Standby Delay.
Boiler 1 <input checked="" type="checkbox"/> Active Fault Supply 132 F Setpoint 140 F Rate 100% ▾ Priority: Standby Status: Lockout	Priority: Standby Status: Lockout A lockout status is entered to prevent the boiler from running due to a detected problem. Select "Help" button from the "Home Screen" to determine the cause of the Lockout. The last 10 Lockouts are recorded in the Lockout History.

I. Operation E. Boiler Sequence Of Operation (continued)

2. Using The Display

The Control includes a touch screen LCD display. The user monitors and adjusts boiler operation by selecting screen navigation “buttons” and symbols. The “Home Screen” and menu selections are shown below. When no selection is made, while viewing any screen, the display reverts to the “Home Screen” after 4 minutes. The “Home Screen” provides boiler temperature, firing rate in BTU/hr, boiler status, efficiency information and page links.

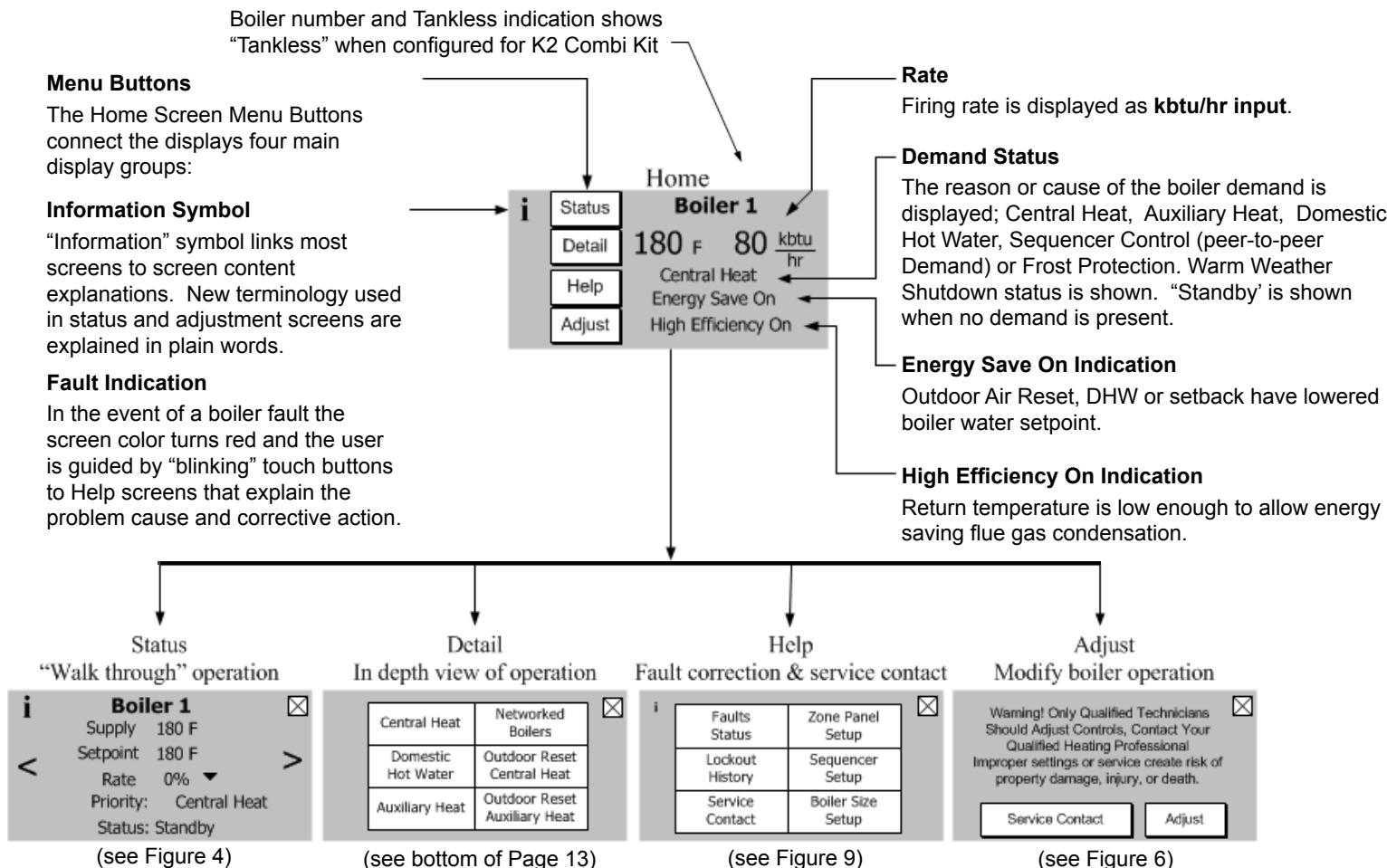


Figure 1: Home Screen Details

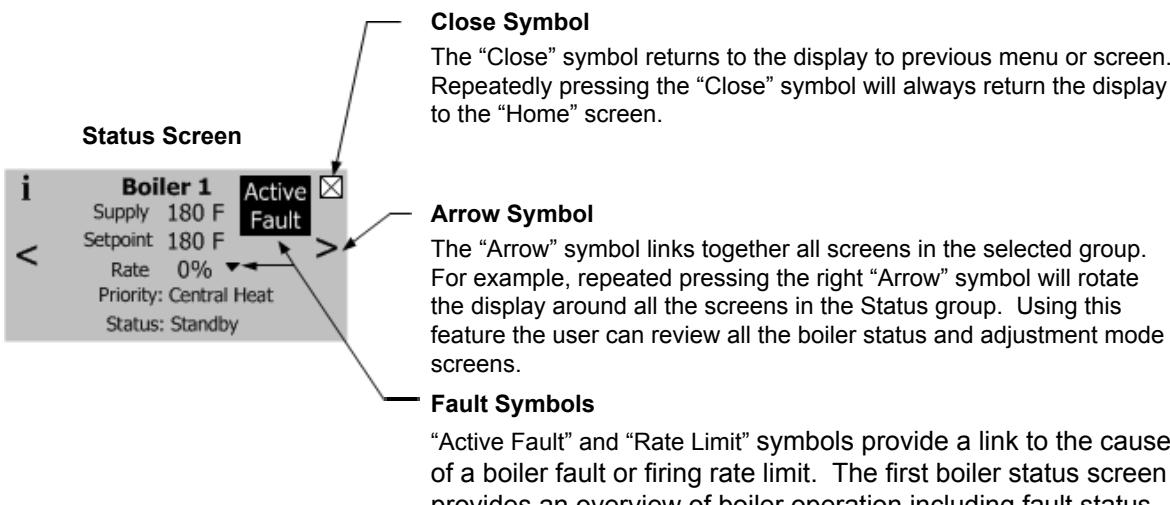


Figure 2: Screen Navigation

I. Operation E. Boiler Sequence Of Operation (continued)

3. Status Screens

Boiler Status screens are the primary boiler monitoring screens. The user may simply “walk” though boiler operation by repeatedly selecting the right or left “arrow” symbol. These screens are accessed by selected the “Status” button from the “Home” screen.

NOTE

Only visible if Zone Panel is connected. Zone Panel 1 and 2 shown typical for 1 through 4.

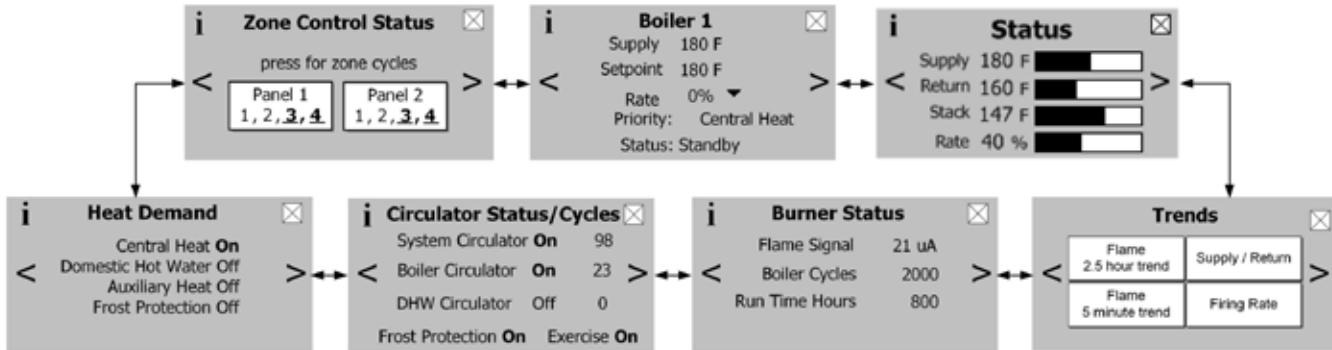


Figure 3: Status Screen Overview

Supply:

Measured supply water temperature. This is the temperature being used to start/stop and fire boiler when there is a call-for- heat. Header temperature is shown when selected.

Setpoint:

This is the active setpoint. This temperature setpoint determined based on active priority; Central Heat, Auxiliary Heat or Domestic Hot Water. The setpoint may be the result of Outdoor Air Reset and Setback selections.

Rate:

The rate % value is equal to the actual kbtu/hr input divided by the boiler rated input.

Priority:

The selected Priority is shown. Available Priorities are: Standby (no call for heat is present), Sequencer Control, Central Heat, Auxiliary Heat, Domestic Hot Water, Frost Protection or Warm Weather Shutdown.

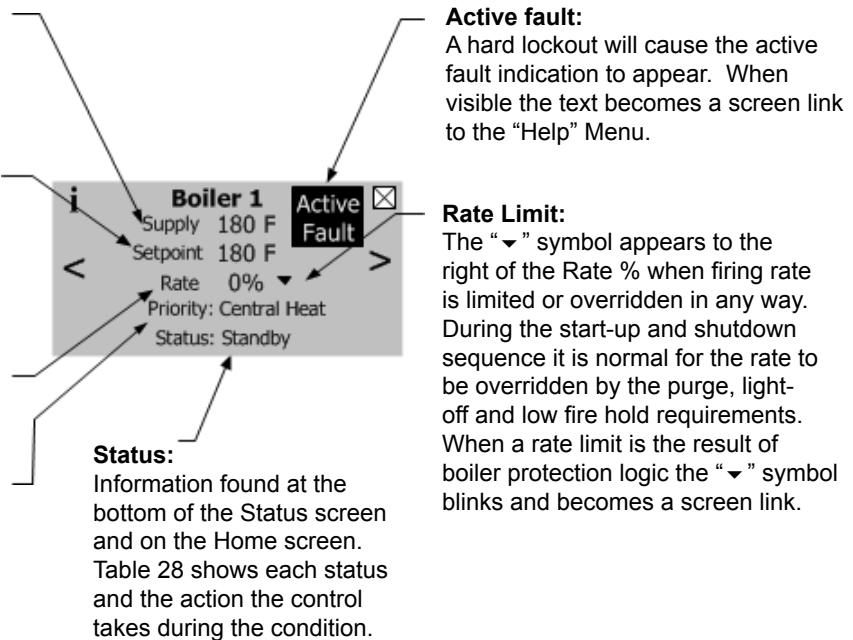
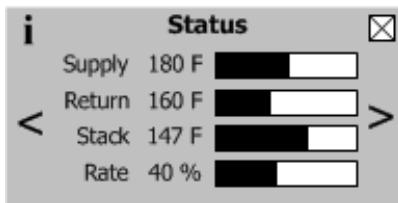


Figure 4: Boiler Status Screen Definitions

I. Operation E. Boiler Sequence Of Operation (continued)

3. Status Screens (continued)

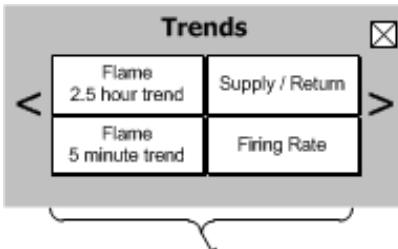
Bargraph Screen



Bargraph Screen

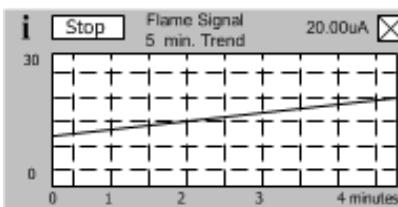
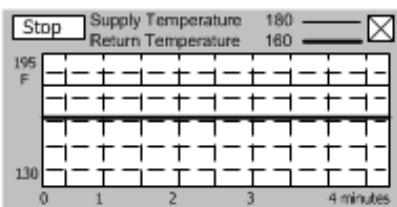
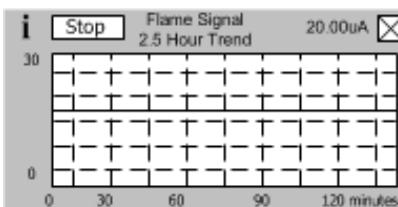
The bargraph screen presents measured values for easy comparison.

Trend Screens



Data Logging

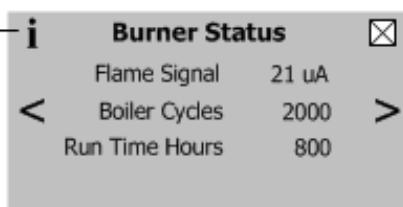
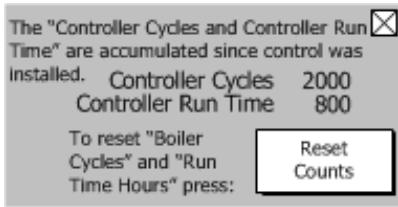
Real time graphic trends allow users to observe process changes over time providing valuable diagnostic information. For example, flame current performance over start up periods and varying loads can be an indication of gas supply issues. Additionally, supply and return temperature dual pen trends brings a focused look at heat exchanger and pump performance. For example, studying a differential temperature trend may indicate pump speed settings need to be changed.



NOTE

Firing Rate Trend shows fan demand and feedback.

Burner Status Screen



Cycles and Hours

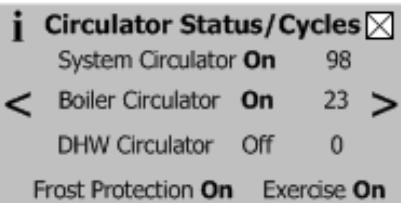
Boiler cycles and hours are used to monitor the boilers overall compatibility to the heating load. Excessive cycling compared to run time may be an indication of pumping, boiler sizing or adjustment issues.

NOTE

"Boiler Cycle" and "Run Time Hours" are resettable by selecting the "Reset Counts" button located on the information screen. The "Controller Cycles" and "Controller Run Time" data is not resettable and remains for the life of the control.

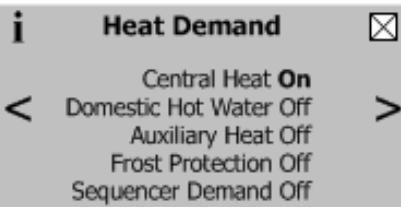
I. Operation E. Boiler Sequence Of Operation (continued)

Circulator Status Screen



Pumping is a major part of any hydronic system. This screen provides the status of the boiler's demand to connected pumps as well as the status of Frost Protection and pump Exercise functions.

Head Demand Screen



This screen provides the status of the boilers five (5) possible heat demands. When demand is off the Control has not detected the call-for-heat. This screen allows the user to determine which demands are present when more than one demand is present.

Zone Control Status Screens

NOTE

Only visible if Zone Panel is connected. Zone Panel 1 and 2 shown typical for 1 through 4.

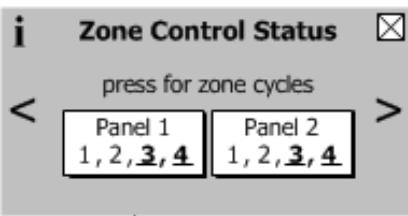
Individual zone heat loss may be adjusted under the Adjust "Modulation" menu. Also zone descriptions may be modified using the "Zone Control Description" menu.

To reset all zone cycle counts to zero press "Reset Cycle Counts":

Reset Cycle Counts

NOTE

Zone cycles are resettable by selecting the "Reset Cycle Counts" button located on the information screen.



Zone Control Status

Screen provides status and a page links for up to four zone panels. Individual zone "on" status is shown by a bold zone number with a solid underscore. "Press" the zone control "button" to view individual zone .

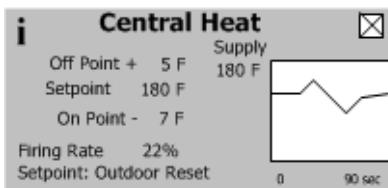
Demand	Cycles	Size(kbtu/hr)
KITCHEN	OFF	500
KIDS BEDROOM	OFF	100
MASTER BEDROOM	ON	50
Domestic HW	ON	3500
		40

Zone Panel 1 (typical for 2 through 4)

Zone panel screens show individual zone status, cycle counts and individual zone expected heat rate in kbtu/hr. Individual zone expected heat rate may be adjusted under the Adjust "Modulation" menu. Also zone descriptions may be modified using the "Zone Control Description Setup" menu.

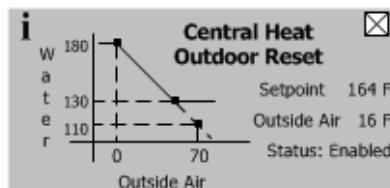
4. Detail Screens

Detail screens are accessed by selecting the "Detail" button from the "Home" screen. These screens provide in depth operating parameter status such as "On Point", "Off Point" and "Setpoint Source" information. Demand-specific details are provided for Central Heat, Auxiliary Heat, Domestic Hot Water and the Sequence Master demands. Detail screens also provide details on outdoor air reset and Sequencer network status. Sequencer screens are only shown when the Sequence Master is enabled.



Demand Detail Display

(Central Heat shown, Typical for Auxiliary Heat, Domestic Hot Water and Sequencer Master)



Outdoor Reset Display

(Central Heat shown, Typical for Auxiliary Heat)

I. Operation E. Boiler Sequence Of Operation (continued)

5. Multiple Boiler Sequencer Screens

When the Sequence Master is enabled the following screens are **available**:

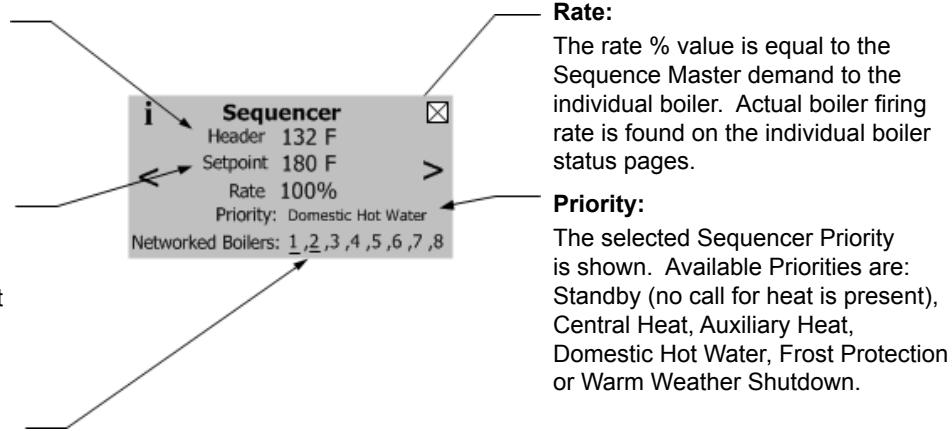
The Sequencer Status screen is selected by “pressing” “Status” button from the “Home” screen when Sequence Master is enabled.

Header:

measured header water temperature. This is the temperature being used to start, stop and fire boiler when there is a call-for-heat.

Setpoint:

this is the active setpoint. This temperature is the result of Outdoor Air Reset, Setback and Domestic Hot Water (DHW) selections.



Rate:

The rate % value is equal to the Sequence Master demand to the individual boiler. Actual boiler firing rate is found on the individual boiler status pages.

Priority:

The selected Sequencer Priority is shown. Available Priorities are: Standby (no call for heat is present), Central Heat, Auxiliary Heat, Domestic Hot Water, Frost Protection or Warm Weather Shutdown.

Networked Boiler Status:

Provides connected, start sequence and firing rate status information for all connected boiler addresses. The boiler number is underlined if the boiler is running and blinks if the boiler has the start sequence in progress. For example the status for boiler address 1 is provided as follows:

- 1 - Boiler 1 is connected to the network
- 1 - “Blinking underline” - boiler 1 is starting
- 1 - “Solid underline” - boiler 1 is running

The “Networked Boilers” screen is selected by “pressing” the “Detail” button from the “Home” screens and “pressing” Networked Boilers” from the “Detail” screen.

Boiler Number:

Up to eight (8) boiler's status is shown

Lead Boiler:

Upon power up the lowest numbered boiler becomes the lead boiler. The lead boiler is the first to start and last to stop. The lead boiler is automatically rotated after 24 hours of run time.

Additionally, the lead is rotated if there is a lead boiler fault.

Networked Boilers			
Boiler 1	Lead	50%	Firing
Boiler 2		50%	Firing
Boiler 3		0 %	Available
Boiler 4		0 %	Available

Firing Rate:

Actual firing rate is provided.

Sequence Status:

Slave boiler status is provide as follows:

Available: Boiler is ready and waiting to be started by the Sequencer Master.

Add Stage:

Boiler has begun the start sequence but has not yet reached the boiler running status.

Boiler is running.

On Leave: Boiler has left the network to service a DHW demand.

Recovering: Boiler is in the process of returning to the network. For example, the slave boiler is in the Postpurge state.

Note: The recovery time is normally 30 seconds. However, if the slave boiler fails to start the recovery time increases from 30 seconds to 5, 10 and 15 minutes.

Disabled:

Boiler has a lockout condition and is unable to become available to the Sequencer Master.

I. Operation

F. Changing Adjustable Parameters

1. Entering Adjust Mode

The Control is factory programmed to include basic modulating boiler functionality. These settings are password protected to discourage unauthorized or accidental changes to settings. User login is required to view or adjust these settings:

- Press the “Adjust” button on the “Home” screen.
- Press the “Adjust” button on the Adjust Mode screen or Press “Service Contact” for service provider contact information.
- Press “Login” button to access password screen.
- Press 5-digit display to open a keypad. Enter the password (Installer Password is 86) and press the return arrow to close the keypad. Press the “Save” button.
- Press the “Adjust” button to enter Adjustment mode.

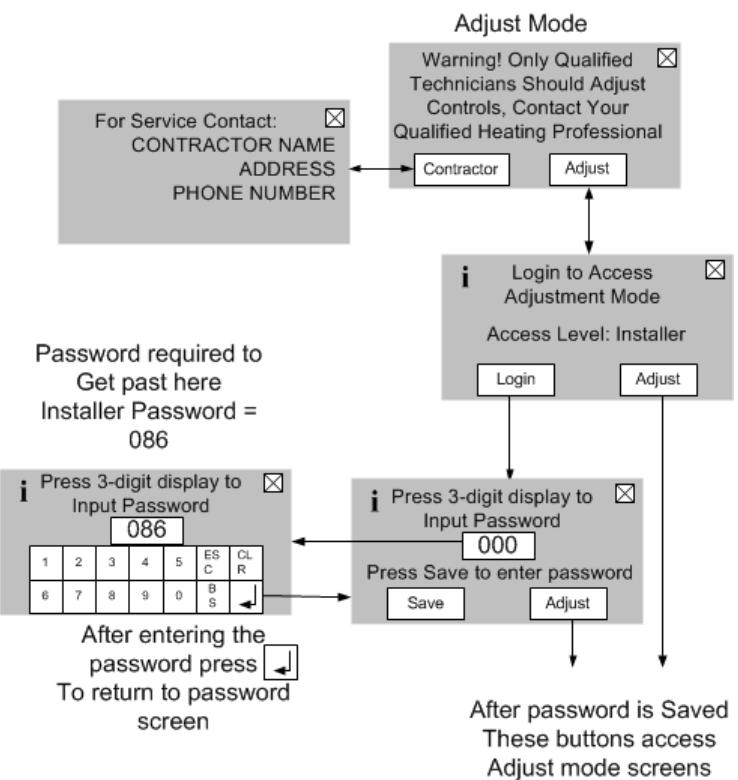
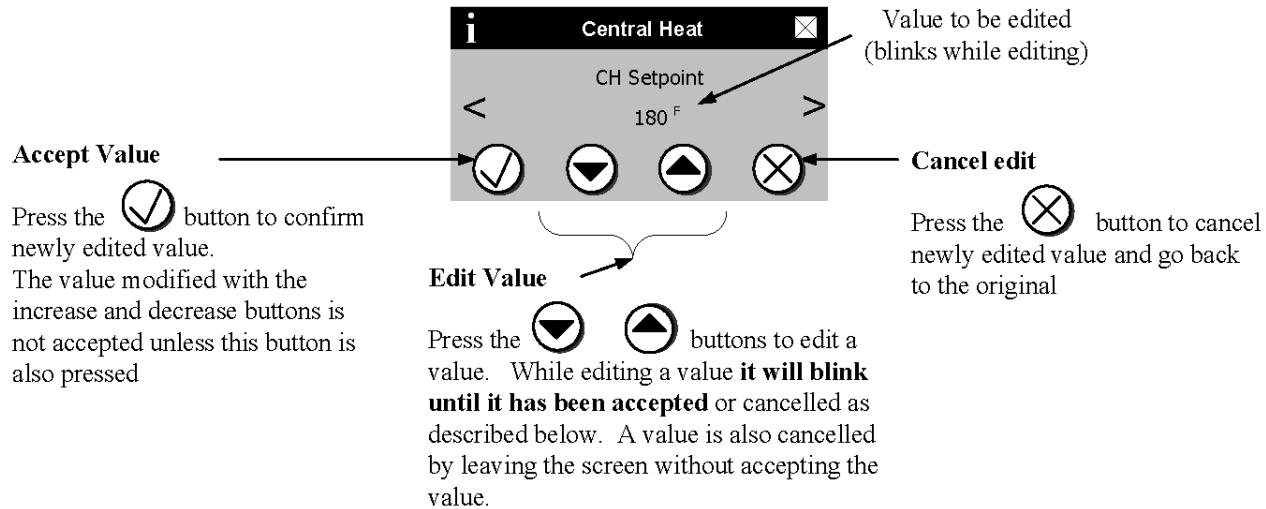


Figure 5: Adjust Mode Screens

2. Adjusting Parameters

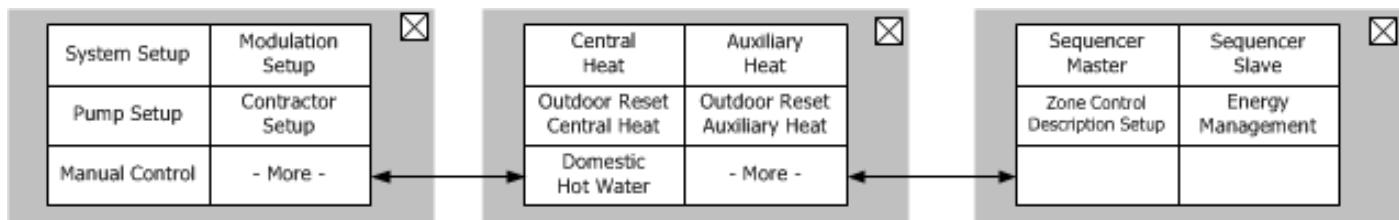
Editing parameters is accomplished as follows:



I. Operation F. Changing Adjustable Parameters (continued)

2. Adjusting Parameters (continued)

The following pages describe the Control's adjustable parameters. Parameters are presented in the order they appear on the Control's Display, from top to bottom and, left to right. From the "Home" screen select the Adjust button to access the adjustment mode screens show below (if required, refer to the previous page to review how to enter Adjustment mode):



"Press" **System Setup** button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description						
Fahrenheit	Fahrenheit, Celsius	Temperature Units The Temperature Units parameter determines whether temperature is represented in units of Fahrenheit or Celsius degrees.						
2	0-14	Display Brightness Display brightness is adjustable from 0 to 14.						
7	0-14	Display Contrast Display contrast is adjustable from 0 to 14.						
Wired	Not Installed, Wired, Wireless	Outdoor Sensor Source Not Installed Outdoor Sensor is not connected to the boiler, the sensor is not monitored for faults. Wired Outdoor Sensor is installed directly on the boiler terminal Strip-TB2. Wireless Outdoor sensor is installed and wireless.						
0	-100 to 100 tenths of degree	Outdoor Air Sensor Calibration Outdoor Air Sensor Calibration offset allows a single point calibration. Using a reliable source (reference) for outdoor temperature measure outdoor air temperature. Set the offset equal to the difference between the controller reading and the reference. The result will be the Control's measurement matching the reference reading.						
Not Connected	Connected, Not Connected	Zone Control Status Connected When the Zone Control is connected adjustable settings are automatically shown under the Adjust "Modulation", "Auxiliary Heat" and "Zone Control Description Setup" menus. This feature allows these adjustments to be made before the zone panel is connected. When the user selects "Show As If Connected" Zone Control related parameters are made visible and may be adjusted.						
Enabled	Enable/Disable	Frost Protection Disable Frost Protection is not used. Enable Boiler and system circulators start and boiler fires when low outside air, supply and return temperatures are sensed as follows: <table style="margin-left: auto; margin-right: auto;"><thead><tr><th>Device Started</th><th>Start Temperatures</th><th>Stop Temperatures</th></tr></thead><tbody><tr><td>Boiler & System</td><td>Outside Air < 0° (-18°C)°F</td><td>Outside Air > 4°F (-16°C)</td></tr></tbody></table>	Device Started	Start Temperatures	Stop Temperatures	Boiler & System	Outside Air < 0° (-18°C)°F	Outside Air > 4°F (-16°C)
Device Started	Start Temperatures	Stop Temperatures						
Boiler & System	Outside Air < 0° (-18°C)°F	Outside Air > 4°F (-16°C)						
0 Secs	0-900 Secs	Anti-Short Cycle Time Anti-short cycle is a tool that helps prevent excessive cycling resulting from a fast cycling Thermostat or Zone valves. It provides a minimum delay time before the next burner cycle. DHW demand is serviced immediately, without any delay.						
Disabled	Enable/Disable	Warm Weather Shutdown Enable Disable Warm Weather Shutdown (WWSD) is not used. Enable The boiler and pumps will not be allowed to start in response to a central heat call for heat if the outside temperature is greater than the WWSD setpoint. WWSD is initiated as soon as outside air temperature is above WWSD Setpoint. The control does not require call for heat to be satisfied. The boiler will still start in response to a Domestic Hot Water call for heat.						
70°F	0-100°F	Warm Weather Shutdown Setpoint The Warm Weather Shutdown (WWSD) Setpoint used to shutdown the boiler when enabled by the "WWSD Enable" parameter.						

I. Operation F. Changing Adjustable Parameters (continued)

2. Adjusting Parameters (continued)



WARNING

Asphyxiation Hazard. Boiler type is factory set and must match the boiler model. Only change the boiler type setting if you are installing a new or replacement Control. The boiler type setting determines minimum and maximum blower speeds. Incorrect boiler type can cause hazardous burner conditions and improper operation that may result in PROPERTY LOSS, PHYSICAL INJURY OR DEATH.

“Press”  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
See Table 4	See Table 4	<p>Boiler Type Boiler Size Setup To verify the boiler size selection, a qualified technician should do the following: 1. Check boiler's label for actual boiler size. 2. Set “Boiler Type” to match actual boiler size. 3. Select “Confirm”. The Boiler Type parameter changes the minimum and maximum modulation settings. This parameter is intended to allow a user to set the parameters in a spare part Control to a particular boiler type.</p>
100%	Minimum to Maximum Heat Rate	<p>Central Heat Maximum Expected Heat Rate This parameter defines the highest modulation rate the Control will go to during a central heat call for heat. If the rated input of the installed home radiation is less than the maximum output of the boiler, change the Central Heat Maximum Expected Heat Rate (fan speed) setting to limit the boiler output accordingly.</p>
80%	Minimum to Maximum Heat Rate	<p>Domestic Hot Water (DHW) Max Expected Heat Rate This parameter defines the highest modulation rate the Control will go to during a Domestic Hot Water call for heat. If the rated input of the indirect water heater is less than the maximum output of the boiler, change the DHW Maximum Expected Heat Rate (fan speed) setting to limit the boiler output accordingly.</p>
100%	Minimum to Maximum Heat Rate	<p>Auxiliary Maximum Expected Heat Rate This parameter defines the highest modulation rate the Control will go to during the auxiliary heat call for heat. If the rated input of the Auxiliary Heat Zones is less than the maximum output of the boiler, change the Auxiliary Heat Maximum Expected Heat Rate (fan speed) setting to limit the boiler output accordingly.</p>
40%	Minimum to Maximum Heat Rate	<p>Zone 1 Expected Heat Rate (typical for zone 1 through 16) This parameter defines the highest modulation rate the Control will go to during the Zone 1 call for heat. If the rated input of the installed home radiation in zone 1 is less than the maximum output of the boiler, change the Zone 1 Expected Heat Rate (fan speed) setting to limit the boiler output accordingly.</p>
30 Minutes	0 to 60 Minutes	<p>Zone Release Time After the Zone Release Time minutes and a zone has not been satisfied (thermostat opens) the measured heat loss will be released to increase to the Central Heat Maximum Heat Rate.</p>
See Table 4	Minimum - 100 to Maximum	<p>Minimum Modulation This parameter is the lowest modulation rate the Control will go to during any call for heat.</p>
See Table 4	See Table 4	<p>Lightoff Rate This is the blower speed during ignition and flame stabilization periods.</p>

I. Operation F. Changing Adjustable Parameters (continued)

Table 4: Parameters Changed Using the Boiler Type Parameter Selections:

Control Repair Part Kit	Part Number 106194-01				
Altitude	0 - 2000 Ft.				
Parameter	K2-80-02	K2-100-02	K2-120-02	K2-150-02	K2-180-02
Maximum Heat Rate (RPM)	5100	5500	5100	5400	6000
Minimum Heat rate (RPM)	1600	1650	1600	2000	1800
Absolute Maximum Heat Rate (RPM)	5400	6900	5700	6300	6700
Minimum Light-off (RPM)	3500	3500	3500	3500	3500
Maximum Light-off rate (RPM)	4000	4000	4000	4000	4000
Altitude	2001 - 4500 Ft.				
Parameter	K2-80-24	K2-100-24	K2-120-24	K2-150-24	K2-180-24
Maximum Heat Rate (RPM)	6000	7450	6900	7200	7050
Minimum Heat rate (RPM)	1600	1850	1750	2000	1800
Absolute Maximum Heat Rate (RPM)	7565	7620	6984	7200	7150
Minimum Light-off (RPM)	3500	3500	3500	3500	3500
Maximum Light-off rate (RPM)	4000	4000	4000	4000	4000
Altitude	4501 - 7800 Ft.				
Parameter	K2-80-57	K2-100-57	K2-120-57	K2-150-57	K2-180-57
Maximum Heat Rate (RPM)	6200	7500	7050	7300	7200
Minimum Heat rate (RPM)	1800	2000	1800	2000	1900
Absolute Maximum Heat Rate (RPM)	7720	7680	7132	7300	7385
Minimum Light-off (RPM)	3500	3500	3500	3500	3500
Maximum Light-off rate (RPM)	4000	4000	4000	4000	4000
Altitude	7801 - 10100 Ft.				
Parameter	K2-80-80	K2-100-80	K2-120-80	K2-150-80	K2-180-80
Maximum Heat Rate (RPM)	7000	7900	7240	7450	7500
Minimum Heat rate (RPM)	1900	2000	1800	2000	1900
Absolute Maximum Heat Rate (RPM)	7950	7975	7360	7450	7760
Minimum Light-off (RPM)	3500	3500	3500	3500	3500
Maximum Light-off rate (RPM)	4000	4000	4000	4000	4000

I. Operation F. Changing Adjustable Parameters (continued)

Expected Heat Rate Adjustment Screens (HeatMatch Software)

The Control is shipped with defaults that will provide improved operation. Adjustment is only required to optimize setup.

The expected heat rate adjustment is used to better match boiler output to the home heating needs. After receiving a "call for heat" the Control first uses the expected heat rate value to set a maximum heat rate. The maximum heat rate is the highest heat rate that the boiler can fire to at that moment. The maximum heat rate is the summation of the expected heat rates for the active (turned on) zones. After establishing the maximum heat rate the Control then measures water temperature and fires the boiler only as hard as required for the heat demand.

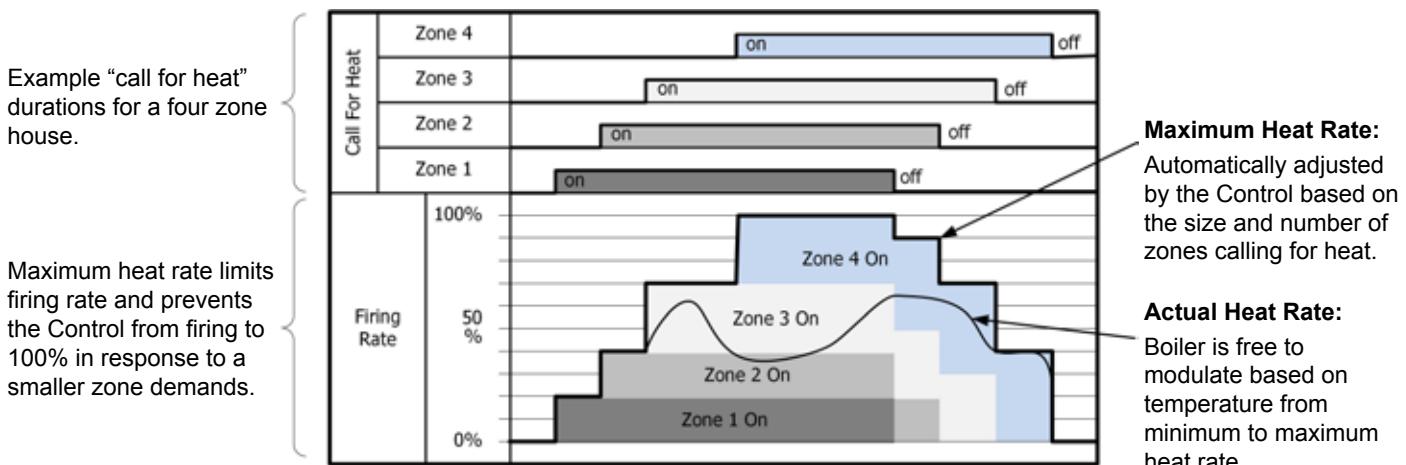


Figure 6: Four Zone House (with Zone Control Connected)

Maximum modulation numbers are shown in both RPM and kbtu/hr to allow for easier understanding of boiler heat rate.

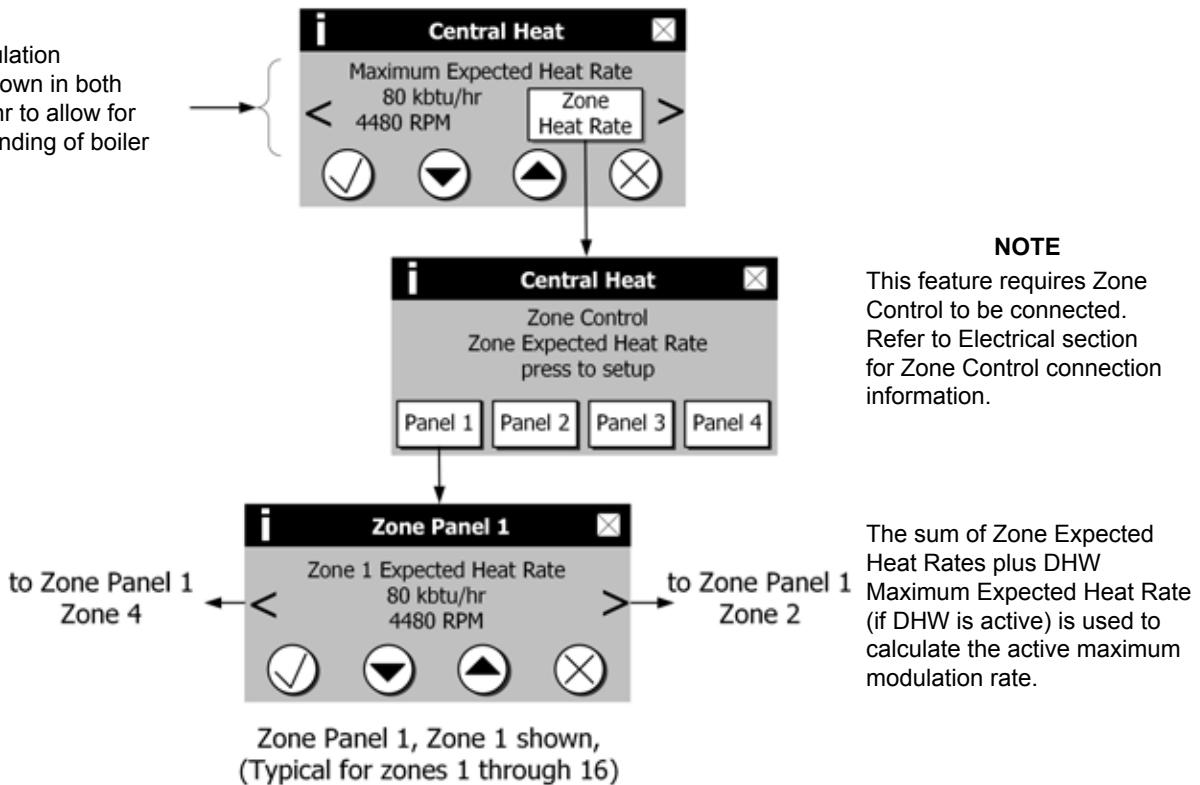


Figure 7: Expected Heat Rate Adjustment (with Zone Control Connected)

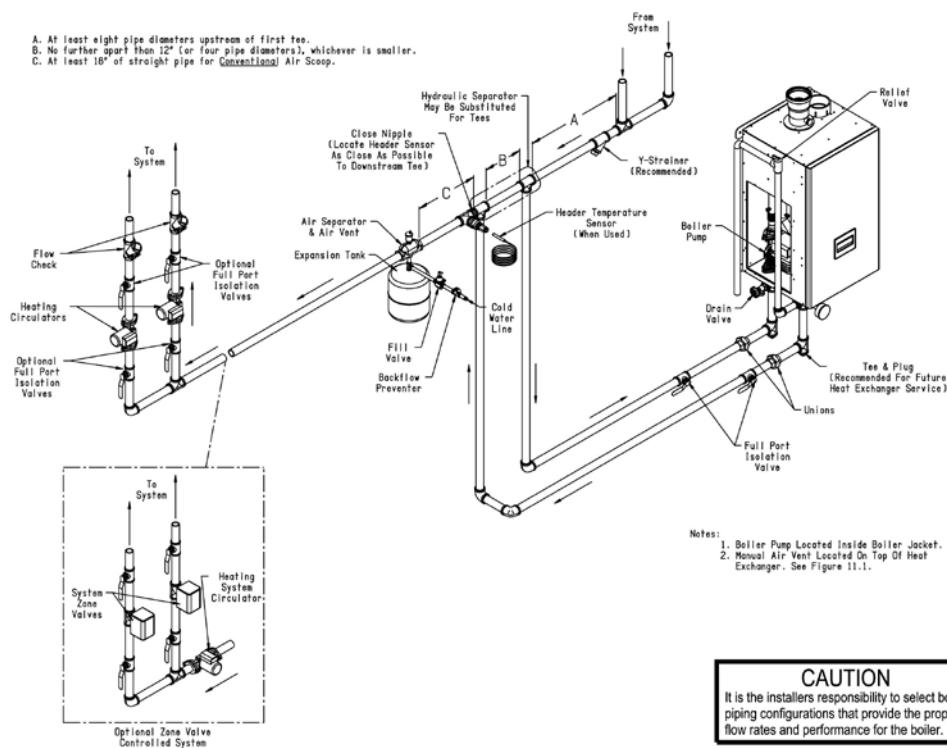
I. Operation F. Changing Adjustable Parameters (continued)

“Press” **Pump Setup** button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Central Heat, Optional Priority	Never, Any Demand, Central Heat, No Priority, Central Heat, Optional Priority	System Pump run pump for: Activates the system pump output according to selected function. Never: Pump is disabled and not shown on status screen. Any Demand: Pump Runs during any call for heat. Central Heat, No Priority: Pump Runs during central heat and frost protection call for heat. Pump <u>does not start</u> for a DHW call for heat and continues to run during Domestic Hot Water Priority. Central heat, Optional Priority: Pump Runs during central heat and frost protection call for heat. Pump <u>does not start</u> for a DHW call for heat and will be forced off if there is a DHW call for heat and Domestic Hot Water Priority is active.
Any Demand	Any Demand, Header Sensor Demand	Boiler Pump run pump for: Activates the boiler pump output according to selected function. Any Demand: Pump Runs during any call for heat. Header Sensor Demand: Pump Runs when boiler is firing and when there is DHW demand. Selected when Header Sensor is selected as modulation sensor and boiler is a stand alone boiler.
Primary Loop Pipe IWH	Never, Primary Loop Piped IWH,	Domestic Pump run pump for: Activates the Domestic pump output according to selected function. Never: Pump is disabled and not shown on status screen. Primary Loop Piped IWH: Pump Runs during domestic hot water call for heat. Domestic Hot Water Priority enable/disable does not affect pump operation.

Example Pump Parameter selections:

Single boiler with no Indirect Water Heater



Parameter Selection:

System pump = “Central Heat, Optional Priority”

Boiler pump = “any demand”

DHW pump = “never”

Explanation:

This piping arrangement only services central heat. When there is any demand both boiler and system pumps turn on.

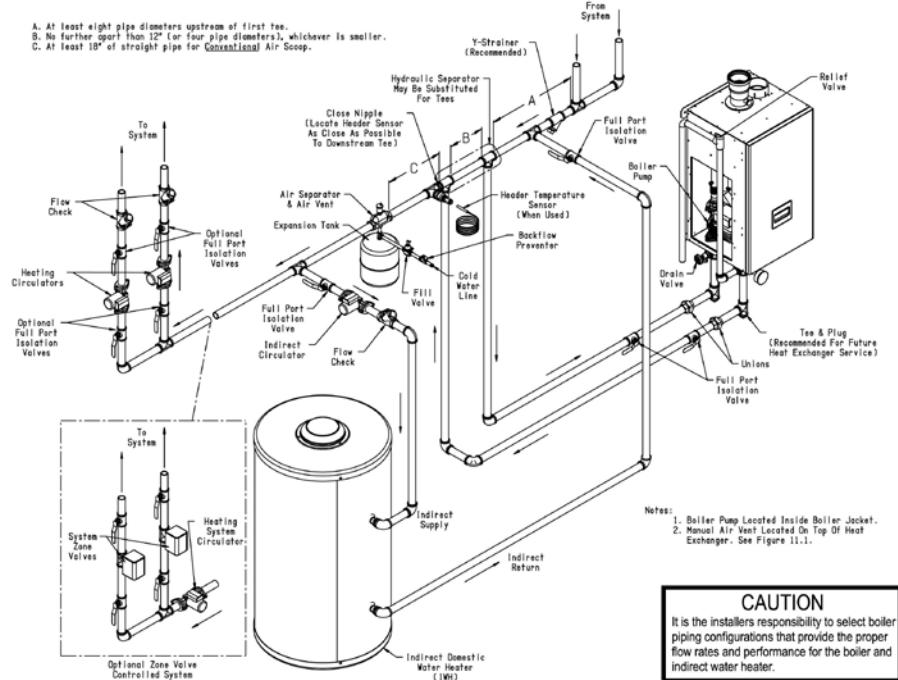
CAUTION

It is the installers responsibility to select boiler piping configurations that provide the proper flow rates and performance for the boiler.

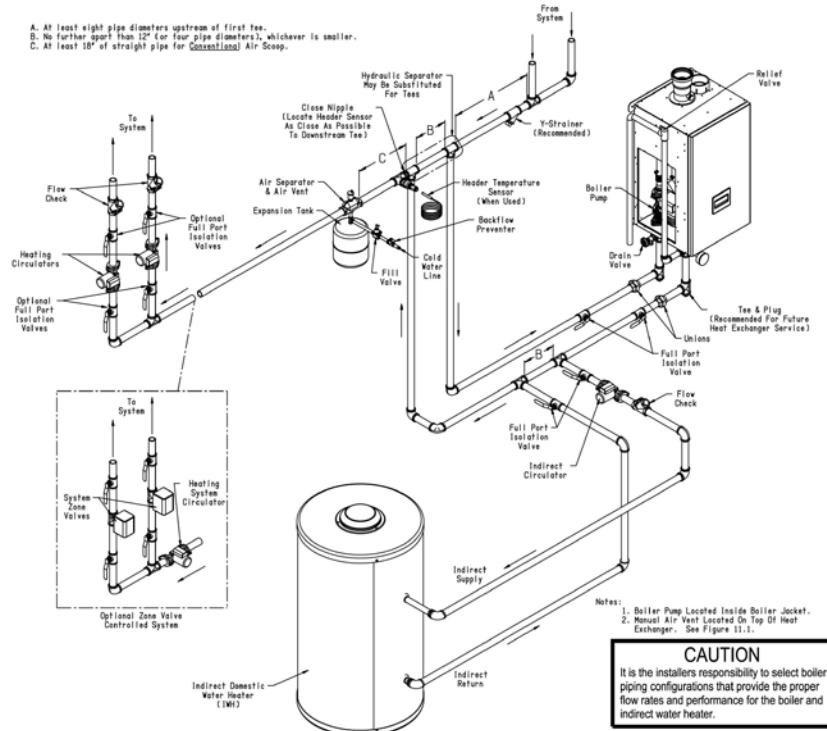
I. Operation F. Changing Adjustable Parameters (continued)

Example Pump Parameter selections (continued):

Single boiler Indirect Water Heater (IWH) Piped to Primary, Optional Domestic Hot Water Priority.



Multiple Boilers with Boiler Piped IWH, System and DHW Wired to Master



	Sequencer Master (Boiler 1)	Boiler 2
Wiring locations:		
Thermostat	X	
DHW call for heat	X	
System pump	X	
DHW pump	X	
Boiler Pump	X	X
Sequencer Master Parameter Selections:		
Sequencer Master	Enabled	
Indirect Water Heater	"Boiler Piped"	
Pump Parameter Selections:		
System Pump =	Central Heat, No Priority	Never
Boiler Pump =	Any demand	Any demand
DHW Pump =	"Primary Piped"	Never

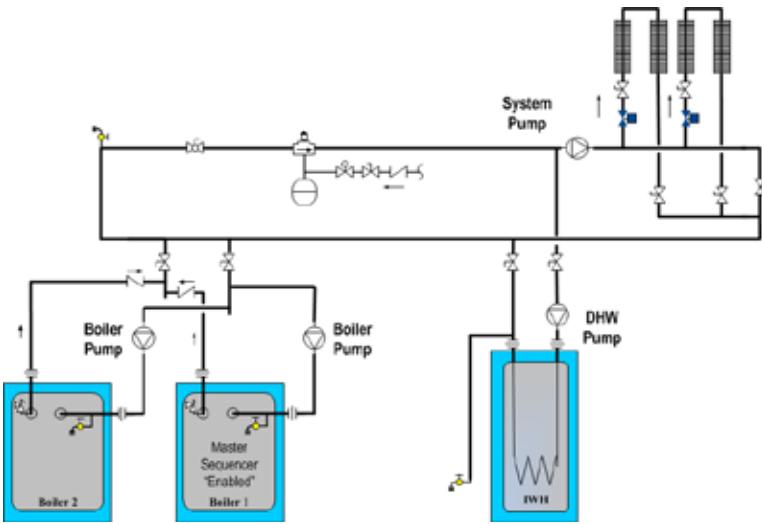
Explanation:

When call for Domestic Hot Water is received the DHW pump is turned on and the boiler pump is turned on. However, the system pumps may run to satisfy a central heat demand that is being satisfied by a different slave. The central heat demand is ignored by Slave 1 until the domestic hot water demand is ended.

I. Operation F. Changing Adjustable Parameters (continued)

Example Pump Parameter selections (continued):

Multiple boilers IWH Piped to Primary, Optional Domestic Hot Water Priority

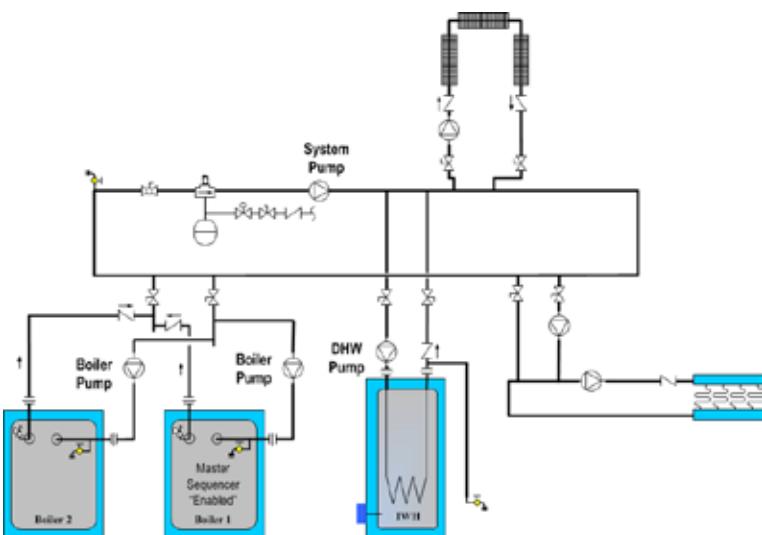


	Sequencer Master (Boiler 1)	Boiler 2
Wiring locations:		
Thermostat	X	
DHW call for heat	X	
System pump	X	
DHW pump	X	
Boiler Pump	X	X
Sequencer Master Parameter Selections:		
Sequencer Master	Enabled	
Indirect Water Heater	"Primary Piped"	
Pump Parameter Selections:		
System Pump =	Central Heat, Optional Priority	Never
Boiler Pump =	Any demand	Any demand
DHW Pump =	Primary Loop Piped IWH	Never

Explanation:

This piping arrangement permits the system pump to run or not run when there is a domestic hot water call for heat. Domestic hot water priority is optional. It is permissible for the domestic and system pumps to run at the same time. The boiler pump must run for every call for heat.

Multiple Boilers, IWH piped to primary, system pump required to run for any call for heat



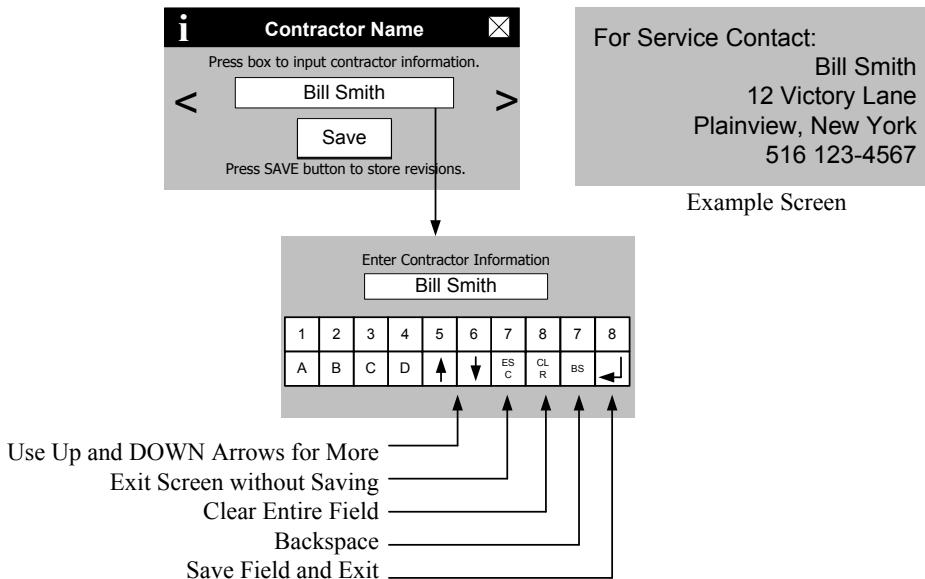
	Sequencer Master (Boiler 1)	Boiler 2
Wiring locations:		
Thermostat	X	
DHW call for heat	X	
System pump	X	
DHW pump	X	
Boiler Pump	X	X
Sequencer Master Parameter Selections:		
Sequencer Master	Enabled	
Indirect Water Heater	"Primary Piped"	
Pump Parameter Selections:		
System Pump =	Any demand	Never
Boiler Pump =	Any demand	Any demand
DHW Pump =	Primary Loop Piped IWH	Never

Explanation:

This piping arrangement requires the system pump to be running for any calls for heat. Also the boiler pump must run for any call for heat.

I. Operation F. Changing Adjustable Parameters (continued)

“Press”  button to access the following parameters:



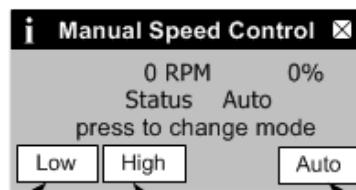
Factory Setting	Range / Choices	Parameter and Description
Contractor Name	User defined	Contractor Name
Address Line 1	User defined	Contractor Address Line 1
Address Line 2	User defined	Contractor Address Line 2
Phone	User defined	Contractor Phone

“Press”  button to access the following screen:

The Manual Speed Control speed screen allows the technician to set firing rate at low or high speed for combustion testing.

NOTE
 Rate % can only be set when the boiler has heat demand and is released to modulate.

“Press” “Low” to select manual firing rate control and Minimum firing rate %



“Press” “High” to select manual firing rate control and Central Heat Maximum firing rate %

NOTE
 Selecting “Low” or “High” locks (manual mode) firing rate at min or max Rate %. After combustion testing select “Auto” to return the boiler to normal operation.

Press “Auto” to return firing rate to Automatic Mode

I. Operation F. Changing Adjustable Parameters (continued)

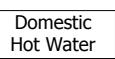
"Press"  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
180°F (82.2°C)	60°F to 190°F (16°C to 87.8°C)	Central Heat Setpoint Target temperature for the central heat priority. Value also used by the outdoor air reset function.
170°F (76.7°C)	60°F to 190°F (16°C to 87.8°C)	Central Heat Thermostat "Sleep" or "Away" Setback Setpoint Thermostat setback setpoint is used when the EnviraCOM thermostat is in "leave" or "sleep" modes and sensed at E-COM terminals D, R, and C. When setback is "on" the thermostat setback setpoint shifts the reset curve to save energy while home is in a reduced room temperature mode. The reset curve is shifted by the difference between the High Boiler Water Temperature and the Thermostat Setback Setpoint. Honeywell VisionPro IAQ part number TH9421C1004 is a "setback" EnviraCOM enabled thermostat. When connected, it allows boiler water setback cost savings.
10°F (5.6°C)	2°F to 25°F (1.1°C to 14°C)	Central Heat Diff Above The boiler stops when the water temperature rises 'Diff Above' degrees above the setpoint. NOTE Never set the Diff Above such that the Setpoint plus the 'Diff Above' is greater than 200°F. the result may be nuisance manual reset hard lockouts. For example, if the setpoint is 180°F, the maximum 'Diff Above' is 20°F. Further, if the setpoint is 190°F, the maximum 'Diff Above' is 10°F.
5°F (2.8°C)	2°F to 25°F (1.1°C to 14°C)	Central Heat Diff Below The boiler starts when the water temperature drops 'Diff Below' degrees below the setpoint.
3	1 to 5	Response Speed This parameter adjusts the Central Heat temperature controller Proportion Integral Derivative (PID) values. Higher values cause a larger firing rate change for each degree of temperature change. If set too high firing rate "overshoots" required value, increases to high fire causing the temperature to exceed the "Diff Above" setpoint and cycle the boiler unnecessarily. Lower values cause a smaller firing rate change for each degree of temperature change. If set too low, the firing rate response will be sluggish and temperature will wander away from setpoint.
120 seconds	0 to 300 seconds	Low Fire Hold Time "Low Fire Hold Time" is the number of seconds the control will wait at low fire modulation rate before being released to modulate. After ignition and flame stabilization periods the firing rate is held at low fire for "Low Fire Hold Time". This delay allows heat to travel out to the system and provide system feedback prior to the control modulating firing rate.
Supply Sensor	Supply Sensor, Header Sensor	Modulation Sensor Heat Demand may respond to the boiler's Supply Temperature or Header Temperature sensors. When Header Sensor is selected the boiler is fired in response to the sensor wired to Header Sensor Low Voltage Terminal Block Terminals.

I. Operation F. Changing Adjustable Parameters (continued)

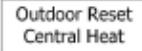
 “Press” Auxiliary Heat button to access the following parameters:		
Factory Setting	Range / Choices	Parameter and Description
180°F (82.2°C)	60°F to 190°F (16°C to 87.8°C)	Auxiliary Heat Setpoint Target temperature for the Auxiliary Heat priority. Value also used by the outdoor air reset function.
170°F (76.7°C)	80°F to 190°F (26.7°C to 87.8°C)	Auxiliary Heat Thermostat “Sleep” or “Away” Setback Setpoint Thermostat setback setpoint is used when the EnviraCOM thermostat is in “leave” or “sleep” modes and sensed at E-COM terminals D, R, and C. When setback is “on” the thermostat setback setpoint shifts the reset curve to save energy while home is in a reduced room temperature mode. The reset curve is shifted by the difference between the High Boiler Water Temperature and the Thermostat Setback Setpoint. Honeywell VisionPro IAQ part number TH9421C1004 is a “setback” EnviraCOM enabled thermostat. When connected, it allows boiler water setback cost savings.
10°F (5.6°C)	2°F to 25°F (1.1°C to 14°C)	Auxiliary Heat Diff Above The boiler stops when the water temperature rises ‘Diff Above’ degrees above the setpoint. NOTE Never set the Diff Above such that the Setpoint plus the ‘Diff Above’ is greater than 200°F. the result may be nuisance manual reset hard lockouts. For example, if the setpoint is 180°F, the maximum ‘Diff Above’ is 20°F. Further, if the setpoint is 190°F, the maximum ‘Diff Above’ is 10°F.
5°F (2.8°C)	2°F to 25°F (1.1°C to 14°C)	Auxiliary Heat Diff Below The boiler starts when the water temperature drops ‘Diff Below’ degrees below the setpoint.
3	1 to 5	Response Speed This parameter adjusts the Auxiliary Heat temperature controller Proportion Integral Derivative (PID) values. Higher values cause a larger firing rate change for each degree of temperature change. If set too high firing rate “overshoots” required value, increases to high fire causing the temperature to exceed the “Diff Above” setpoint and cycle the boiler unnecessarily. Lower values cause a smaller firing rate change for each degree of temperature change. If set too low, the firing rate response will be sluggish and temperature will wander away from setpoint.
Disable	Disable, Enable	Auxiliary Priority Over Central Heat This parameter allows the Auxiliary Heat demand to be higher or lower priority than Central Heat demand. When both demands are active at the same time the Control uses the Setpoint, Diff Above and Diff Below for the demand that has priority. Disabled Auxiliary Heat is lower priority than Central Heat demand. Enable Auxiliary Heat is higher priority than Central Heat demand.
Zone Control	Zone Control, DHW Terminal	Auxiliary Heat Demand Source The Control’s “DHW Temp Switch” input terminal may be used as a Domestic Hot Water (DHW) demand or Auxiliary Heat demand. When the Domestic Hot Water Demand Source is set to Zone Control and the Auxiliary Heat Demand Source is set to “DHW Terminal” an Auxiliary Heat Demand may be wired to the DHW Temp Switch terminals. This feature may be used even if a Zone Control is not installed. Zone Control Auxiliary Heat demand may only be wired to the Zone Control DHW Terminal Auxiliary Heat demand may be wired to the Zone Control or DHW Terminal.
Supply Sensor	Supply Sensor, Header Sensor	Modulation Sensor Heat Demand may respond to the boiler’s Supply Temperature or Header Temperature sensors. When Header Sensor is selected the boiler is fired in response to the sensor wired to Header Sensor Low Voltage Terminal Block Terminals.

I. Operation F. Changing Adjustable Parameters (continued)

“Press”  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Tank	Tank, Tankless	Domestic Hot Water Heater Type Tank Selected when boiler is piped to an indirect water heater. Tankless Selected when a K2 Combi Kit is attached to the boiler. When selected special parameters are entered to allow the required Combi rate of response. When “Tankless” is selected the only Domestic Hot Water parameter that is visible is Priority Time.
170°F (76.7°C)	60°F to 190°F (16°C to 87.8°C)	Domestic Hot Water Setpoint The Domestic Hot Water (DHW) Setpoint parameter is used to create a minimum boiler water temperature setpoint that is used when DHW heat demand is “on”. When the DHW heat demand is not “on” (the contact is open or <u>not wired</u>) this setpoint is ignored.
160°F (71.1°C)	60°F to 190°F (16°C to 87.8°C)	Domestic Hot Water Thermostat “Sleep” or “Away” Setback Setpoint Thermostat setback setpoint is used when the EnviraCOM thermostat is in “leave” or “sleep” modes and sensed at E-COM terminals D, R, and C. When setback is “on” the thermostat setback setpoint shifts the DHW setpoint to lower the DHW temperature and to save energy while home is in a reduced room temperature mode.
7°F (3.9°C)	2°F to 10°F (1.1°C to 5.6°C)	Domestic Hot Water Diff Above The boiler stops when the water temperature rises ‘Diff Above’ degrees above the setpoint.
5°F (2.8°C)	2°F to 25°F (1.1°C to 14°C)	Domestic Hot Water Diff Below The boiler starts when the water temperature drops ‘Diff Below’ degrees below the setpoint.
3	1 to 5	Response Speed This parameter adjusts the Domestic Hot Water temperature controller Proportion Integral Derivative (PID) values. Higher values cause a larger firing rate change for each degree of temperature change. If set too high firing rate “overshoots” required value, increases to high fire causing the temperature to exceed the “Diff Above” setpoint and cycle the boiler unnecessarily. Lower values cause a smaller firing rate change for each degree of temperature change. If set too low, the firing rate response will be sluggish and temperature will wander away from setpoint.
10 seconds	0 to 300 seconds	Low Fire Hold Time “Low Fire Hold Time” is the number of seconds the control will wait at low fire modulation rate before being released to modulate. After ignition and flame stabilization periods the firing rate is held at low fire for “Low Fire Hold Time”. This delay allows heat to travel out to the indirect water heater and provide feedback prior to the control modulating firing rate.
Enable	Enable Disable	Domestic Hot Water Priority (DHWP) When Domestic Hot Water Priority is Enabled and Domestic Hot Water (DHW) heat demand is “on” the DHW demand will take “Priority” over home heating demand. When the System and Boiler pumps are configured as “Central Heat (off DHW priority)” or “Central Heat, Optional Priority” then they will be forced “off” during DHW Priority. Priority protection time is provided to end DHWP in the event of a failed or excessive long DHW demand.
60	30 to 120 Minutes	Priority Time When DHWP is Enabled the Priority Time Parameter appears and is adjustable.
DHW Terminal	DHW Terminal, Zone Control	Domestic Demand Source The Control’s “DHW Temp Switch” input terminal may be used as a DHW demand or Auxiliary Heat demand. When “DHW Terminal” is selected the Control will accept a DHW input from either the “DHW Temp Switch” or the Zone Control (zone 4, set to priority). If “Zone Control” is selected the Control can only accept the DHW input from the Zone Control. This allows the Control to be set to accept an Auxiliary heat demand from the “DHW Temp Switch” input terminal. Refer to the Auxiliary heat menu for required selection to use this input. DHW Terminal DHW demand may be wired to the DHW Switch terminal or Zone Control. Zone Control DHW demand may only be wired to the Zone Control.

I. Operation F. Changing Adjustable Parameters (continued)

“Press”  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Enabled	Enable Disable	<p>Central Heat Outdoor Reset Enable If an outdoor sensor is installed and Outdoor Reset is Enabled, the boiler will automatically adjust the heating zone set point temperature based on the outdoor reset curve in Figure 8. The maximum set point is defined by the Central Heat Setpoint [factory set to 180°F (82.2°C)] when the outdoor temperature is 0°F (-18°C) or below. The minimum set point temperature shown is 130°F (54.4°C) [adjustable as low as 80°F (26.7°C)] when the outdoor temperature is 50°F (10°C) or above. As the outdoor temperature falls the supply water target temperature increases. For example, if the outdoor air temperature is 30°F, (-1.1°C) the set point temperature for the supply water is 150°F (65.6°C).</p> <p>Disable <u>Do Not Calculate</u> setpoint based on outdoor temperature Enable Calculate the temperature setpoint based on outdoor temperature using a reset curve defined by Low Outdoor Temp, High Outdoor Temp, Low Boiler Water Temp, Min Boiler Temp and Central Heat Setpoint and Boost Time parameters.</p>
0°F (-18°C)	-40°F to 100°F (-40°C to 37.8°C)	<p>Central Heat Low Outdoor Temperature The Low Outdoor Temperature parameter is also called “Outdoor Design Temperature”. This parameter is the outdoor temperature used in the heat loss calculation. It is typically set to the coldest outdoor temperature.</p>
70°F (21.1°C)	32°F to 100°F (0°C to 37.8°C)	<p>Central Heat High Outdoor Temperature The High Outdoor Temperature parameter is the outdoor temperature at which the Low Boiler Water Temperature is supplied. This parameter is typically set to the desired building temperature.</p>
110°F (43.3°C)	70°F to 190°F (21.1°C to 87.8°C)	<p>Central Heat Low Boiler Water Temperature The Low Boiler Water Temperature parameter is the operating setpoint when the High Outdoor Temperature is measured. If the home feels cool during warm outdoor conditions, the Low Boiler Water Temperature parameter should be increased.</p>
130°F (54.4°C)	80°F to 190°F (26.7°C to 87.8°C)	<p>Minimum Boiler Temperature (Central Heat and Auxiliary Heat) The Minimum Boiler Temperature parameter sets a low limit for the Reset setpoint. Set this parameter to the lowest supply water temperature that will provide enough heat for the type radiation used to function properly. Always consider the type of radiation when adjusting this parameter.</p>
20 Minutes	0-1800 Seconds (0-30 Minutes)	<p>Central Heat Boost Time When the Central Heat Setpoint is decreased by Outdoor Reset settings, the Boost Time parameter is used to increase the operating setpoint when the home heat demand is not satisfied after the Boost Time setting is exceeded. When heat demand has been “on” continuously for longer than the Boost Time parameter the operating setpoint is increased by 10°F (5.6°C). The highest operating setpoint from Boost Time is current Central Heat Setpoint minus the Central Heat “Diff Above” setting. A setting of 0 seconds disables this feature. Boost is not used when Sequence Master is enabled.</p>

X. Operation F. Changing Adjustable Parameters (continued)

“Press”  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Enabled	Enable Disable	<p>Auxiliary Heat Outdoor Reset Enable</p> <p>If an outdoor sensor is installed and Outdoor Reset is Enabled, the boiler will automatically adjust the heating zone set point temperature based on the outdoor reset curve in Figure 8. The maximum set point is defined by the Central Heat Setpoint [factory set to 180°F (82.2°C)] when the outdoor temperature is 0°F (-18°C) or below. The minimum set point temperature shown is 130°F (54.4°C) [adjustable as low as 80°F (26.7°C)] when the outdoor temperature is 50°F (10°C) or above. As the outdoor temperature falls the supply water target temperature increases. For example, if the outdoor air temperature is 30°F, (-1.1°C) the set point temperature for the supply water is 150°F (65.6°C).</p> <p>Disable <u>Do Not</u> Calculate setpoint based on outdoor temperature Enable Calculate the temperature setpoint based on outdoor temperature using a reset curve defined by Low Outdoor Temp, High Outdoor Temp, Low Boiler Water Temp, Min Boiler Temp and Central Heat Setpoint and Boost Time parameters.</p>
0°F (-18°C)	-40°F to 100°F (-40°C to 37.8°C)	<p>Auxiliary Heat Low Outdoor Temperature</p> <p>The Low Outdoor Temperature parameter is also called “Outdoor Design Temperature”. This parameter is the outdoor temperature used in the heat loss calculation. It is typically set to the coldest outdoor temperature.</p>
70°F (21.1°C)	32°F to 100°F (0°C to 37.8°C)	<p>Auxiliary Heat High Outdoor Temperature</p> <p>The High Outdoor Temperature parameter is the outdoor temperature at which the Low Boiler Water Temperature is supplied. This parameter is typically set to the desired building temperature.</p>
110°F (43.3°C)	70°F to 190°F (21.1°C to 87.8°C)	<p>Auxiliary Heat Low Boiler Water Temperature</p> <p>The Low Boiler Water Temperature parameter is the operating setpoint when the High Outdoor Temperature is measured. If the home feels cool during warm outdoor conditions, the Low Boiler Water Temperature parameter should be increased.</p>
0 Minutes	0-1800 Seconds (0-30 Minutes)	<p>Auxiliary Heat Boost Time</p> <p>When the Central Heat Setpoint is decreased by Outdoor Reset settings, the Boost Time parameter is used to increase the operating setpoint when the home heat demand is not satisfied after the Boost Time setting is exceeded. When heat demand has been “on” continuously for longer than the Boost Time parameter the operating setpoint is increased by 10°F (5.6°C). The highest operating setpoint from Boost Time is current Central Heat Setpoint minus the Central Heat “Diff Above” setting. A setting of 0 seconds disables this feature.</p>

I. Operation F. Changing Adjustable Parameters (continued)

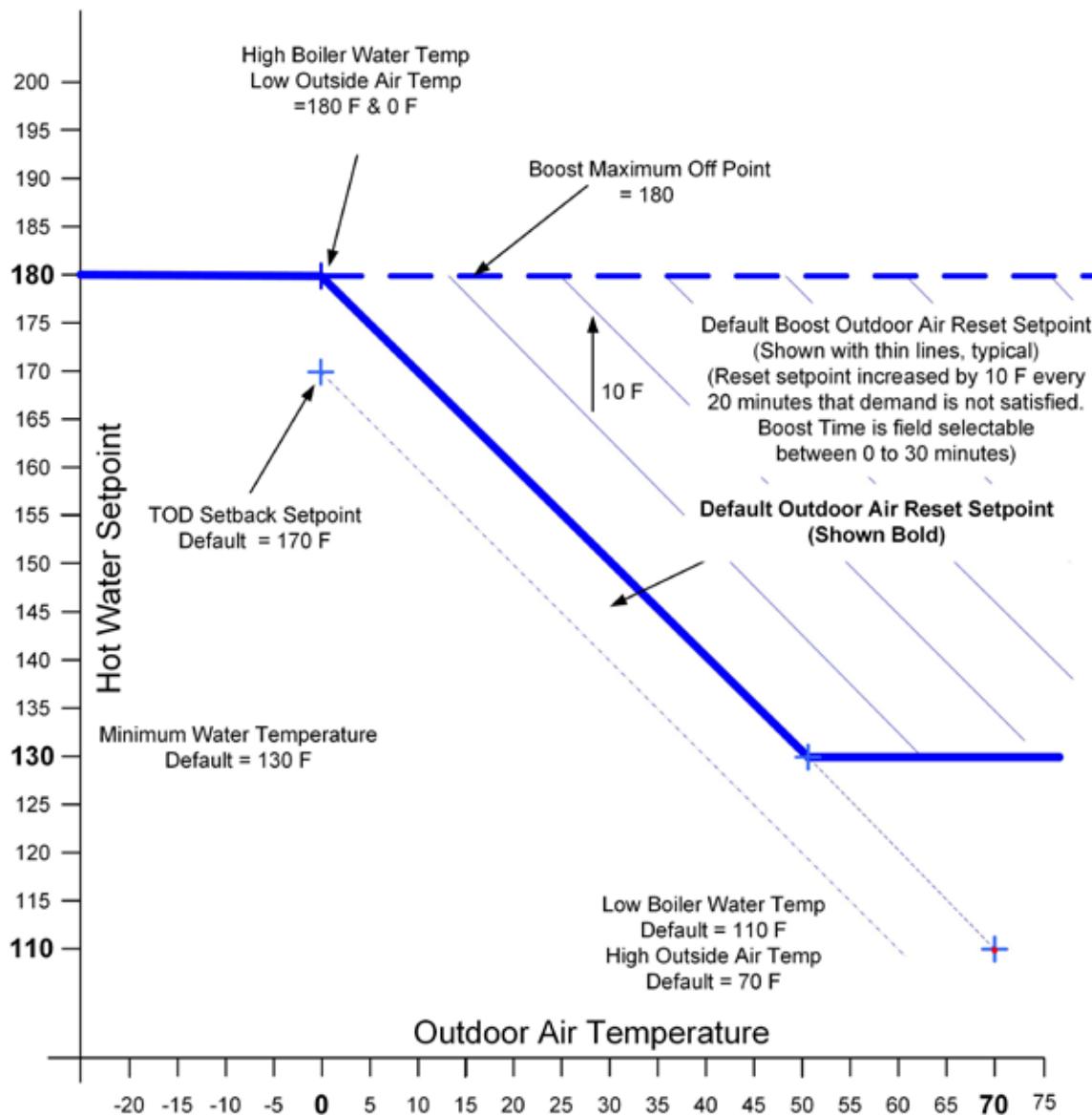


Figure 8: Outdoor Reset Curve

Central Heat Setpoint	Heating Element Type		Central Heat Setpoint	Heating Element Type	
180°F to 190°F (82.2°C to 87.8°C)	Fan Coil		100°F to 140°F (37.8°C to 60°C)	In Slab Radiant High Mass Radiant	
160°F to 190°F (71.1°C to 87.8°C)	Convection Baseboard Fin Tube Convective		130°F to 160°F (54.4°C to 71.1°C)	Staple-up Radiant Low Mass Radiant	
130°F to 160°F (54.4°C to 71.1°C)	Radiant Baseboard		140°F to 160°F (60°C to 71.1°C)	Radiators	

I. Operation F. Changing Adjustable Parameters (continued)

“Press”  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Disable	Enable, Disable	Master Enable/Disable The Sequencer Master Enable/Disable is used to “turn on” the Multiple Boiler Controller. Warning! enable ONLY one Sequence Master.
Boiler Piped	Boiler Piped, Primary Piped	Indirect Water Heater (IWH) Boiler Piped Sequencer to respond to an Isolated DHW demand that is piped to a single boiler. The individual boiler goes on “Leave” from the Sequencer Master and goes to DHW Service. Primary Piped The Sequence Master responds to the DHW Call For Heat. This allows one or more boilers to provide heat to the IWH.
Disabled	Enable, Disable	DHW Two Boiler Start The Sequencer to immediately start two boilers for a DHW call for heat. Used when DHW is the largest demand. Only visible when primary piped IWH is selected.
180 Secs	120 - 1200 Secs	Boiler Start Delay Slave boiler time delay after header temperature has dropped below the setpoint minus “Diff below” setpoint. Longer time delay will prevent nuisance starts due to short temperature swings.
195°F (90.6°C)	Central Heat Setpoint, 195°F (90.6°C)	Stop All Boilers Setpoint When this temperature is reached all boilers are stopped. This setpoint allows the Sequencer to respond to rapid load increases.
70%	50% - 100%	Base Load Common Rate To maximize condensing boiler efficiency, the firing rate is limited to an adjustable value. Boilers are kept at or below this firing rate as long as the boilers can handle the load. After last available boiler has started, the modulation rate limit is released up to 100%.
3	1-5	Response Speed This parameter adjusts the Sequence Master temperature controller Proportion Integral Derivative (PID) values. Higher values cause a larger firing rate change for each degree of temperature change. If set too high firing rate “overshoots” required value, increases to high fire causing the temperature to exceed the “Diff Above” setpoint and cycle the boiler unnecessarily. Lower values cause a smaller firing rate change for each degree of temperature change. If set too low, the firing rate response will be sluggish and temperature will wander away from setpoint.

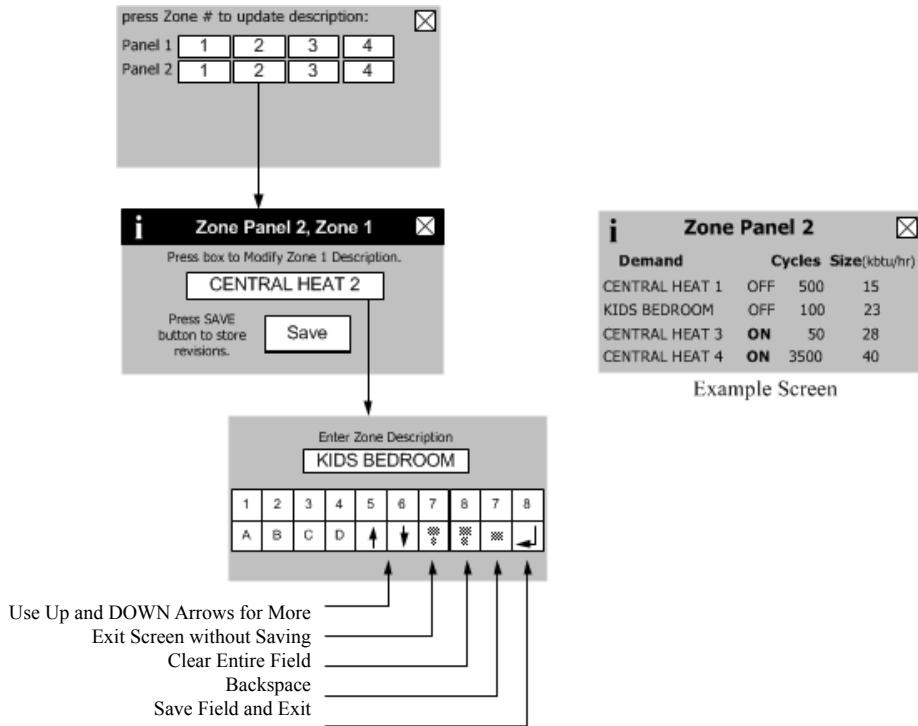
“Press”  button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
None	1-8	Boiler Address Each boiler must be given a unique address. When “Normal” slave selection order is used, the boiler address is used by the Master Sequencer as the boiler start order. The boiler address is also the Modbus Address when a Energy Management System is connected.
Normal	Use Boiler First, Normal, Use Boiler Last	Slave Selection Order “Use Boiler First”; places the Slave in the lead permanently. “Normal”; firing order follows boiler number (1,2,3,...) order. “Use Boiler Last”; places the slave last in the firing order.

I. Operation F. Changing Adjustable Parameters (continued)

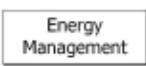
“Press”  button to access the following parameters:

NOTE
Zone Control Description Setup shown for 2 panels, typical for up to 4.



Factory Setting	Range / Choices	Parameter and Description	
Central Heat 1	User defined	Zone Control 1	Zone 1
Central Heat 2	User defined	Zone Control 1	Zone 2
Central Heat 3	User defined	Zone Control 1	Zone 3
Central Heat 4	User defined	Zone Control 1	Zone 4
Central Heat 1	User defined	Zone Control 2	Zone 1
Central Heat 2	User defined	Zone Control 2	Zone 2
Central Heat 3	User defined	Zone Control 2	Zone 3
Central Heat 4	User defined	Zone Control 2	Zone 4
Central Heat 1	User defined	Zone Control 3	Zone 1
Central Heat 2	User defined	Zone Control 3	Zone 2
Central Heat 3	User defined	Zone Control 3	Zone 3
Central Heat 4	User defined	Zone Control 3	Zone 4
Central Heat 1	User defined	Zone Control 4	Zone 1
Central Heat 2	User defined	Zone Control 4	Zone 2
Central Heat 3	User defined	Zone Control 4	Zone 3
Central Heat 4	User defined	Zone Control 4	Zone 4

I. Operation F. Changing Adjustable Parameters (continued)

 “Press” **Energy Management** button to access the following parameters:

Factory Setting	Range / Choices	Parameter and Description
Local	Local, 4-20mA	Central Heat Modulation Source This parameter enables the 4-20mA input to control firing rate and the thermostat input to control boiler on/off demand directly without using the internal setpoint. The 4-20mA selection is used to enable a remote multiple boiler controller to control the Sage2.2 Control: Local: 4-20mA Input on Terminal 9 & 10 is ignored. 4-20mA 4-20mA Input on Terminal 9 & 10 is used to control firing Rate % directly. Modbus Modbus input used to control firing Rate % directly.
Local	Local, 4-20mA	Central Heat Setpoint Source Sets the remote (Energy Management System) control mode as follows: Local: Local setpoint and modulation rate is used. 4-20mA input on Terminal 9 & 10 is ignored. 4-20mA 4-20mA Input on Terminal 9 & 10 is used as the temperature setpoint. The following two parameters may be used to adjust the signal range. Modbus Modbus is used as the temperature setpoint.
130°F (54.4°C)	80°F (26.7°C) - Central Heat Setpoint	Central Heat 4-20mAdc Setup, 4 mA Water Temperature* Sets the Central Heat Temperature Setpoint corresponding to 4mA for signal input on terminal 9 & 10. Current below 4mA is considered invalid, (failed or incorrect wired input).
180°F (82.2°C)	80°F (26.7°C) - Central Heat Setpoint	Central Heat 4-20mAdc Setup, 20 mA Water Temperature* Sets the Central Heat Temperature Setpoint corresponding to 20mA for signal input on terminal 9 & 10. Current above 20mA is considered invalid, (failed or incorrect wired input).
Local	Local, Modbus	Central Heat Demand Source This parameter enables a Modbus input to be take the place of the Heating Thermostat Input: Local Local Heating Thermostat input is used for Central Heat demand. Modbus Modbus input is used for Central Heat demand.

* Only visible when Central Heat Setpoint Source is set to 4-20mA.

II. Troubleshooting



WARNING

Electrical Shock Hazard. Turn off power to boiler before working on wiring.

A. Troubleshooting problems where no error code is displayed.

Condition	Possible Cause
Boiler not responding to call for heat, "Status" and "Priority" show "Standby".	Boiler is not seeing call for heat. Check thermostat or zone wiring for loose connection, miswiring, or defective thermostat/zone control.
Boiler not responding to a call for heat, "Status" shows "Standby" and "Priority" shows Central Heat or Domestic Hot Water.	Boiler is not firing, temperature is greater than setpoint. Water flow through boiler primary loop non-existent or too low.
Boiler Running but System or Boiler Circulator is not running	<ul style="list-style-type: none"> Check wiring for loose connection, miswiring. When there is a Domestic Hot Water Heat Request the System or Boiler pumps will be forced "off" when there "Run Pump for" parameter is set to "Central heat, off DHW demand" or "Central Heat, Optional Priority". This has been set to allow all of the heat to be provided for fast indirect water heater recovery. After one hour of "priority protection" or the end of the Domestic Hot Water Heat Request the system and boiler pumps will be free to run.
Home is cold during mild weather days	<ul style="list-style-type: none"> Increase Low Boiler Water Temperature parameter 5°F (2.8°C) per day.
Home is cold during cold weather days	<ul style="list-style-type: none"> Increase High Boiler Water Temperature parameter 5°F (2.8°C) per day

B. Display Faults:

Faults are investigated by selecting the "Help" button from the "Home" screen. When a fault is active the "Help" button flashes and the home screen turns a red color. Continue to select flashing buttons to be directed to the Fault cause.

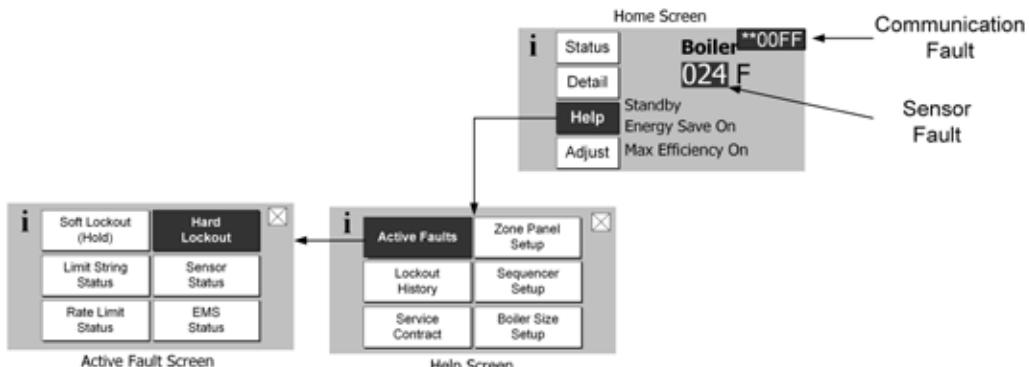


Figure 9: Help Menu

Indication	Condition	Possible Cause
Display Completely Dark Fan off, LWCO lights off, no green power light on Control	No 120Vac Power at Boiler	Check breaker and wiring between breaker panel and boiler. <ul style="list-style-type: none"> - Blown high voltage fuse, Replacement Fuse Kit, part number 105349-01.
Display Completely Dark, Fan running	No 24Vac Power to Control	<ul style="list-style-type: none"> - Loose 120Vac connection wiring between boiler J-Box and transformer - Loose 24 Vac connection wiring between transformer and Control. - Blown low voltage fuse, Replacement Fuse Kit, part number 105349-01.
Blinking Green power light on Control	Control Fault	<ul style="list-style-type: none"> - The green light is connected to internal power supply. The power supply is repeatedly starting and stopping (not normal) making the light flash. The microprocessors are not running. - Try disconnecting all terminals except 24VAC to power the Control. The green light should be steady. If it is not, then the control is defective. If steady, start plugging in all the connectors while watching the green light. When faulty wiring reconnected, green light will begin to flash.
Display Completely Dark but Boiler fires	No 5 Vdc Power to Display	<ul style="list-style-type: none"> - Loose 5 Vdc connection wiring between display and Control - Defective Display or Control.
**00FF or **ERFF	Display lost Communication with Control	<ul style="list-style-type: none"> - Loose or defective display harness - Defective Display - Defective Control
ER0011	Adjustment Mode Password Timeout	<ul style="list-style-type: none"> - The Control and Display are NOT defective. The password has timed out. Simply cycle power to the Display to restore operation.
ER0012	Control Failed	Defective Control. Replace Sage.

II. Troubleshooting (continued)

C. Help Screen Faults

Indication	Condition	Possible Cause
Zone Panel Setup Flashing	Zone Panel 1 Setup Flashing	<p>Zone Panel 1 communication lost, typical for Panel 1 through 4: The zone panel's communication was established and then lost. Check the following to correct the issue:</p> <ul style="list-style-type: none"> • Wiring between panel and boiler. • Zone panel DIP switch settings have changed: <ul style="list-style-type: none"> - Set Master/Slave switch to "Master" - Set Zone Control switch ZC1 to "ON" - Cycle power
	Zone Panel Failure Flashing	Zone Panel Electronics Failure: A Zone Panel
	Duplicate Zone Flashing	<p>Duplicate Zone: The Control has detected duplicate zone panel numbers. Check the following to correct:</p> <ul style="list-style-type: none"> • Each Zone Control DIP Switch must be set to a Unique setting: <p>Note that when multiple ZC switches are set on ON the Zone Panel is reported as Zone Panel 1.</p>
Sequencer Setup	Sequencer Setup Fault	<p>This alarm is active if the slave boiler has lost communication with the Sequence Master. Check the following:</p> <ul style="list-style-type: none"> - RJ 45 peer-to-peer network disconnected - Sequencer Master was Enabled and then Disabled - Master's Boiler has been powered down. - To clear fault restore communication or cycle power
Boiler Size Setup	Boiler Size Fault	<p>WARNING! Boiler size setting may not match actual boiler size. The Boiler size setting determines min, max and light-off blower speeds. Incorrect boiler size can cause hazardous burner conditions and improper operation that may result in PROPERTY LOSS, PHYSICAL INJURY, OR DEATH. Refer to page 95 for boiler size setting instructions.</p>

D. Help Screen Diagnostic Features

Indication	Possible Cause
<p>Lockout History 1 of 10 Supply High Limit < When Happen > Hard Lockout: 4 Cleared Status: Running Standby Run Time Hour: 50 75</p>	<p>Lockout History is stored in a first-in, first-out basis. Each History file is stored with boiler run hour of when the lockout occurred.</p> <p>The "When happened" and "Current" provide:</p> <ul style="list-style-type: none"> - "Current" is the run hour and status the boiler just finished. - "When happened" is the run hour and status when the lockout occurred.
<p>For Service Contact: CONTRACTOR NAME CONTRACTOR ADDRESS 1 CONTRACTOR ADDRESS 2 PHONE NUMBER</p>	<p>The user is given the contact information of the responsible service provider. Refer to page 20 for data entry instructions.</p>

II. Troubleshooting (continued)

E. Active Fault Screen Faults

Indication	Condition	Possible Cause
<p>Limit String Status</p> <p>i Limit String Status <input checked="" type="checkbox"/></p> <p>Limits Flow Switch</p> <p>Air Proving Switch</p>	Limit String Fault	<p>The Limit String Status screen shows the safety limit status. A contact icon, either "open" or "closed", graphically represents each safety limit. The "closed" contact icon is steady; the "open" contact icon is blinking. For example, the screen shown to the left illustrates a "closed" Limit contact and an "open" Flow Switch and Air Proving Switch Limit contacts.</p> <p>NOTE: Since the limit string items are wired in series, all limits downstream of the "open" limit will also appear on the screen as "open" (blinking) icons regardless of whether or not they are actually open. The Air Proving Switch is wired independent to all other limits. The Air Proving Switch is only required to be closed during boiler pre-purge. It is normal for it to be open during run mode.</p>
<p>Sensor Status</p> <p>i Sensor Inputs <input checked="" type="checkbox"/></p> <p>Supply Sensor 180 F Normal</p> <p>Return Sensor 768 F Shorted</p> <p>Stack Sensor 024 F Open</p> <p>Outdoor Sensor 45 F Normal</p> <p>Header Sensor 180 F Normal</p>	Sensor Fault	<p>The Sensor Status screen shows the status of all sensors. Possible states include:</p> <ul style="list-style-type: none"> None: Feature requiring this sensor has not been selected. Normal: Sensor is working normally. Shorted: Sensor is shorted or is defective. Open: There is a break in the wiring between the Control and the sensor or the sensor is defective Out of Range: Sensor is defective or is being subjected to electrical noise. Unreliable: Sensor is defective or is being subjected to electrical noise. <p>When a sensor fails "opened" or "shorted" the value is changed to reverse video (background black and value white) "024" or "768" respectively to indicate that there is a fault with the sensor.</p>
<p>Rate Limit</p> <p>Rate Limiter Max Expected Heat Rate <input checked="" type="checkbox"/></p> <p>The firing rate is limited by the expected heat rate (DHW plus Zones). Boiler is free to modulate up to the sum of the active heat rates. Each expected heat rate is adjustable under the modulation menu.</p>	Rate Limit	<p>The following messages appear when the firing rate is limited or reduced to help avoid a lockout or save energy.</p> <p>Refer to Hard Lockout section for corrective actions</p> <ul style="list-style-type: none"> - High Stack Temperature Limit - High Supply Temperature Limit - High Differential Temperature Limit <p>The following messages appear as part of normal start and stop sequences:</p> <ul style="list-style-type: none"> - Minimum Modulation (normal start/stop sequence) - Low Fire Hold Rate: Low fire hold rate is a normal start-up rate hold used to help ensure system temperature feedback prior to release to modulation. Low Fire Hold Time may be adjusted. Refer to the "Changing Adjustable Parameters", Paragraph F, for additional information. - Maximum Expected Heat Rate: Maximum Expected Heat Rate limit is a normal start-up rate hold used to save energy. This limit helps reduce extra cycles and save energy. Boiler is free to modulate up to the sum of the active zones and domestic hot water expected heat rates. Each zone heat rate is adjustable and may be modified under the modulation menu. Refer to the "Changing Adjustable Parameters", Paragraph F, for additional information.
<p>EMS Status</p> <p>i Energy Management Inputs <input checked="" type="checkbox"/></p> <p>Modbus Stat (563) on Selected</p> <p>Modbus Rate (581) 535 Selected</p> <p>Modbus Setpoint (562) Not Selected</p> <p>4-20mA Rate Input 4-20 mA Input Setpoint Not Selected</p>	Energy Management System Fault	<p>The Energy Management System (EMS) fault screen provides input fault status. When an input is shown as "Not Selected" it is not required for this application or has not yet been selected. These options are selected under the "Energy Management" Adjust mode menu.</p> <p>Modbus Input Failure</p> <p>If a modbus input is selected and out of range or not present a "535" value is shown reverse video (background black and value white). To fix the problem check the input source and check that the input is properly connected.</p> <p>4-20mA Input Failure</p> <p>Failure status for the 4-20mA input is the same as shown under Sensor Fault.</p>

II. Troubleshooting (continued)

F. Troubleshooting problems where a Soft Lockout Code is displayed. When a soft lockout occurs, the boiler will shut down, the display will turn red and the “Help” button will “blink”. Select the “blinking” “Help” button to determine the cause of the soft lockout. The boiler will automatically restart once the condition that caused the lockout is corrected.

Soft Lockout Codes Displayed

Lockout Number	Condition	Possible Cause
1 Anti Short Cycle	Minimum time between starts has not been reached. Normal delay used to avoid excessive cycles.	
2 Boiler Safety Limit Open	Boiler Safety Limit wired to terminals J6-1, 2 or 3 OPEN: <ul style="list-style-type: none"> • Thermal Fuse Switch contact open. • Air Pressure Switch contact open. • Auto Reset High Limit contact open. 	<ul style="list-style-type: none"> • Loose wiring to limit device. • Auto Reset Supply high limit sensor detected temperature in excess of 200°F. • Defective Auto Reset Supply High Limit Switch. • Thermal Fuse Switch blown due to temperature rise above 358°F. • Air Pressure Switch contact open - check for blocked vent/air intake. • See possible causes for “Hard Lockout 4”. <p>NOTE Block Vent Special Note Before a call for heat the air pressure switch is closed. When there is a call for heat with a blocked vent the air pressure switch will open (due to excessive pressure of the blower against a blocked flue pipe) after the blower starts. The control stops the start sequence and stops the blower. After the blower stops the pressure switch re-closes and the cycle continues. The displays shows the cause of trip for only the time the pressure switch is open.</p>
3 Boiler Safety Limit Open	Boiler Safety Limit, or External Limit wired to terminals J5-1 OPEN: <ul style="list-style-type: none"> • Jumper for External Limit wired to terminals 11 and 12 or device connected to it open. • Flow Switch contact open. 	<ul style="list-style-type: none"> • See possible causes for “Hard Lockout 4”. • Loose wiring to limit device. • External Limit defective or jumper not installed. • If yellow light on LWCO is on, system is low on water. • If neither yellow or green light is on, check LWCO harness. • Flow Switch contact open - Check for adequate flow. • Bad Flow Switch.
7 Return sensor (10 KOhms) fault	Shorted or open return temperature sensor.	<ul style="list-style-type: none"> • Shorted or mis-wired return sensor wiring. • Defective return sensor.
8 Supply sensor (10 KOhms) fault	Shorted or open supply temperature sensor.	<ul style="list-style-type: none"> • Shorted or mis-wired supply sensor wiring. • Defective supply sensor.
9 DHW sensor fault	Shorted or open Domestic Hot Water (DHW) temperature sensor.	<ul style="list-style-type: none"> • Shorted or mis-wired DHW sensor wiring. • Defective DHW sensor.
10 Stack sensor (10 KOhms) fault	Shorted or open flue gas (stack) temperature sensor.	<ul style="list-style-type: none"> • Shorted or mis-wired flue temperature sensor wiring. • Defective flue temperature sensor.
11 Ignition failure	Models K2-080 through K2-180 - flame failure after 5 tries to restart. <ul style="list-style-type: none"> • Flame rod not detecting flame. • Condensate trap plugged. 	<ul style="list-style-type: none"> • No gas pressure. • Gas pressure under minimum value shown on rating plate. • Gas line not completely purged of air. • Defective Electrode. • Loose burner ground connection. • Defective Ignition Cable. • Defective gas valve (check for 24 Vac at harness during trial for ignition before replacing valve). • Air-fuel mixture out of adjustment - consult factory. • Defective or fouled electrode. • Plugged drain line in trap.

II. Troubleshooting (continued)

Soft Lockout Codes Displayed (continued)

Lockout Number	Condition	Possible Cause
13 Flame rod shorted to ground	<ul style="list-style-type: none"> • Flame rod shorted to ground • Condensate Trap plugged. 	<ul style="list-style-type: none"> • Shorted or mis-wired flame rode wiring. • Defective flame rod. • Plugged drain line in trap.
14 DT inlet/outlet high	Temperature rise between supply and return is too high.	<ul style="list-style-type: none"> • Inadequate boiler water flow. Verify that circulator is operating and that circulator and piping are sized per K2 Installation Instructions Manual, Water Piping and Trim Section.
15 Return temp higher than supply	The Control is reading a return sensor temperature higher than the supply sensor temperature. Condition must be present for at least 75 seconds for this error code to appear.	<ul style="list-style-type: none"> • Flow through boiler reversed. Verify correct piping and circulator orientation. • No boiler water flow. Verify that system is purged of air and that appropriate valves are open. • Sensor wiring reversed. • Supply or return sensor defective.
16 Supply temp has risen too quickly	Supply water temperature has risen too quickly.	<ul style="list-style-type: none"> • See possible causes for "Hard Lockout 4". • Inadequate boiler water flow. • Verify that circulator is operating and that circulator and piping are sized per K2 Installation Instructions Manual, Water Piping and Trim Section.
17 Blower speed not proved	Normal waiting for blower speed to match purge and light-off setpoint.	
27 Interrupted Airflow Switch On	Interrupted Airflow Switch Failed in closed position	The air proving switch has failed on, check switch is operating properly
27 or 28 Interrupted Airflow Switch Off	Interrupted Airflow Switch Failed to Close	<p>The air proving switch has failed to close;</p> <ul style="list-style-type: none"> • Check switch, check switch connection and wiring. • Blocked vent, blocked inlet, blocked or disconnected inlet air switch tube, blocked heat exchanger or burner. • Something is blocking air/flue gas flow through boiler

II. Troubleshooting (continued)

G. Troubleshooting problems where a Hard Lockout Code is displayed. When a hard lockout occurs, the boiler will shut down, the display will turn red and the “Help” button will “blink”. Select the “blinking” “Help” button to determine the cause of the Hard Lockout. Once the condition that caused the lockout is corrected, the boiler will need to be manually reset using the Reset button on the “Active Fault” display or located on the Sage2.2 Control.

Alarm Output Contact

The Control includes an alarm output contact located on Control terminals J6 - 7 & 8. The alarm contact closes when the Control goes into a manual reset Hard Lockout. The list of Hard Lockouts is shown below.

Hard Lockout Codes Displayed

Lockout Number	Condition	Possible Cause
4 Supply high limit	Sage2.2 supply sensor detected temperatures in excess of 210°F.	<ul style="list-style-type: none"> Heating load at time of error was far below the minimum firing rate of the boiler. Defective system circulator or no flow in primary loop. Defective boiler circulator, no flow or insufficient flow in boiler loop. Control system miswired so that the boiler operation is permitted when no zones are calling.
5 DHW high limit	Sage2.2 DHW sensor detected temperatures in excess of Setpoint.	<ul style="list-style-type: none"> DHW load at time of error was far below the minimum firing rate of the boiler. Control system miswired so that boiler operation is permitted when no DHW are calling.
6 Stack High limit	Sage2.2 Flue gas (Stack) sensor detected temperatures in excess of 214°F (101°C).	<ul style="list-style-type: none"> Heat exchanger needs to be cleaned. Boiler over-fired. Air-fuel mixture out of adjustment - consult factory.
12 Flame detected out of sequence	A flame signal was present when there should be no flame. • Condensate trap plugged.	<ul style="list-style-type: none"> Defective gas valve - make sure inlet pressure is below maximum on rating plate before replacing valve. Plugged drain line in trap.
18 Light off rate proving failed	Blower is not running at Light-off rate when it should or blower speed signal not being detected by Sage2.2.	<ul style="list-style-type: none"> Loose connection in 120 VAC blower wiring. Loose or miswired blower speed harness. Defective blower
19 Purge rate proving failed	Blower is not running at Purge rate when it should or blower speed signal not being detected by Sage2.2.	<ul style="list-style-type: none"> Loose connection in 120 VAC blower wiring. Loose or miswired blower speed harness. Defective blower
20 Invalid Safety Parameters	Unacceptable Sage2.2 control Safety related parameter detected.	Safety Parameter verification required. Contact factory.
21 Invalid Modulation Parameter	Unacceptable Sage2.2 control Modulation related parameter detected.	Reset the control.
22 Safety data verification needed	Safety related parameter change has been detected and a verification has not been completed.	Safety related Sage2.2 control parameter has been changed and verification has not been performed.
23 24VAC voltage low/high	Sage2.2 control 24Vac control power is high or low.	<ul style="list-style-type: none"> Loose connection in 24Vac VAC power wiring. Loose or miswired 24Vac harness. Miswired wiring harness causing power supply short to ground. Defective transformer. Transformer frequency, voltage and VA do not meet specifications.
24 Fuel Valve Error	Power detected at fuel valve output when fuel valve should be off.	<ul style="list-style-type: none"> Loose or defective gas valve harness. Check electrical connections. Defective gas valve (check for 24 Vac at harness during trial for ignition before replacing valve).
25 Hardware Fault	Internal control failure.	<ul style="list-style-type: none"> Reset the control. If problem reoccurs, replace the Sage.
26 Internal Fault	Internal control failure.	<ul style="list-style-type: none"> Reset the control. If problem reoccurs, replace the Sage.
27 Ignition failure	Models K2-080 through K2-180 Flame failure after 1 try to restart.	<ul style="list-style-type: none"> No gas pressure. Gas pressure under minimum value shown on rating plate. Gas line not completely purged of air. Defective Electrode. Loose burner ground connection. Defective Ignition Cable. Defective gas valve (check for 24 Vac at harness during trial for ignition before replacing valve). Air-fuel mixture out of adjustment - consult factory.
27 Interrupted Airflow Switch On	Interrupted Airflow Switch Failed to On	The air proving switch has failed on, check switch is operating properly.

SERVICE RECORD

DATE

SERVICE PERFORMED

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