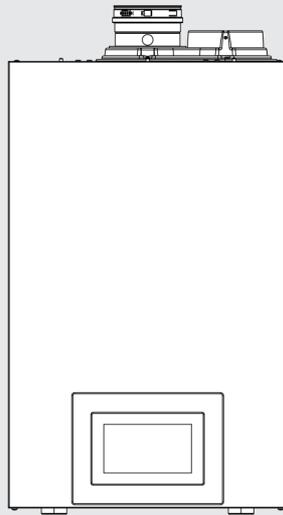


SOLO MODELS:

RCB301AN

RCB399AN



CSA/ANSI Z21.13 CSA 4.9

Rinnai Commercial Boiler

User Manual

Rinnai

WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- WHAT TO DO IF YOU SMELL GAS
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a licensed professional.

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Contents

1. Welcome	3
1.1 Acronyms and Abbreviations	3
2. Safety	4
2.1 Safety Symbols	4
2.2 Safety Precautions.....	4
3. About the Boiler	6
3.1 Front View.....	6
3.2 Bottom View.....	6
3.3 Components.....	7
3.4 Altitude.....	10
3.5 Specifications	11
3.6 Dimensions.....	12
3.7 Included Accessories	14
3.8 Optional Accessories	15
4. Operation	17
4.1 Start-Up Information	17
4.2 Control Panel.....	18
4.3 Error and Diagnostic Codes	40
4.4 Operating Information	47
5. Maintenance	51
5.1 Owner Maintenance	51

1. Welcome

Thank you for purchasing a Rinnai Commercial Boiler. Before operating this boiler, be sure to read these instructions completely and carefully to familiarize yourself with the boiler's features and functionality.

1.1 Acronyms and Abbreviations

Following is a list of common acronyms and abbreviations used in this manual:

ANSI	American National Standards Institute
Btu	British Thermal Unit
CH	Central Heating
SOLO	Heating only boiler capable of DHW through an indirect tank
DHW	Domestic Hot Water
GPM	Gallons per minute
LP	Liquid Propane
LWCO	Low Water Cut Off
NG	Natural Gas
PP	Polypropylene
PRV	Pressure Relief Valve
PSI	Pounds per square inch
wc	Inches water column

2. Safety

WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- WHAT TO DO IF YOU SMELL GAS:
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.
- The warning signs in this manual are here to prevent injury to you and others. Please follow them explicitly.

2.1 Safety Symbols

This manual contains the following important safety symbols. Always read and obey all safety messages.



Safety alert symbol. Alerts you to potential hazards that can kill or hurt you and others.

DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in personal injury or death.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in personal injury or death.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It may also be used to alert against unsafe practices.

2.2 Safety Precautions

The following precautions apply to the installer and consumer. Read and follow all instructions in this section.

- Before operating, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- Keep the area around the appliance clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- Combustible construction refers to adjacent walls and ceiling and should not be confused with combustible or flammable products and materials. Combustible and/or flammable products and materials should never be stored in the vicinity of this or any gas appliance.
- Always check the water temperature before entering a shower or bath.

- Do not use this appliance if any part has been under water. Immediately call a licensed professional to inspect the appliance and replace any part of the control system and any manual gas control valve which has been under water.
 - Do not use substitute materials. Use only parts certified for the appliance.
 - Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the appliance.
 - It is strongly recommended that you use a trained and qualified professional who has attended a Rinnai installation training class to adjust parameter settings.
 - Do not use an extension cord or adapter plug with this appliance.
 - Any alteration to the appliance or its controls can be dangerous and will void the warranty.
 - To protect yourself from harm, before performing maintenance:
 - Turn off the electrical power supply by turning off the electricity at the circuit breaker. (The boiler controller does not control the electrical power.)
 - Turn off the gas at the gas control, usually located immediately below the boiler.
 - Turn off the incoming water supply. Turning off the water for the central heating system is done at the boiler system filling station shut-off valve or the main water supply to the building.
 - Use only your hand to turn the manual gas control valve. Never use tools. If the manual gas control valve will not turn by hand, do not try to repair it; call a trained and qualified professional. Force or attempted repair may result in a fire or explosion.
 - Proper venting is required for the safe operation of this appliance. Failure to properly vent this appliance can result in death, personal injury and/or property damage.
- Flammable liquids such as cleaning solvents, aerosols, paint thinners, adhesives, gasoline and propane must be handled and stored with extreme care. These flammable liquids emit flammable vapors and when exposed to an ignition source can result in a fire hazard or explosion. Flammable liquids should not be used or stored in the vicinity of this or any other gas appliance.
 - DO NOT operate the boiler without the front panel installed. The front panel should only be removed for service/ maintenance or replacing internal components.
 - BURN HAZARD. Hot exhaust and vent may cause serious burns. Keep away from the boiler. Keep small children and animals away from the boiler.
 - Heating supply and return pipes leaving the boiler can be hot to touch.
 - Do not obstruct combustion air to the boiler.
 - This product burns gas to produce heat. The appliance must be properly installed, operated, and maintained to avoid exposure to appreciable levels of carbon monoxide and the installer is required to confirm that at least one carbon monoxide alarm is installed in the living space before the appliance is put into operation. It is important for the carbon monoxide alarms to be installed, maintained, and replaced following the alarm manufacturer's instruction and applicable local codes. Rinnai recommends that every home have a carbon monoxide (CO) alarm in the hallway near bedrooms in each sleeping area. Check batteries monthly and replace them annually.

3. About the Boiler

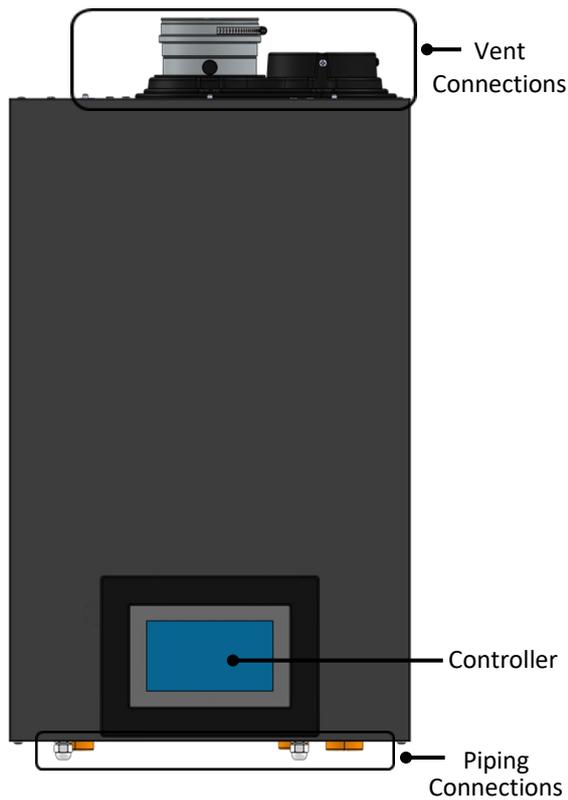
Topics in this section

- Front View
- Bottom View
- Components
- Altitude
- Specifications
- Dimensions
- Included Accessories
- Optional Accessories

The Rinnai Commercial Boiler is a wall-mounted, gas-fired boiler designed to provide heating to the building with the ability to connect an indirect tank for DHW production.

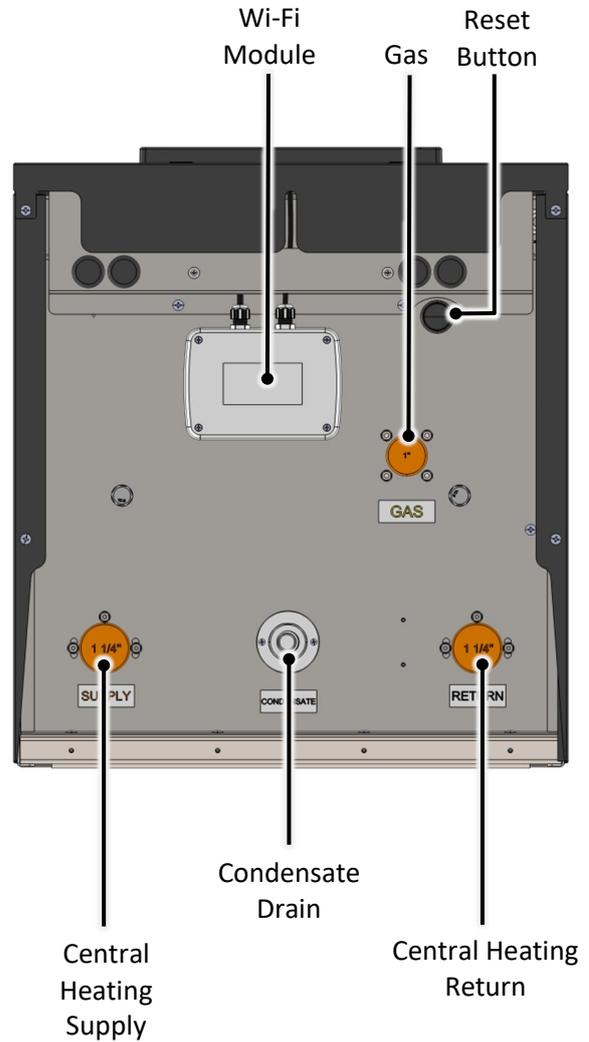
3.1 Front View

Figure 1



3.2 Bottom View

Figure 2



3.3 Components

Refer to the next page for a description of each component.

Figure 3

Left Side Internal - RCB301AN shown

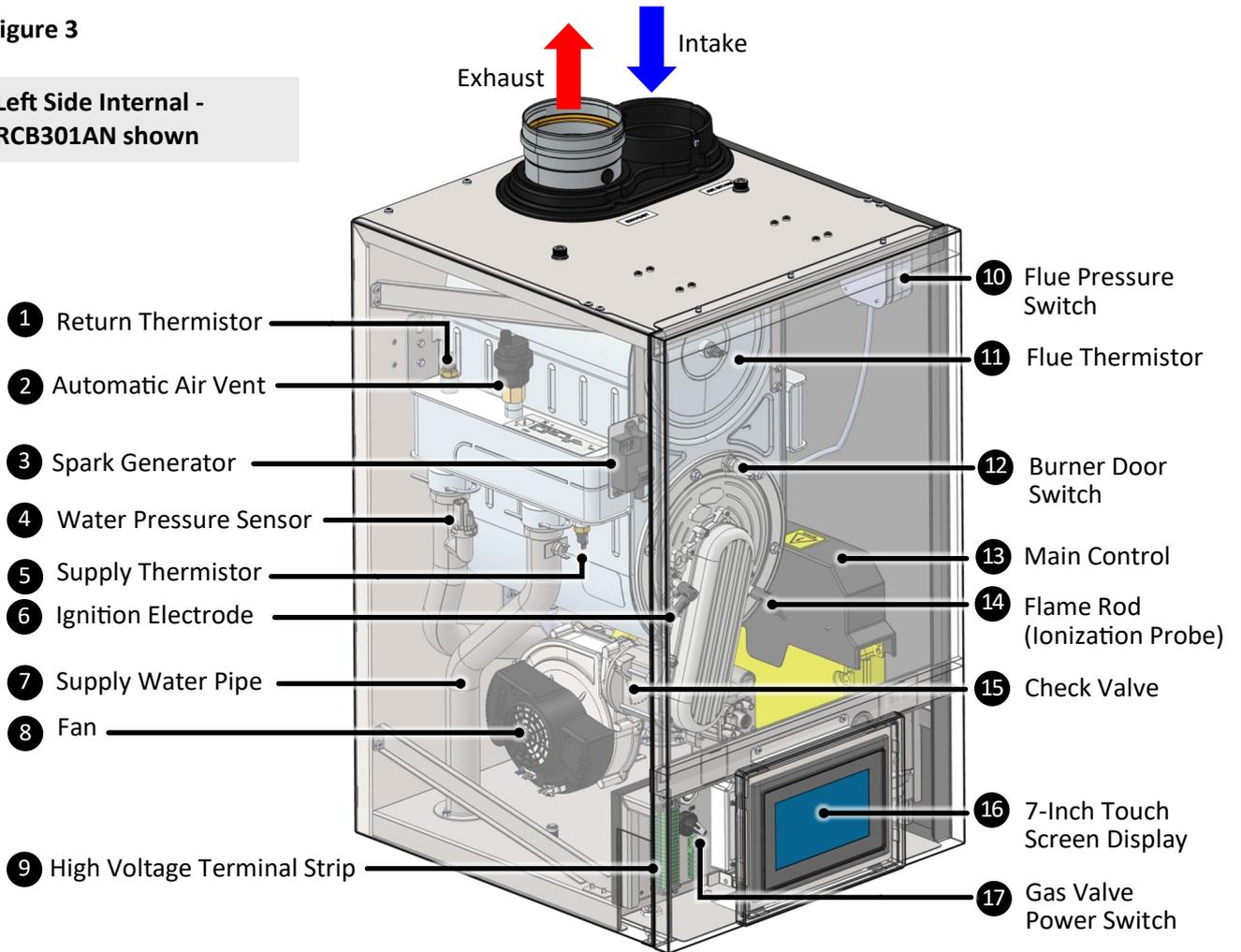
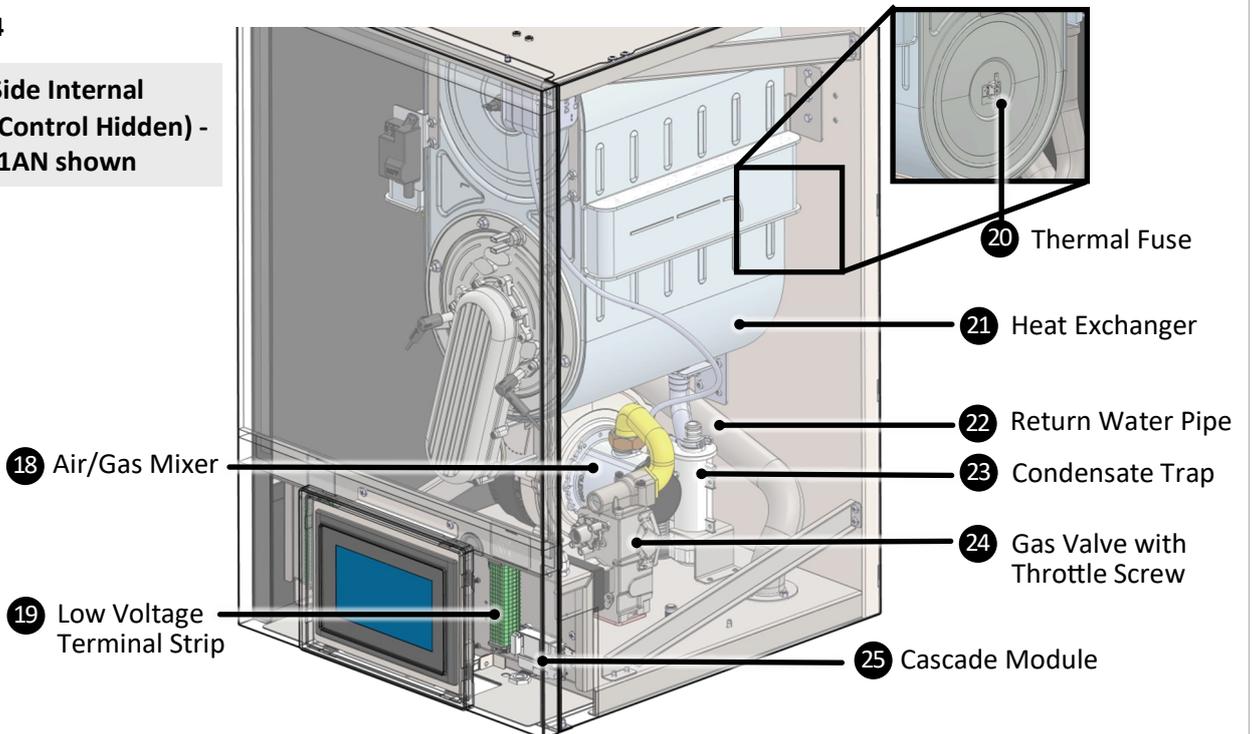


Figure 4

Right Side Internal (Main Control Hidden) - RCB301AN shown



Listed below are descriptions of each boiler component. Refer to the previous page for component illustration.

Table: Boiler Component Descriptions

Item	Name	Description
1	Return Thermistor	A sensor that monitors the water temperature returning into the boiler.
2	Automatic Air Vent	A device used to bleed the air from the heating system.
3	Spark Generator	Applies high voltage through the spark electrode to ignite the burner.
4	Water Pressure Sensor	A sensor that monitors the pressure in the system and will disable operation in case it senses low or high water pressure.
5	Supply Thermistor	A sensor that monitors the boiler outlet water temperature. The control will shut down the boiler in case the temperature exceeds a certain limit.
6	Ignition Electrode	Provides direct spark to ignite the burner.
7	Supply Water Pipe	A 1-1/4 in. water pipe that supplies hot water from the heat exchanger to the system.
8	Fan	Pulls air and gas through the air/gas mixer. Air and gas are pre-mixed inside of the fan and are pushed into the burner for combustion.
9	High Voltage Terminal Strip	Contains connection points for main power supply and all pumps power.
10	Flue Pressure Switch	A safety device that monitors the pressure in the vent and shuts down the appliance in case of blockage to avoid unsafe conditions.
11	Flue Thermistor	A sensor that monitors the flue gas exit temperature. The control will shut down the boiler if the flue gas temperature gets too hot to protect the flue pipe from overheating.
12	Burner Door Switch	A switch that will break the control circuit, shutting down the boiler in case the burner door temperature is too high.
13	Main Control	The integrated controller monitors and controls the system operation. The controller responds to internal and external signals and controls the fan, gas valve, spark generator, and pumps to meet the heat demand.
14	Flame Rod (Ionization Probe)	Detects and monitors the presence of a flame.
15	Check Valve	Prevents flue gas back flow into the fan in case of negative pressure in the boiler room in a power vent installation. The check valve also acts as back flow preventer in a common vent system where multiple units are cascaded.
16	7-Inch Touch Screen Display	The full-color touch screen allows a user friendly interface with the boiler control.
17	Gas Valve Power Switch	Manually interrupts the power to the gas valve.
18	Air/Gas Mixer	The venturi controls the mixture of air and gas before entering the burner for combustion.
19	Low Voltage Terminal	Contains connection points for low voltage input and output

Boiler Component Descriptions (Continued)

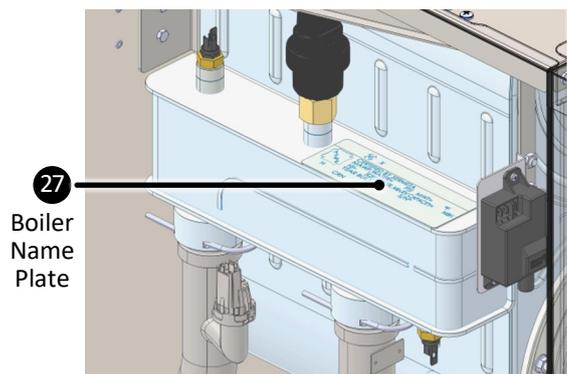
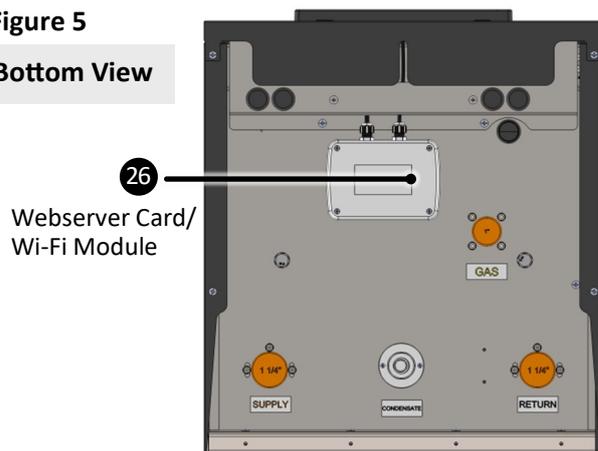
Item	Name	Description
20	Thermal Fuse	A safety device that will stop the boiler operation in case of unusual temperature rise.
21	Heat Exchanger	The stainless steel condensing heat exchanger is efficiently designed to maximize heat transfer through the coils while providing protection against flue gas corrosion.
22	Return Water Pipe	A 1-1/4 in. water pipe that returns water from the system to the heat exchanger to be reheated.
23	Condensate Trap	The high efficiency heat exchange produces condensate during operation. The condensate trap manages the condensate disposal and the built-in float prevents flue gases to escape through the condensate drain.
24	Gas Valve	The zero governor gas valve regulates the gas flow through the venturi based on suction from the fan.
25	Cascade Module	Used to establish communication between boiler in a cascade system by connecting them to each other using two conductor 18-20 AWG shielded wire.
26	Webserver Card/ Wi-Fi Module	The Webserver Card/Wi-Fi Module (located on bottom of boiler) (Figure 5) allows the installer to remotely monitor the system operation, pro-actively optimize efficiency, and aid in troubleshooting. This card also establishes the communication between main control board and user interface screen.
27	Boiler Name Plate	The ASME name plate (Figure 5) includes the National Board (NB) and Canadian Registration Number (CRN) numbers.

Additional Components Not Shown in Images:

	Burner	The metal fiber and stainless steel burner uses premixed air and gas to provide a wide range of firing rates.
	Outdoor Sensor	Uses the outdoor temperature to adjust the unit setpoint to provide greater efficiency.
	Cascade System Sensor	In a cascade system, the master boiler requires a system supply sensor to operate properly. The location of the sensor should be downstream of the of the boiler connection in the main system loop.
	DHW Sensor/ Aquastat	Monitors and controls the temperature of an indirect tank.

Figure 5

Bottom View



3.4 Altitude

This boiler can operate from sea level up to 10,200 feet [3,109 m]. The table below represents the de-rates for each model, gas type, and altitude. For proper operation ensure to set the control for proper gas type and altitude. Use the setup, boiler setup page on the boiler screen for proper gas type and altitude settings. De-rate values are based on proper combustion settings as recommended in this manual. For installation above 2,000 ft (609 m) in Canada, follow all applicable local codes and regulations.

NOTE: See control section on how to change altitude setting from the control panel.

ALTITUDE VENTING:

For all installations above 2000 ft (609 m), the venting is reduced from 140 feet to 90 feet.

Air Intake: 90 Feet

Exhaust: 90 Feet

Model	0 - 2000 ft		2001 - 5400 ft		5401 - 7700 ft		7701 - 10200 ft	
	NG	LP	NG	LP	NG	LP	NG	LP
RCB301AN	0.0 %	0.0 %	0.0 %	0.0 %	5.0 %	13.0 %	15.0 %	24.0 %
RCB399AN	0.0 %	0.0 %	7.0 %	7.0%	16.0 %	20.0 %	23.0 %	27.0 %

NOTE: The values listed on the above table are the total percentage of boiler input de-rate for each elevation range.

3.5 Specifications

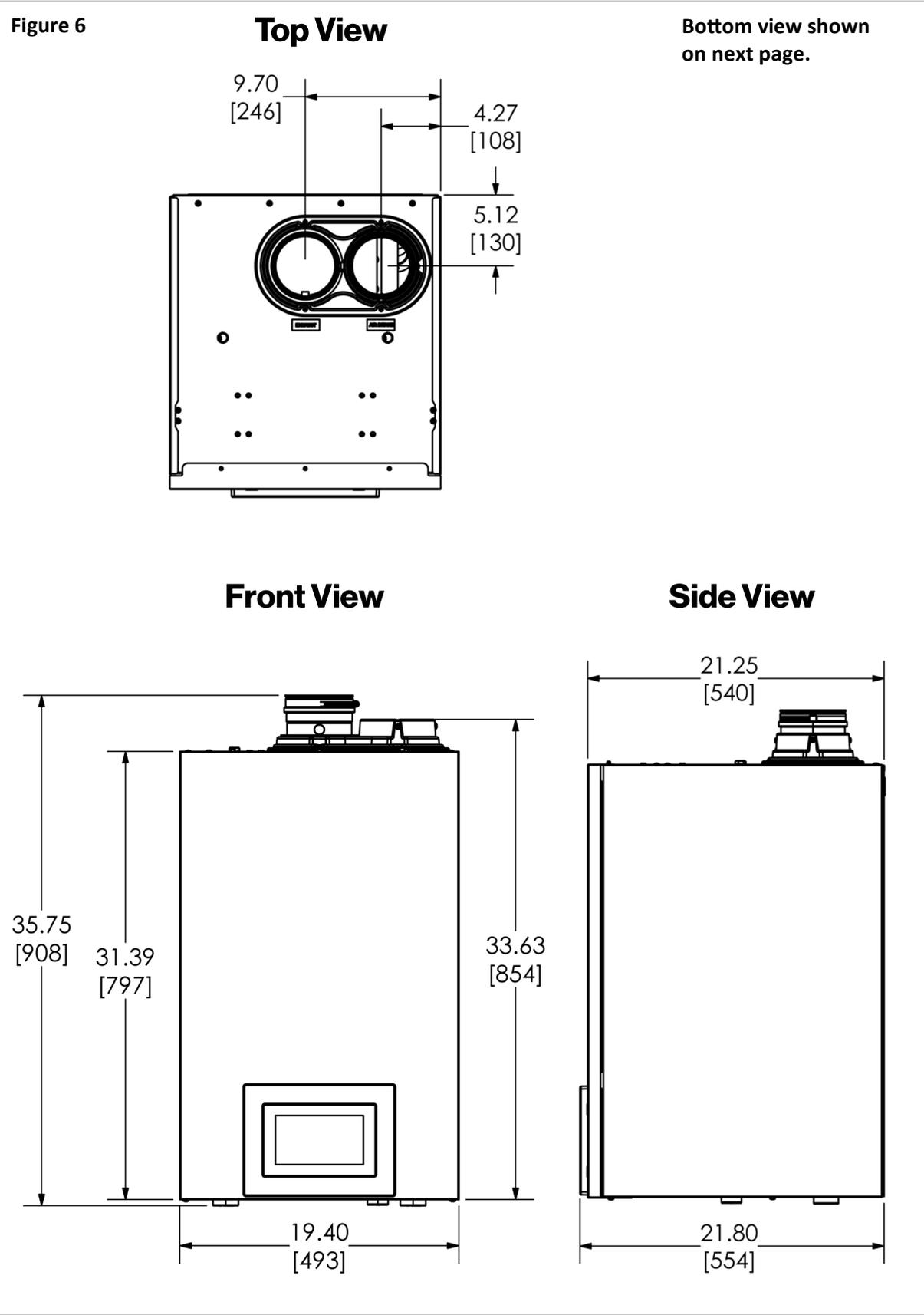
Table: Specifications

Model		RCB301AN	RCB399AN
Appliance Type		Condensing Wall-Mounted, Gas-Fired, Heat-Only (Solo) Boiler	
Installation Type		Internal (Indoor) Commercial Applications	
Model Numbers		RCB301AN, RCB399AN	
Ignition System		Direct Electronic Ignition	
Gas Types		Natural and Propane IMPORTANT: Units ship as NG only. Propane Conversion Kits available as accessory (purchased separately)	
Dimensions - w, h, d		19.4 in. x 35.75 in. x 21.8 in. (493 mm x 908 mm x 554 mm)	
Weight (Shipping)		194 lb (88 kg)	207lb (94 kg)
Weight (Appliance)		170 lb (77 kg)	183 lb (83 kg)
Heat Exchanger Surface Area		24.6 sq ft	30.7 sq ft
Gas Consumption (Btu/h)	Minimum	30,100	39,900
	Maximum	301,000	399,000
Temperature Setting	CH	(Minimum - Maximum) 86°F - 180°F (30°C - 82°C)	
	Indirect Tank (DHW)	104°F - 176°F (40°C - 80°C)	
Water Content		1.8 gal (6.8 lt)	2.2 gal (8.3 lt)
Water Pressure	CH	Minimum: 14.5 PSI (1 bar) Maximum: 87 PSI (6 bar) Maximum Allowable Water Pressure (MAWP): 160 PSI (1103 kPa)	
	PRV	75 PSI (5.2 bar) (Pressure Relieve Valve included with system)	
Sound Level		55 dB(A)	56 dB(A)
Electrical Data	Normal	133 W	210 W
	Standby	10 W	
	Max Current	6.3 Amps	
	Fuse	2 x 6.3 Amps	
Gas Supply Pressure ¹	Natural Gas	3.5 in. - 10.5 in. wc (0.87 - 2.61 kPa)	
	Propane	8.0 in. - 13.5 in. wc (1.99 - 3.36 kPa)	
Electric Connections		AC 120 Volts, 60 Hz	
Certifications		ANSI Z21.13, CSA 4.9, ASME	
Canada CRN		Y6325.2C	
Warranty		Heat Exchanger: 10 Years. All Other Parts & Components: 1 Year. Reasonable Labor: 1 Year. See the "Rinnai Commercial Boiler Warranty" for Complete Details	
Venting 45° elbow is equivalent to 3 ft (1 m). 90° elbow is equivalent to 6 ft (2 m).	Options:	<ul style="list-style-type: none"> • Direct Vent • Non-Direct Vent (Room Air) 	
	Materials	PVC, CPVC, PP and Stainless Steel	
	Vent Size	4 in. PVC/CPVC	
	Exhaust	Vent Run (Min-Max): 10 ft (3 m) - 140 ft (43 m)	
	Intake	Vent Run (Min-Max): 0 ft (0 m) - 140 ft (43 m)	
	High Altitude	<ul style="list-style-type: none"> • 0-2,000 feet (0-609 m) - 140 ft (43 m) • For altitudes above 2,000 ft (609 m), vent length is reduced to 90 ft (27 m). 	

¹ Maximum gas supply pressure must not exceed the value specified by the manufacturer. Rinnai products are continually being updated and improved; therefore, specifications are subject to change without prior notice.

3.6 Dimensions

Measurements: in. [mm]



3.6.1 Supply Connections

Figure 7

Bottom View

Measurements: in. [mm]

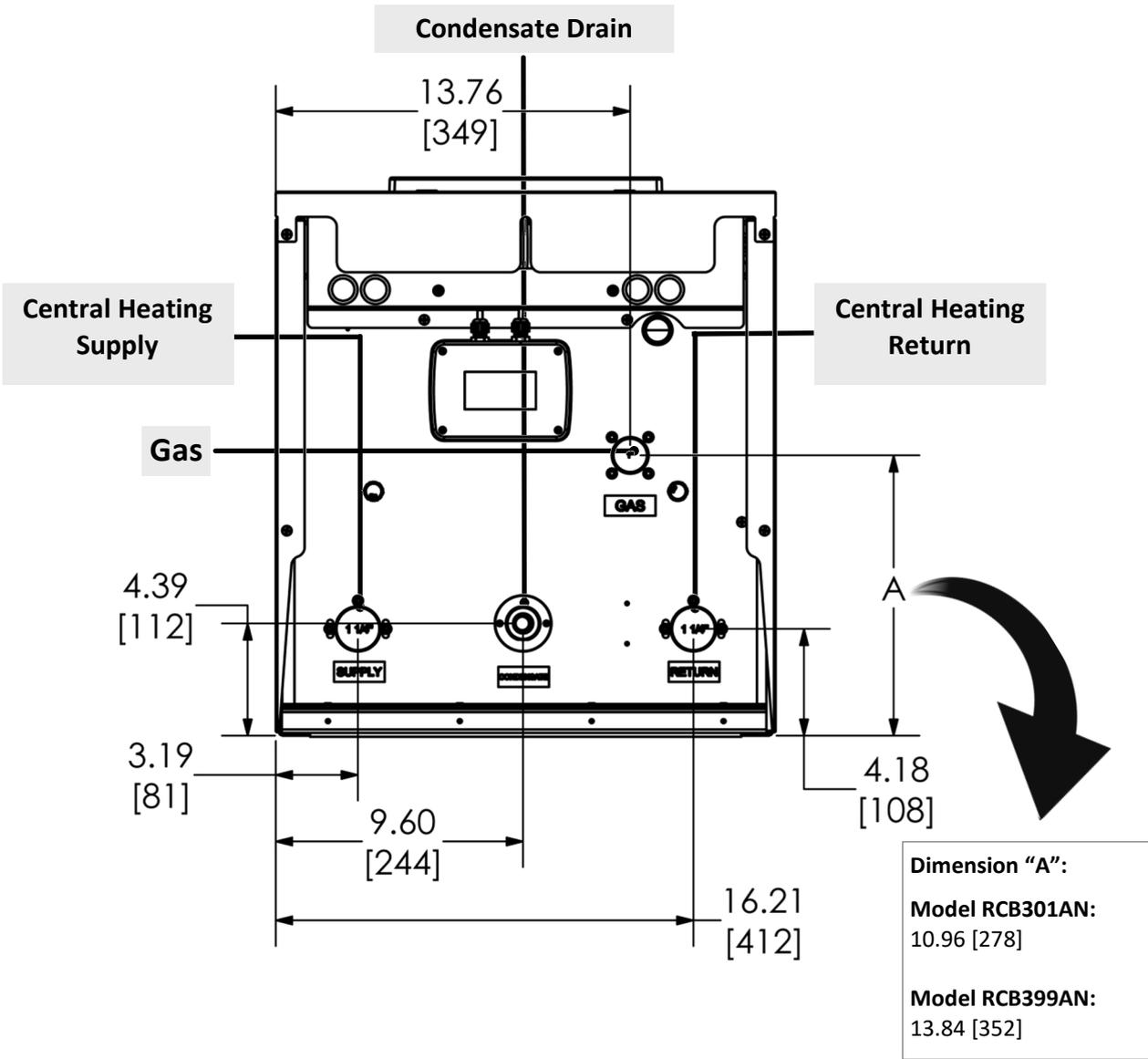


Table: Connection Sizes

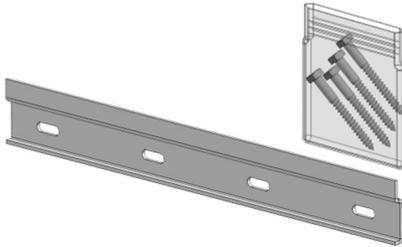
Connection	Connection Size	Minimum Pipe Size
Gas	1 in. NPT	1 in.
CH In (CH Return)	1-1/4 in. NPT	1-1/4 in.
CH Out (CH Supply)	1-1/4 in. NPT	1-1/4 in.
Condensate Drain	1 in. NPT	3/4 in.
Venting (Intake & Exhaust)	4 in. PVC/CPVC	4 in.

3.7 Included Accessories

Carefully unpack your boiler system and verify the following contents are included. If any items are damaged or missing, contact your local dealer/distributor. Do not attempt to use any item that appears damaged.

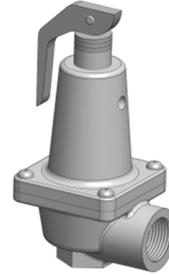
Figure 8

WALL MOUNTING BRACKET (WITH SCREWS)



PART #: 809000198

PRESSURE RELIEF VALVE, 75 PSI



PART #: 807000224

OUTDOOR TEMPERATURE SENSOR



PART #: 805000097

SPARE FUSES - 2 X 6.3 A (LOCATED INSIDE OF MAIN CONTROL COVER)



PART #: 803000079

INTAKE PIPE SCREWS 4.8 X 25 MM SS PANHEAD PH2 (TAPPED TO INTAKE ADAPTER)



PART #: 809000304

DOCUMENTATION

- Installation and Operation Manual (this manual)
- User Manual
- Warranty Card
- Additional technical literature included inside product box

3.8 Optional Accessories

The following optional accessories are available for the Rinnai Commercial Boiler.

CONDENSATE NEUTRALIZER



Neutralizes the condensate generated by the boiler.

PART #: 804000074

AIR INLET FILTER



Filters and eliminates debris (> 0.5 mm) from entering the combustion chamber for indirect venting (room air) piping.

PART #: 803000050

CASCADE SYSTEM SENSOR



In a cascade system the Master boiler requires a system supply sensor in order to operate properly. The location of the sensor should be downstream of the of the boiler connection in the main system loop.

PART #: 803000051

BOILER RACK



Provides a standalone mounting solution for the Rinnai Commercial Boiler.

PART #: 803000047

GAS CONVERSION KIT



Converts the boiler gas type.

PART #: 803000053 - 301 NG

PART #: 803000054 - 399 NG

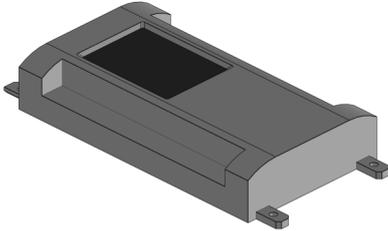
PART #: 803000048 - 301 PROPANE

PART #: 803000049 - 399 PROPANE

Continued on next page.

Optional Accessories (Continued)

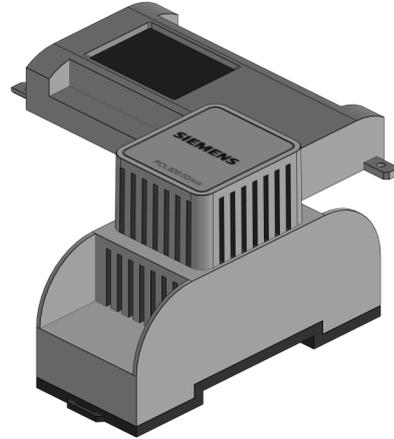
BACNET ADAPTER



To establish boiler communication with Building Management System (BMS) through BACnet.

PART #: 803000078

BACNET ADAPTER WITH LONWORKS



To establish boiler communication with Building Management System (BMS) through LonWorks.

PART #: 803000080

4. Operation

Topics in this section

- Start-Up Information
- Control Panel
- Error and Diagnostic Codes
- Operating Information

4.1 Start-Up Information



IMPORTANT

- On initial startup of the system, it is necessary to manually run the pumps from the service page to remove all air from the system piping and boiler. Failure to properly deaerate the boiler and system may result in damage to the boiler, which is not covered by the boiler warranty.
- It can take up to a week before all the air has disappeared from a newly-filled and pressurized installation. During the first week of operation, noises can be heard which indicate the presence of air. The automatic air vent in the boiler and air separator in the heating system will remove the air, which means the water pressure will reduce some during this period; therefore, additional water is necessary to maintain proper pressure in the heating system. Water pressure needed for operation:
 - The boiler is in normal operation between 20 - 70 PSI.
 - Below 12 PSI and above 87 PSI, the boiler will have error codes (117 or 118 error code will be present on the controller display) and will not operate. Increasing the heating system water pressure is necessary for operation.
 - Below 12 PSI, error code 117 will be present on the controller display.
 - Above 87 PSI, error code 118 will be present on the controller display.
 - The maximum pressure permitted inside the heat exchanger is 160 PSI.
 - The pressure relief valve supplied with the boiler is rated to 75 PSI.

4.2 Control Panel

Home Page / Dashboard

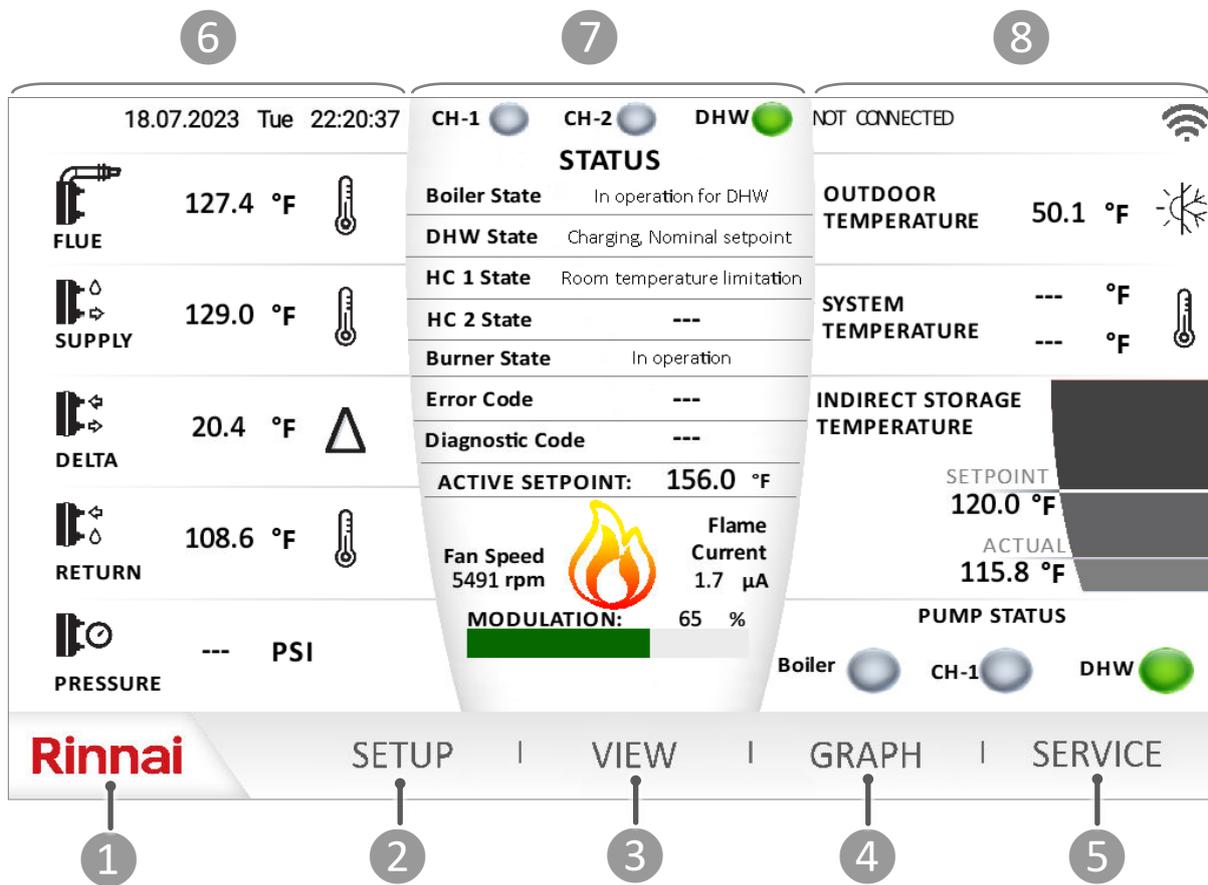


Table: Home Screen

ITEM	DESCRIPTION	FUNCTION
1	RINNAI	The Rinnai logo will return the user to the home page (shown). This page will provide information regarding the boiler operation.
2	SETUP	This page will allow the user to adjust and customize parameters, such as outdoor reset curve(s), and others. NOTE: This page should only be accessed by qualified service technician.
3	VIEW	The view screen shows the state of the appliance and its internal components (temperature values, switches condition, water pressure, fan speed, and all other inputs and outputs).
4	GRAPH	The graph page allows the user to monitor real time system information (temperature, pressure, pump operation, and fan speed).
5	SERVICE	In this page allows for a different user level selection by choose user from the dropdown menu and enter a password to access parameters from basic to critical functions.
6	LEFT PANE	This pane provides information about boiler internal temperature and pressure. It also includes date and time. NOTE: Date and time can be changed from the setup page.
7	CENTER PANE	This pane shows information about demand, boiler modulation, error messages, setpoint, fan speed, and ionization current. The center pane changes color to show the boiler status: Dark Gray - standby; Light Gray - Running; Red - Error Code (hard lockout), Yellow - Error Code (soft lockout); Orange—service reminder
8	EXTERNAL	This pane shown information about external devices connect to the boiler (outdoor sensor, system sensor, indirect tank sensor/thermostat, pump status, and Wi-Fi).

Setup

To access the SETUP page, the control will prompt the user to select the access level and enter password. The password for Installer is **9419**. The technician and Engineer user levels can ONLY be accessed by a Rinnai employee.

Quick Setup

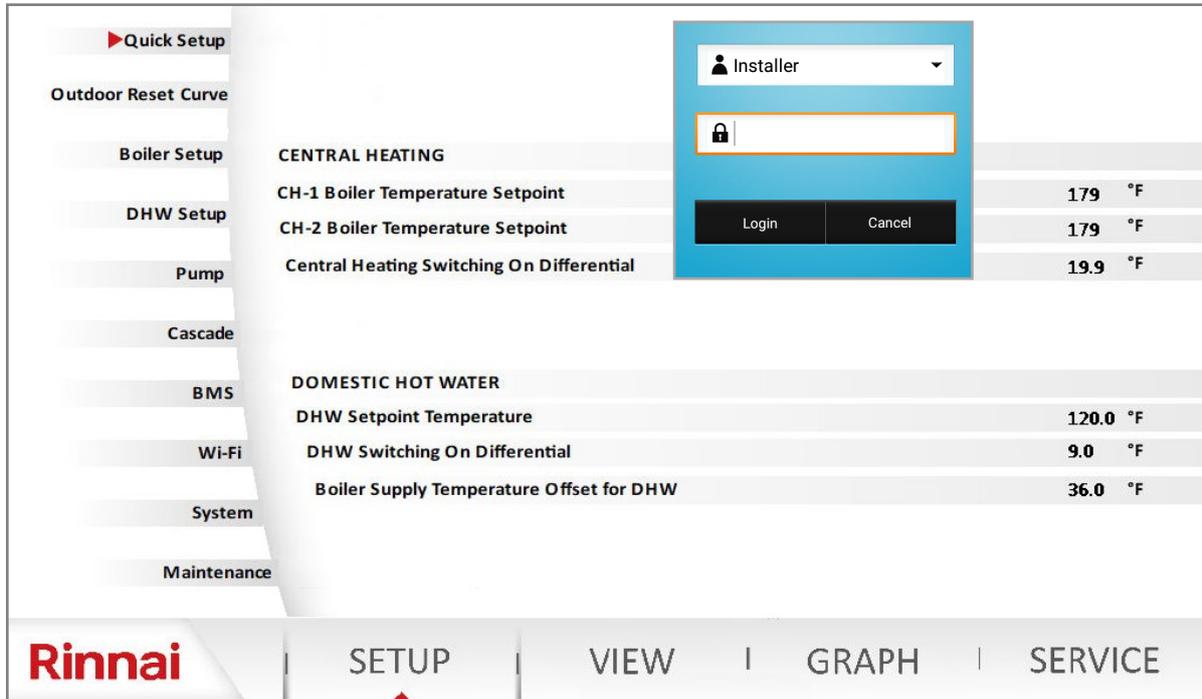
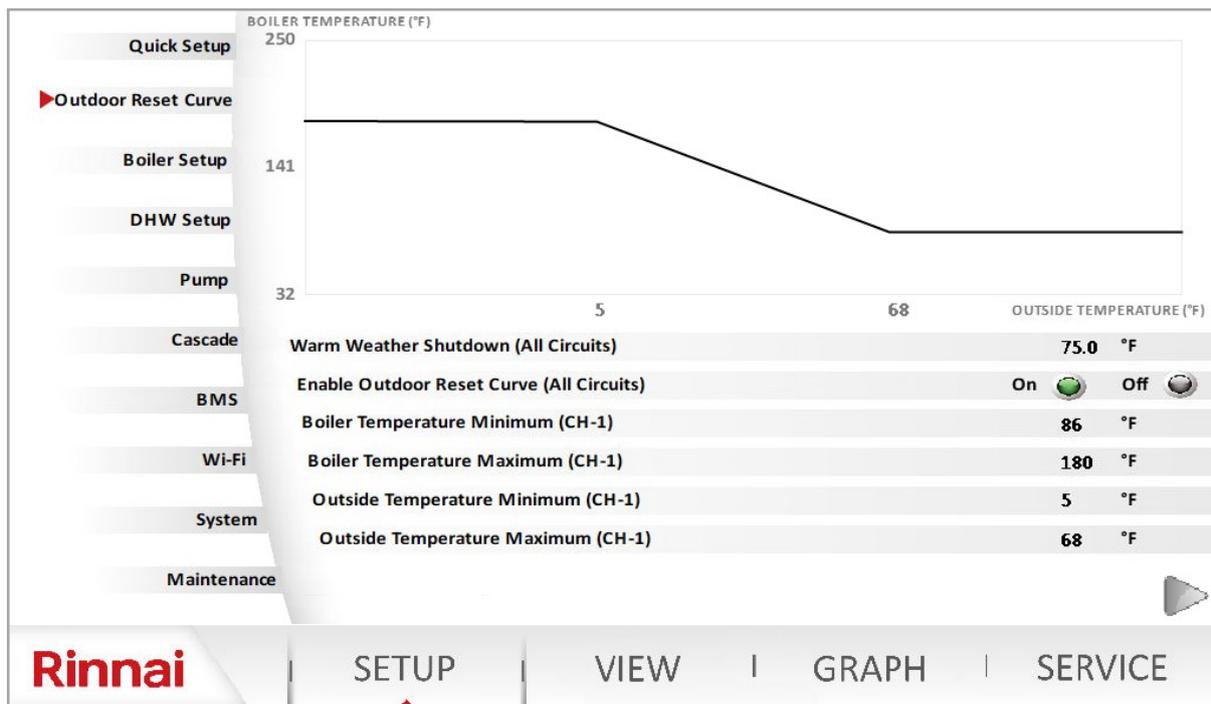


Table: Setup Page

NO.	DESCRIPTION	FUNCTION
CENTRAL HEATING		
1	CH-1 Boiler Temperature Setpoint	This parameter is used to set the boiler supply temperature setpoint for CH-1 manually if an outdoor sensor is not used. When an outdoor reset function is desired use the Outdoor Reset Curve page to set the boiler min and max temperatures. Range: 86°F [30°C] - 180°F [82°C]; Default: 180°F [82°C]
2	CH-2 Boiler Temperature Setpoint	This parameter is used to set the boiler supply temperature setpoint for CH-2 manually if an outdoor sensor is not used. When an outdoor reset function is desired use the Outdoor Reset Curve page to set the boiler min and max temperatures. Range: 86°F [30°C] - 180°F [82°C]; Default: 180°F [82°C]
3	Central Heating Switching On Differential	This parameter is used to set the temperature differential when the boiler will light up the burner. For instance if the boiler setpoint is 180°F [82°C] and this parameter is set to 20°F [11°C], the boiler will ONLY fire when the actual supply temperature is below 160°F [71°C]. Range: 0°F [0°C] - 36°F [20°C]
DOMESTIC HOT WATER		
4	DHW Temperature Setpoint	This parameter is used to set the temperature setpoint for the DHW indirect tank. Range: 104°F [40] - 176°F [80°C]; Default: 120°F [49°C]
5	DHW Switching On Differential	This parameter is used when a DHW indirect tank is controlled via a sensor. This parameter sets the temperature differential when the DHW tank will call for heat demand. For instance if the Indirect tank setpoint is 120°F [49°C] and this parameter is set to 9°F [5°C], the boiler will ONLY activate the DHW demand when tank temperature is below 115°F [44°C]. Range: 0°F [0°C] - 36°F [20°C]
6	Boiler Supply Temperature Offset for DHW	When there is a DHW demand, the boiler temperature setpoint will be the DHW temperature setpoint + this parameter. For instance if DHW temperature setpoint is 120°F [49°C] and this parameter is set to 36°F [20°C] the boiler supply setpoint for DHW will be 156°F [69°C]. Range: -4°F [-20°C]—108°F [60°F], Default: 36°F [20°C]

Outdoor Reset

An outdoor sensor is provide with the boiler. The boiler control allows for two customizable outdoor reset curves for each head demand from room thermostats one and two. The graph below represents outdoor reset curve for heating circuit one. To set the second outdoor reset curve press on the arrow at the bottom right corner of the page. Set the minimum, and maximum boiler supply temperature along with minimum and maximum outside temperatures to set outdoor reset curves. The warm weather shutdown is the temperature value at which the boiler will ignore the call for heat. Use the outdoor reset power icon to enable or disable the outdoor reset curve. When an outdoor sensor is not being used the boiler will operate using the maximum boiler temperature value set in this table. When the outdoor reset curve is not intended to be used, the boiler setpoint can be set from the quick setup page and the outdoor reset curve should be disabled. See next page for outdoor reset temperature guideline.



NO.	DESCRIPTION	FUNCTION
1	Warm Weather Shutdown (All Circuits)	This parameter is used to set the outside temperature to disable boiler operation for central heating due to warm weather. Range: 46°F [8°C] - 86°F [30°C]; Default: 75°F [24°C]
2	Enable Outdoor Reset Curve (All Circuits)	This parameter is used to enable or disable the outdoor reset curve function. Range: On - Off; Default: On
3	Boiler Temperature Minimum (CH-1)	This parameter sets the minimum boiler supply temperature for the outdoor reset curve. Range: 86°F [30°C] - Boiler Temperature Maximum; Default: 86°F [30°C]
4	Boiler Temperature Maximum (CH-1)	This parameter the sets the maximum boiler supply temperature for the outdoor reset curve. Range: Boiler Temperature Minimum - 180°F [82°C]; Default: 180°F [82°C]
5	Outside Temperature Minimum (CH-1)	This parameter sets the minimum boiler outside temperature for the outdoor reset curve. Range: -40°F [-40°C] - Outside Temperature Maximum; Default: 5°F [-15°C]
6	Outside Temperature Maximum (CH-1)	This parameter the sets the maximum outside temperature for the outdoor reset curve. Range: Boiler Temperature Minimum - Warm Weather Shutdown; Default: 68°F [20°C]

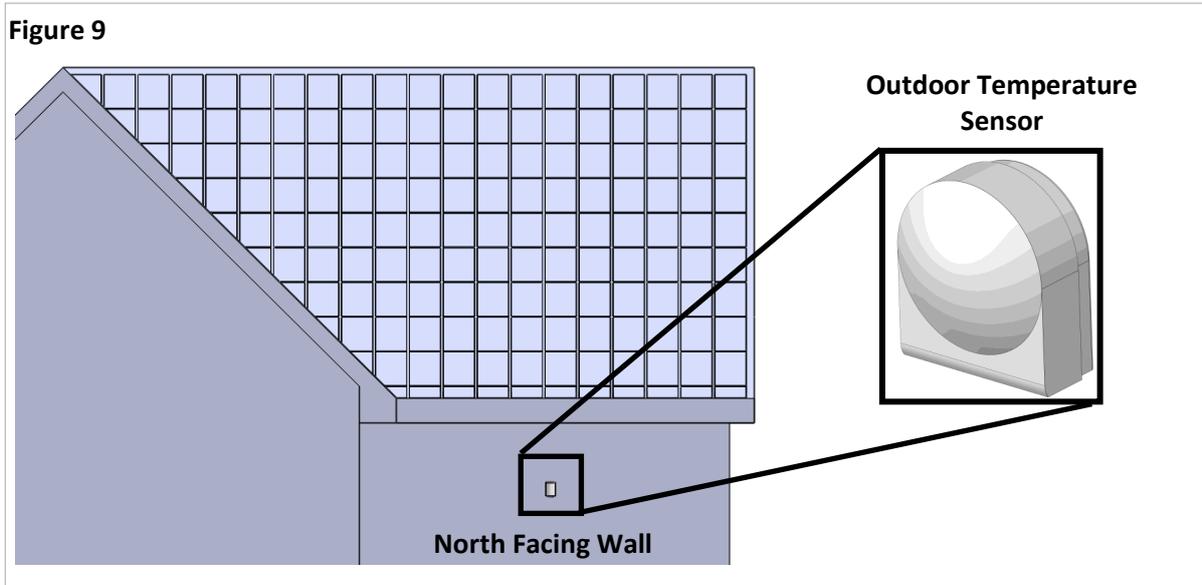
Outdoor reset is a built-in function to help maximize the efficiency of the boiler. The design of this function is to adjust the target temperature of the boiler relative to the outdoor ambient temperature via the flexible outdoor reset curve options included in the boiler setup page. The outdoor ambient temperature is observed via the provided outdoor temperature sensor.

NOTE: When a DHW indirect tank is installed as a heating zone, and the outside temperature may exceed the maximum limit of warm weather shutdown (86°F), the outdoor reset must be disabled.

During warm weather shutdown, the boiler will not provide any heat to the indirect tank if it is connected to the boiler as a heating zone.

Outdoor Temperature Sensor

The outdoor temperature sensor (1 kOhm) should be mounted to avoid direct sun light (to prevent obtaining false reading of the outdoor temperature) ideally on a North facing wall of the house. The sensor should also be mounted away from any vent, duct, or other device that may create an artificial heat source. The sensor should then be wired back to the outdoor temperature sensor terminal on the boiler. Refer to the wiring sections for more information.

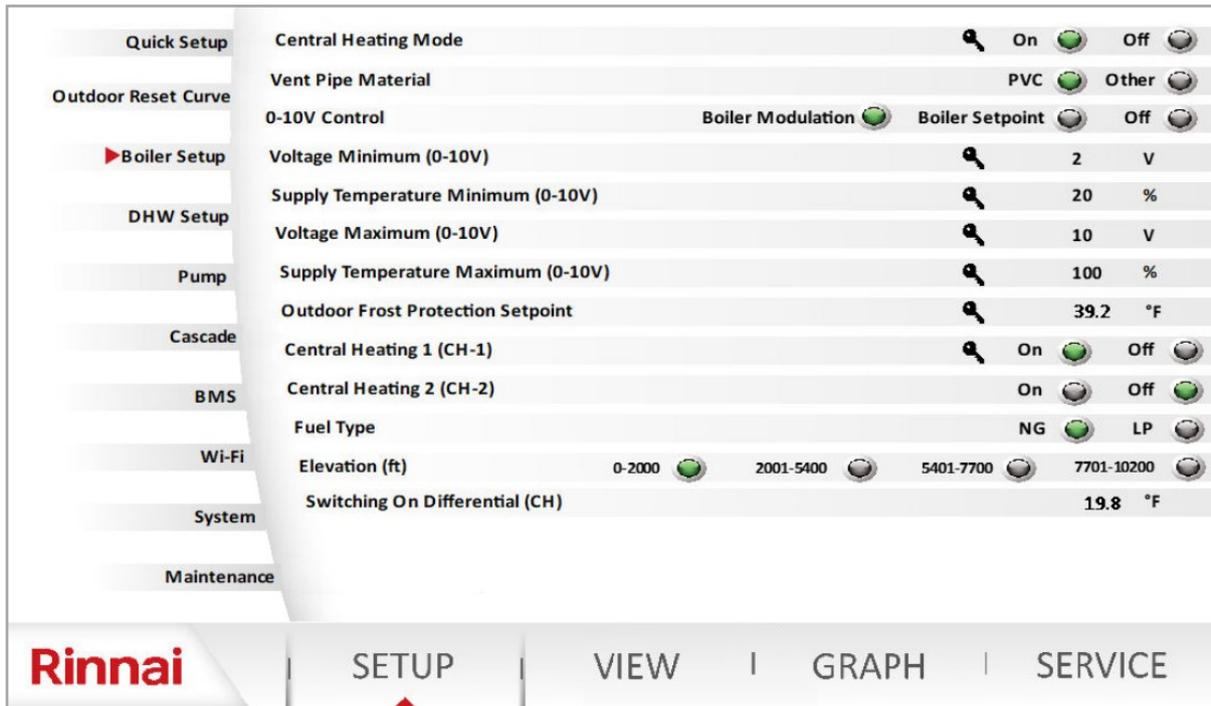


Outdoor Reset Curve Temperature Guidelines

Below are some typical target temperatures for various heat emitters. These are basic guidelines; thus, check with the emitter manufacturer or consult your heating design engineer.

Type of Heat Emitter	Typical Minimum Supply Temperature	Typical Maximum Supply Temperature
Hydronic Air Handler	120 - 140°F	140 - 180°F
Unit Heater	130 - 140°F	160 - 180°F
Base Board Convectors	100 - 140°F	140 - 180°F
Cast Iron/Panel Radiator	90 - 120°F	140 - 180°F
Undermount Radiant	100 - 120°F	120 - 150°F

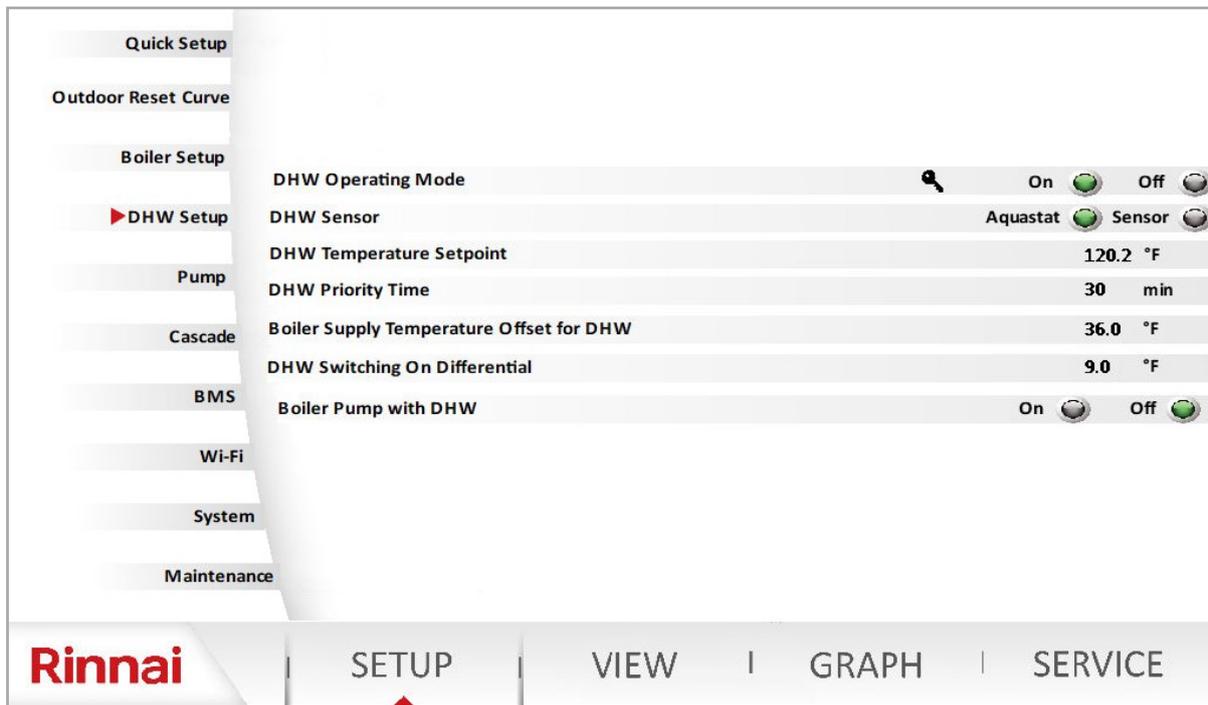
Boiler Setup



NO.	DESCRIPTION	FUNCTION
Boiler Setup		
1	Central Heating Mode	This function enables or disables the central heating mode (Room Thermostat 1, Room Thermostat 2, and 0-10V input functions). Range: On - Off; Default: On NOTE: Requires Technician or Engineer level for access.
2	Vent Pipe Material	This parameter will set the flue temperature limit based on the material used for venting. When set to PVC, the boiler will start to reduce modulation when the vent temperature reaches 140°F [60°C] and will shutdown at 149°F [65°C]. When set as others (CPVC, PP, and FNS), the boiler will reduce modulation when the vent temperature reaches 198°F [92°C] and will shutdown and lockout at 207°F [97°C]. Ensure to use the proper venting material and appropriate parameter setting depending on the application to prevent damage to the vent pipe or boiler short cycling. Range: PVC- Others. Default: PVC
3	0-10V Input Control	This parameter is used to select the two different modes of 0-10V operation or disable the 0-10V function. Range: Boiler Modulation, Boiler Setpoint, Off; Default: Off. NOTE: It is recommended to avoid running low voltage wires in parallel to high voltage wiring to avoid induced voltage. False voltage signal will cause the boiler to operate when it is not needed.
4	Voltage Minimum (0-10V)	This parameter sets the minimum voltage for the 0-10V input function. Range: 0V - 10V; Default: 2V. NOTE: DO NOT change the default setting. Requires Technician or Engineer level for access.
5	Supply Temperature Minimum (0-10V)	This parameter sets the minimum boiler supply temperature or modulation percentage for 0-10V input operation. For instance when the input voltage is set to 2V, the boiler supply setpoint is 86°F [30°C]. Range: 86°F [30°C] - Supply Temperature Maximum (0-10V); Default: 86°F [30°C]
6	Voltage Maximum (0-10V)	This parameter sets the maximum voltage for the 0-10V input function. Range: 0V - 10V; Default: 10V. NOTE: DO NOT change the default setting. Requires Technician or Engineer level for access.
7	Supply Temperature Maximum (0-10V)	This parameter sets the maximum boiler supply temperature or modulation percentage for 0-10V input operation. For instance when the input voltage is set to 10V, the boiler supply setpoint is 180°F [82°C]. Range: Supply Temperature Minimum (0-10V); - 180°F [82°C] - Default: 180°F [82°C]
8	Outdoor Frost Protection Setpoint	This function will alert the boiler about an outside freeze condition based on the set value. The boiler will monitor the supply temperature before activating the freeze protection mode. Range: 40°F [4] - 60°F [16]. NOTE: Requires Technician or Engineer level for access.

NO.	DESCRIPTION	FUNCTION
Boiler Setup (cont.)		
9	Central Heating 1 (CH-1)	This parameters enables or disables CH-1 room thermostat operation. Range: On - Off; Default: On. NOTE: Do not disable this parameter.
10	Central Heating 2 (CH-2)	This parameters enables or disables CH-2 room thermostat operation. Range: On - Off; Default: Off. NOTE: ONLY enable this parameter if you intend to replace the DHW zone with a second CH zone. The DHW pump needs o be assigned as CH-2 pump in the pump setup page for proper operation.
11	Fuel Type	This function will assign the proper fan speed for NG or LP gas depending on the selection. Range: NG - LP; Default: LP
12	Elevation	This function will assign the proper fan speed for each elevation selection. Range: 0-2000 ft; 2001-5400 ft; 5401-7000 ft; 7700-10200ft; Default: 0-2000ft
13	Central Heating Switching On Differential	This parameter is used to set the temperature differential when the boiler will light up the burner. For instance if the boiler setpoint is 180°F [82°C] and this parameter is set to 20°F [11°C], the boiler will ONLY fire when the actual supply temperature is below 160°F [71°C]. Range: 0°F [0°C] - 36°F [20°C] ; Default: 20°F [11°C]

DHW Setup



NO.	DESCRIPTION	FUNCTION
DHW Setup		
1	DHW Operating Mode	This function enables or disables DHW operation (Aquastat or Sensor). Range: On - Off; Default: On NOTE: Requires Technician or Engineer level for access.
2	DHW Sensor	This parameter allows the user to choose either a 10K Ohm sensor (thermistor) or an Aquastat (thermostat) to control the DHW indirect tank demand. In Aquastat mode the control is looking for either an open (no demand) or closed (demand) contact. In Sensor mode the control is reading the actual temperature against the setpoint to determine heat demand. When a sensor is accidentally selected and aquastat is used, the boiler will present an error code when aquastat is closed. Range: Aquastat - Sensor; Default: Aquastat

DHW Setup

NO.	DESCRIPTION	FUNCTION
DHW Setup (cont.)		
3	DHW Temperature Setpoint	This parameter allows the user to set the DHW indirect tank temperature. NOTE: When an aquastat is used ensure to match this parameter with the setting on the mechanical aquastat to ensure proper operation. The control will use this value to set the boiler supply temperature for DHW. Range: 104°F [40°C] - 176°F [80°C]; Default: 120°F [49°C].
4	DHW Priority Time	This parameter sets the DHW priority time in case there are both DHW and Central Heating demands. The control will prioritize DHW demand for the set time and then switch to central heating demand. The control will switch between the two demands until one or both are satisfied. Range: 10 - 600 Minutes; Default: 30 Minutes
5	Boiler Supply Temperature Offset for DHW	When there is a DHW demand, the boiler temperature setpoint will be the DHW temperature setpoint + this parameter. For instance if DHW temperature setpoint is 120°F [49°C] and this parameter is set to 36°F [20°C] the boiler supply setpoint for DHW will be 156°F [69°C]. Range: -4°F [-20°C] - 108°F [60°F], Default: 36°F [20°C]
6	DHW Switching On Differential	This parameter is used when a DHW indirect tank is controlled via a sensor. This parameters sets the temperature differential when the DHW tank will call for heat demand. For instance if the Indirect tank setpoint is 120°F [49°C] and this parameter is set to 9°F [5°C], the boiler will ONLY activate the DHW demand when tank temperature is below 115°F [44°C]. Range: 0°F [0°C] - 36°F [20°C]; Default: 9°F [5°C]
7	Boiler Pump with DHW	This parameter will allow the user to enable the boiler pump to operate during a DHW demand. For instance, if the DHW indirect tank is piped in the system loop as one of the heating zones, the boiler pump can be enabled to deliver the heat to the system loop. NOTE: It is critical to ensure low temperature zones are protected via mixing valve to prevent overheating due to higher setting of boiler supply temperature for DHW. Range: On - Off; Default: Off

Pump Setup



NO.	DESCRIPTION	FUNCTION
Pump Setup		
1	Pump Overrun Time - CH	Allows boiler and Ch pumps to continue to run after the flame is turned off, when a CH demand is terminated. Range: 0-240 Minutes; Default: 1 Minute
2	Pump Overrun Time - DHW	Allows the DHW pump to continue to run after the flame is turned off, when a DHW demand is terminated. Range: 0-240 Minutes; Default: 1 Minute
3	Pump Assignment QX2	This parameter can be used to assign the CH-1 Pump to run with a room thermostat call (room thermostat 1) or Using a 0-10V for Boiler Temperature control. When using Room thermostat, it should to set to CH-1 Pump, when using 0-10V for boiler temperature control it should be set to Q15 pump. Range: CH-1 Pump, Q15. Default: Q15
4	Pump Assignment QX3	This parameter can be used to assign the DHW pump terminal to be used as a DHW pump , CH-2 pump, or Q15 (0-10V operating for boiler temperature control). In case a DHW indirect tank is not used and a second heating zone is desired, this parameter can be set to CH-2. Also CH-2 thermostat needs to be enabled from the boiler setup page. Range: Boiler Pump; CH-1 Pump; CH-2 Pump; DHW Pump; Cascade Pump Q25; Default: DHW Pump
5	Function Output UX2	When Burner Modulation is selected, this parameter can be used to read boiler status and modulation information via a 0-10V signal. 0-0.5V - Boiler in error State; 0.5V - 1V - Boiler in Off state, standby, pre-purge, post-purge...; 1V - 10V—represents 0% - 100% modulation. Range: None, Boiler Pump, DHW Pump, CH-1 Pump, CH-2 Pump, Burner Modulation; Default: Burner Modulation.
6	Function Output UX3	When Burner Modulation is selected, this parameter can be used to read boiler status and modulation information via a 0-10V signal. 0-0.5V - Boiler in error State; 0.5V - 1V - Boiler in Off state, standby, pre-purge, post-purge...; 1V - 10V—represents 0% - 100% modulation. Range: None, Boiler Pump, DHW Pump, CH-1 Pump, CH-2 Pump, Burner Modulation; Default: Burner Modulation.

Cascade

Quick Setup	Release Integral Source Sequence	123 °F*min
	Reset Integral Source Sequence	69 °F*min
Outdoor Reset Curve	Switch-On Delay - CH	5 min
Boiler Setup	Leading Producer	
	Restart Time Lock	300 s
DHW Setup	Device Address	
Pump	Leading Strategy	
▶ Cascade	Output Band Minimum	40 %
	Output Band Maximum	90 %
BMS	Cascade Rotation Time	50 h
	Cascade Rotation Exclusion	
Wi-Fi	Cascade System Sensor	On Off
System	Forced Time Basic Stage	60 s
Maintenance	Switch-On Delay DHW	2 min

Rinnai | SETUP | VIEW | GRAPH | SERVICE

NO.	DESCRIPTION	FUNCTION
Cascade		
1	Released Integral Source Seq	Controls the units release on a cascade system. The higher the value the quicker is the release. Range: 0-500 C*min; Default: 51 C*min
2	Reset Integral Source Seq	Controls when the units are shut-down in a cascade system When the value is decreased, heat sources are switched off at a faster rate. Range: 0-500 C*min; Default: 21 C*min
3	Switch-On Delay - CH	Sets the wait time to release units in a cascade system during a heat demand. For instance when a unit is released for a heat demand in a cascade system due to the modulation load, this unit will wait for this set time before igniting the burner. Range: 0-120 Minutes; Default: 5 Minutes
4	Leading Producer	This parameters sets the first unit that will be energized in a cascade system. The boiler automatically follows the lead-lag strategy according to the operating hours. Range: 1-8; Default: 1 (Master Boiler)
5	Restart Time Lock	The restart lock prevents a deactivated heat source from being switched on again, It is released again only after the set time elapsed. This prevents too frequent switching actions of the heat source and ensure stable plant operating states. Range: 0-1800 Seconds; Default: 300 Seconds
6	Device Address	This parameter sets the cascade address of the device. Range: Standalone; Master, Follower 1, ..., Follower 7. Default: Standalone
7	Leading Strategy	This parameter sets the cascade leading strategy. Range: :Late on, early off; Late on, late off; Early on, late off. Default: Early on, late off. Late on, early off - Additional boiler s are switched on as late as possible (output band max) and switched off again as early as possible (output band max). This means that the smallest possible number of boilers are in operation , or additional boilers operate with short on times. Late on, late off - Additional boilers are switched on as late as possible (output band max) and switched off again as a late as possible (output band min). This leads to the smallest possible number of boiler switched on/off actions for the boiler. Early on, late off —Additional boilers are switched on as early as possible (output band min) and switched off again as late as possible (output band min). This means that the largest possible number of boilers are in operation , or additional boilers operate with the longest possible on time.
8	Output Band Minimum	The heat sources are switched on and off according to the selected lead strategy while giving consideration to the preset output band. NOTE: To deactivate the impact of the output band, the limit values must be set to 0% and 100%, and the lead strategy to be selected is Late on, late off. Range: 0-100%; Default: 40%
9	Output Band Maximum	The heat sources are switched on and off according to the selected lead strategy while giving consideration to the preset output band. NOTE: To deactivate the impact of the output band, the limit values must be set to 0% and 100%, and the lead strategy to be selected is Late on, late off. Range: 0-100%; Default: 90%
10	Cascade Rotation Time	This parameter sets the time for leading source rotation is a cascade system. The boiler loads in a cascaded system can be influenced by defining the order of a lead lag boiler. Range: 10-990 Hours; Default: 50 Hours

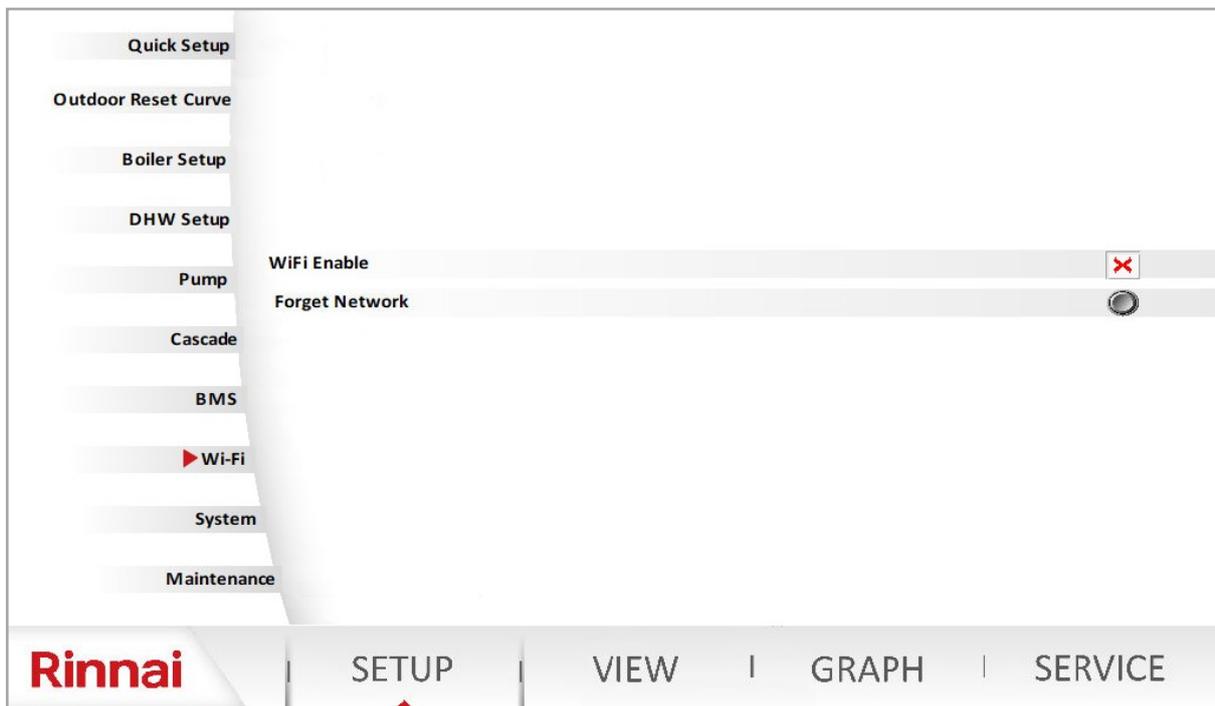
NO.	DESCRIPTION	FUNCTION
Cascade (cont.)		
11	Cascade Rotation Exclusion	This parameters excludes unit from cascade rotation. Range: None, First, Last, First and Last. Default: None
12	Cascade System Sensor	Assigns cascade supply sensor BX1 connection as B10, cascade system sensor. Range: On-Off; Default: Off NOTE: This parameter must be on for a proper operation of a cascade system.
13	Forced Time Basic Stage	Unit will run at min rate and wait for the set time before starting to modulate . Range: 0-1200 Seconds; Default: 60 Seconds
14	Switch-on Delay - DHW	Sets the wait time to release units in a cascade system during a DHW demand. For instance when a unit is released for a DHW demand in a cascade system due to the modulation load, this unit will wait for this set time before igniting the burner. Range: 0-120 Minutes; Default: 2 Minutes
15.	Cascade Master	As soon as more than one heat source is present, the controller with unit address 1 assumes the role of cascade master. It activates the required function and shows the additional operating menus with the cascaded related parameters. Detection of the master role can be automatic (Auto) or can be switched as fix (always). Range: Auto-Always; Default: Auto.
16	Setpoint Compensation	This function will add and offset value to the boiler setpoint above the cascade system sensor temperature setpoint. Range: 1-100; Default: 36°F [20°C]

BMS



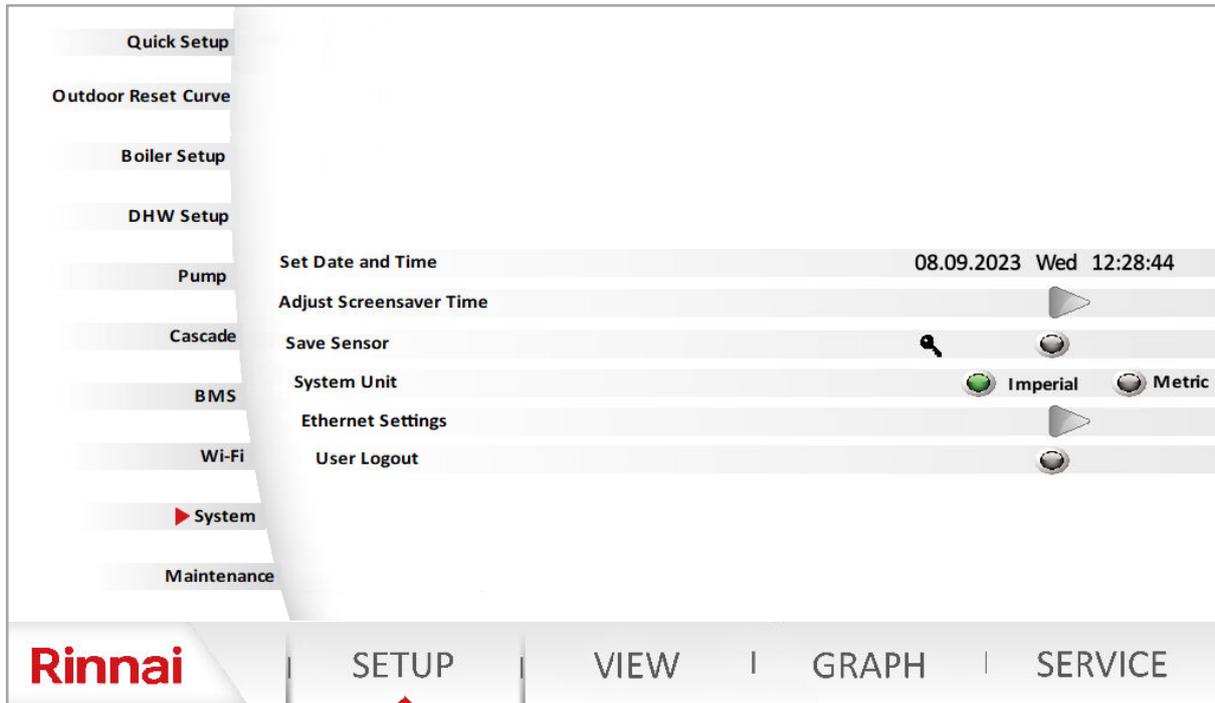
NO.	DESCRIPTION	FUNCTION
BMS		
1	Modbus Address	Sets the Modbus Address for BMS. Range: 0-2; Default: 1
2	Baud Rate	Sets the Baud Rate for BMS. Range: 4800, 9600, 19200, 38400, 115200; Default: 115200
3	Parity	Sets the Parity for BMS. Range: None, Even, Odd; Default: Even
4	Stop Bits	Sets the Stop Bits for BMS. Range: 1 Bit - 2 Bits; Default: 1 Bit
5	Apply Setting	This parameter is used to apply the settings after making changes to the parameters listed above.

Wi-Fi



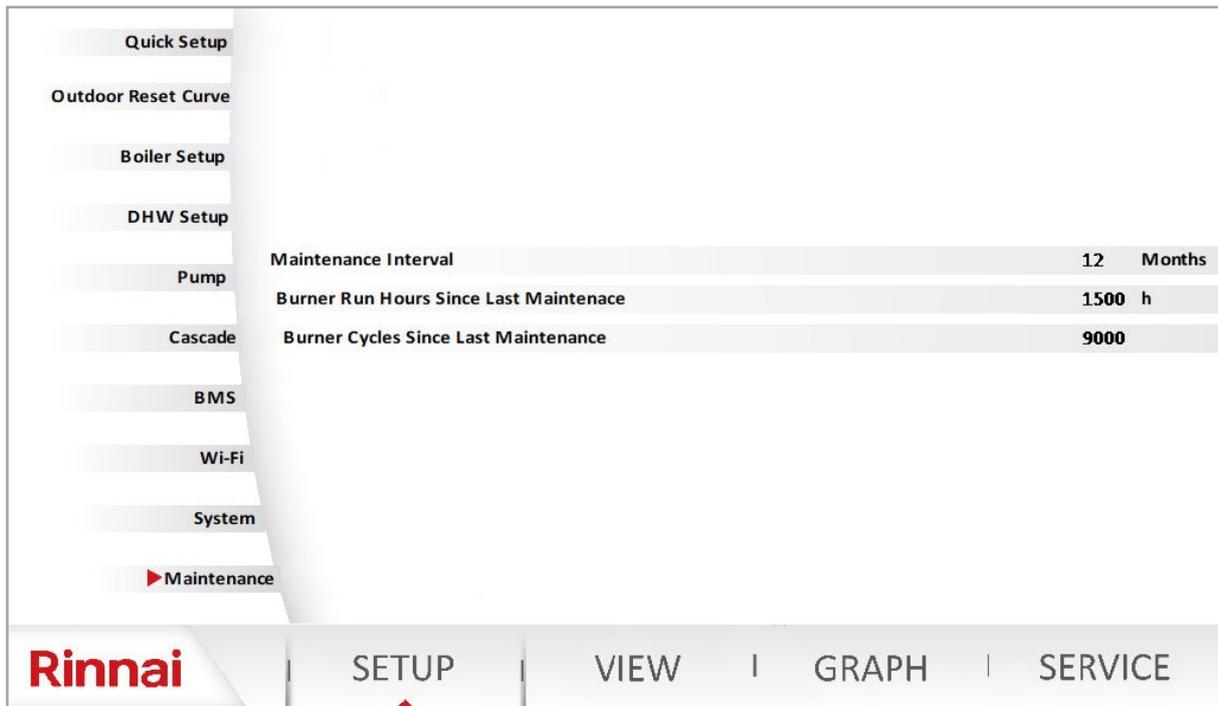
NO.	DESCRIPTION	FUNCTION
BMS		
1	Wi-Fi Enable	This Parameter is used to enable or disable Wi-Fi connectivity. Range: On-Off; Default: Off. NOTE: ONLY enable Wi-Fi when connecting the boiler to a router.
2	Forget Network	This function is available in case there is a need to forget the current Wi-Fi connectivity and connect to a new Wi-Fi. Press the icon to forget network.

System



NO.	DESCRIPTION	FUNCTION
System		
1	Set Date and Time	This function can be used to set the current Date and Time . The user also has options to select a time zone. The clock will adjust automatically for day light savings based on time zone.
2	Adjust Screensaver Time	Sets the screensaver time. This time is also related to how long the system will maintain the Installer, Technician, or Engineer logged in. Range: 1-99 Minutes; Default: 10 Minutes
3	Save Sensor	At midnight, the controller saves the statuses at the sensor terminals, provided controller has been in operation for at least 2 hours. If a sensor drops out after saving, the controller generates and error message. This setting is used to ensure immediate saving of sensors. This becomes a requirement when, for instance, a sensor is removed because it is no longer needed. Range: On - Off Default: Off
4	System Unit	Use this function to change the system of units from Imperial (F, Psi, Btu) to Metric (C, Bar, kWh), or vice-versa. Range: Imperial - Metric Off; Default: Imperial
5	Ethernet Settings	This function can ONLY be accessed by a Rinnai employee.
6	User Logout	This function can be used to logout of SETUP or SERVICE pages, and to change user level once logged in.

Maintenance

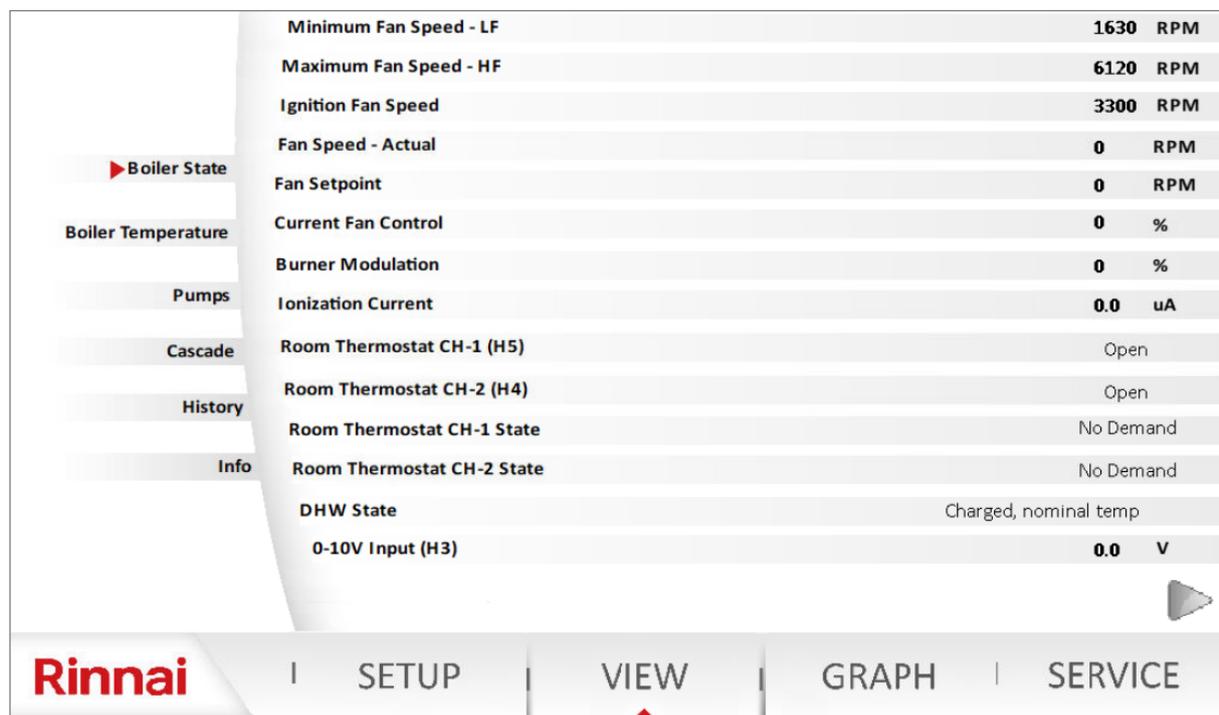


NO.	DESCRIPTION	FUNCTION
Maintenance		
1	Maintenance Interval	Sets the boiler maintenance interval in months. Range: 1-240 Months; Default: 12 Months
2	Burner Hours Since Last Maintenance	Sets the boiler maintenance interval based on burner run hours. Range: 100 - 10,000 Hours; Default: 1500 Hours
3	Burner Cycles Since Last Maintenance	Sets the boiler maintenance interval based on ignition cycles. Range: 100 - 65,500 Cycles; Default: 9000 Cycles

View Page

The view function can be used to monitor boiler operation. NOTE: Password is not required to access this page.

VIEW - Boiler State:



NO.	DESCRIPTION	FUNCTION
Boiler State		
1	Minimum Fan Speed	Displays the minimum fan speed setpoint of the boiler based on model, gas type, and elevation
2	Maximum Fan Speed	Displays the maximum fan speed setpoint of the boiler based on model, gas type, and elevation
3	Ignition Fan Speed	Displays boiler ignition speed setpoint
4	Fan Speed Actual	Displays the current fan speed
5	Fan Setpoint	Displays the current fan setpoint
6	Current Fan Control	Displays the current fan PWM (as a percentage)
7	Burner Modulation	Displays the current boiler modulation from 0% - 100%. 0% represents the minimum boiler input rate, and 100% represents the maximum boiler input rate.
8	Ionization Current	Display the current ionization current of the flame in uA. The boiler will extinguish the flame when the ionization current is less than 0.8 uA.
9	Room thermostat CH-1	Displays the status of the room thermostat CH-1 connection. The contact is normally open and will display open when a room thermostat is not connected or the demand for heat is off. The state will change to closed when a room thermostat is connected and calling for heat demand.
10	Room thermostat CH-2	Displays the status of the room thermostat CH-2 connection. The contact is normally open and will display open when a room thermostat is not connected or the demand for heat is off. The state will change to closed when a room thermostat is connected and calling for heat demand.

NO.	DESCRIPTION	FUNCTION
VIEW - Boiler State (cont.)		
10	Room Thermostat CH-1 State	Display a message regarding the state of the room thermostat CH-1
11	Room Thermostat CH-2 State	Display the a message regarding state of the room thermostat CH-1
12	DHW State	Display the a message regarding DHW demand state
13	0-10VDC Input (H3)	Displays 0-10VDC input signal to control the boiler temperature setpoint
14	Boiler State	Displays the current status of the boiler
15	Burner State	Displays the current status od burner operation (standby, pre-purge, post-purge, running, ...)
16	Water Pressure Sensor	The water pressure sensor state is normally close when water pressure voltage is more than 5VDC. Below 5VDC the state will change to open and the control will generate an error code.
17	Water Pressure Sensor Voltage	Display the current input voltage for water pressure sensor
18	Air Pressure Switch	The air pressure switch is normally closed during normal operation. The switch will open in case of a vent or condensate blockage and the control will generate an error code.
19	Gas Pressure Switch	Not applicable for 301 and 399 models

View: Boiler Temperature

	Boiler Setpoint	-- °F
	Boiler Setpoint (CH-1)	180.0 °F
	Boiler Setpoint (CH-2)	180.0 °F
	Boiler Setpoint (DHW)	156.2 °F
Boiler State	Boiler Setpoint (0-10V)	-- °F / -- %
▶ Boiler Temperature	Outdoor Temperature	-57.2 °F
	Flue Temperature	36.5 °F
Pumps	Supply Temperature	97.8 °F
Cascade	Return Temperature	86.5 °F
History	Delta-T	11.3 °F
	Pressure	85.5 PSI
Info	Indirect Storage Tank Temperature - Setpoint	120.2 °F
	Indirect Storage Temperature - Actual	-- °F

Rinnai | SETUP | **VIEW** | GRAPH | SERVICE

NO.	DESCRIPTION	FUNCTION
VIEW - Boiler Temperature		
1	Boiler Setpoint	Displays the boiler active temperature setpoint. In case there are demands from both room thermostats (CH-1 and CH-2), the boiler setpoint will be the highest setpoint. NOTE: A mixing valve must be used to protect the lower temperature zone.
2	Boiler Setpoint (CH-1)	Displays the boiler active setpoint of room thermostat CH-1
3	Boiler Setpoint (CH-2)	Displays the boiler active setpoint of room thermostat CH-2
4	Boiler Setpoint (DHW)	Displays the boiler active setpoint for an indirect tank demand. This setpoint is equal to DHW temperature setpoint + Boiler Supply Temperature Offset for DHW (on SETUP—DHW Setup page)
5	Boiler Setpoint (0-10V)	Displays the boiler active setpoint or modulation setpoint for 0-10VDC input demand.
6	Outdoor Temperature	Displays the current outside temperature when an outdoor temperature sensor is connected to the boiler
7	Flue Temperature	Displays the current flue temperature
8	Supply Temperature	Displays the actual boiler supply temperature
9	Return Temperature	Displays the actual boiler return temperature
10	Delta-T	Displays the actual boiler temperature differential (Difference between Supply and Return temperatures)
11	Pressure	Displays the system pressure from the built-in water pressure sensor
12	Indirect Storage Tank Temperature—Setpoint	Displays the indirect storage tank active setpoint
13	Indirect Storage Tank Temperature—Actual	Displays the actual indirect storage tank temperature. NOTE: This will ONLY display a value when a temperature sensor is being used to control the indirect storage tank.

View: Pumps

Boiler State	Boiler Pump (Q1)	Off
	Boiler Pump (Q1) Speed	-- %
Boiler Temperature	CH Pump (Q2)	Off
	CH Pump (Q2) Speed	
Pumps	DHW Pump (Q3)	Off
	DHW Pump (Q3) Speed	-- %
Cascade	UX2	0 V
	UX3	0 V
History	P1	0 %
Info		

Rinnai
SETUP
VIEW
GRAPH
SERVICE

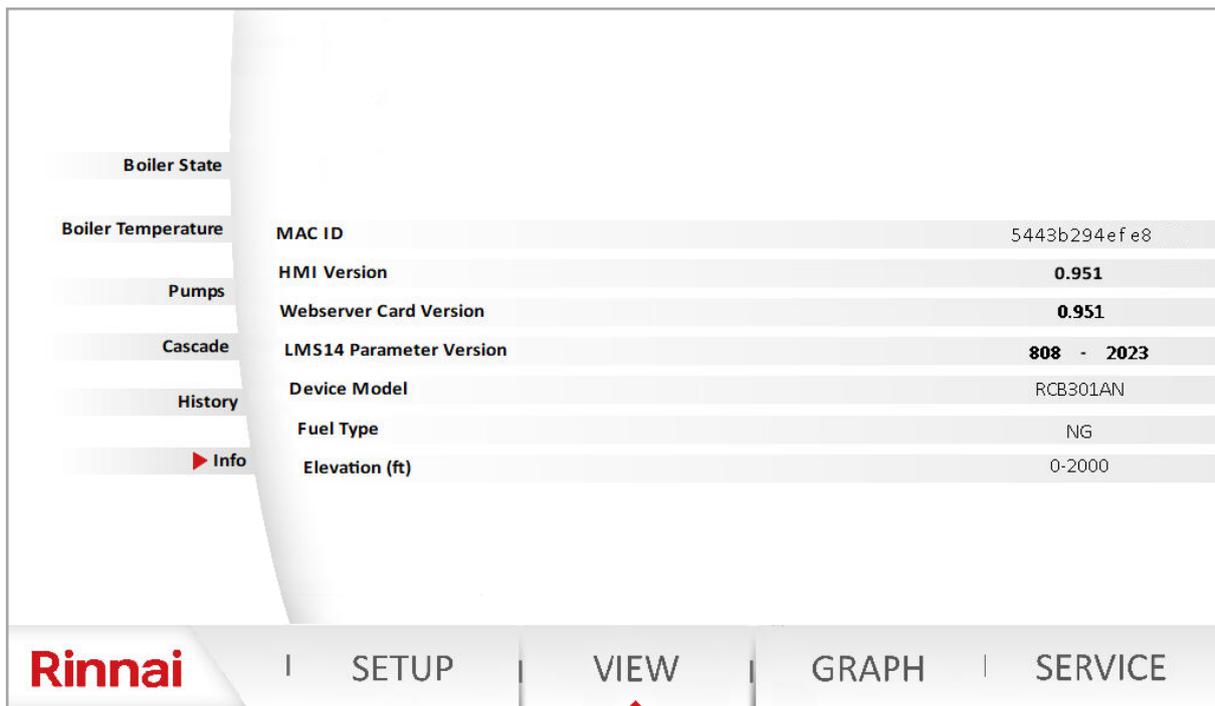
NO.	DESCRIPTION	FUNCTION
VIEW - Pumps		
1	Boiler Pump (Q1)	Displays the current state of boiler pump (on / off)
2	Boiler Pump (Q1) Speed	Not used
3	CH Pump (Q2)	Displays the current state of CH pump (on / off). NOTE: This is for CH-1 room thermostat connection zone.
4	DHW Pump (Q3)	Displays the current state of DHW pump (on / off). NOTE: If DHW pump is assigned as a CH-2 pump from SETUP-DHW Setup page, then this will represent the state of the CH-2 pump for CH-2 room thermostat connection zone.
5	DHW Pump (Q3) Speed	Not used
6	UX2	Displays the value of 0-10V output signal for UX2 connection
7	UX3	Displays the value of 0-10V output signal for UX3 connection
8	P1	Displays the PWM value in % for P1 connection.

View: Cascade

Unit	Status
Master	7-Not Released
Follower 1	0-Not Available
Follower 2	0-Not Available
Follower 3	0-Not Available
Follower 4	0-Not Available
Follower 5	0-Not Available
Follower 6	0-Not Available
Follower 7	0-Not Available

NO.	DESCRIPTION	FUNCTION
VIEW - History (cont....)		
4	Hours Run Heating	Displays the run hours for Central Heating (CH) mode
5	DHW Hours Run	Displays the run hours for DHW mode
6	Reset Error Code	This will clear the error history (ONLY available for Rinnai employees)
7	List of Error Codes	This page accumulative error codes. This list can ONLY be reset by a Rinnai employee.

View: Info

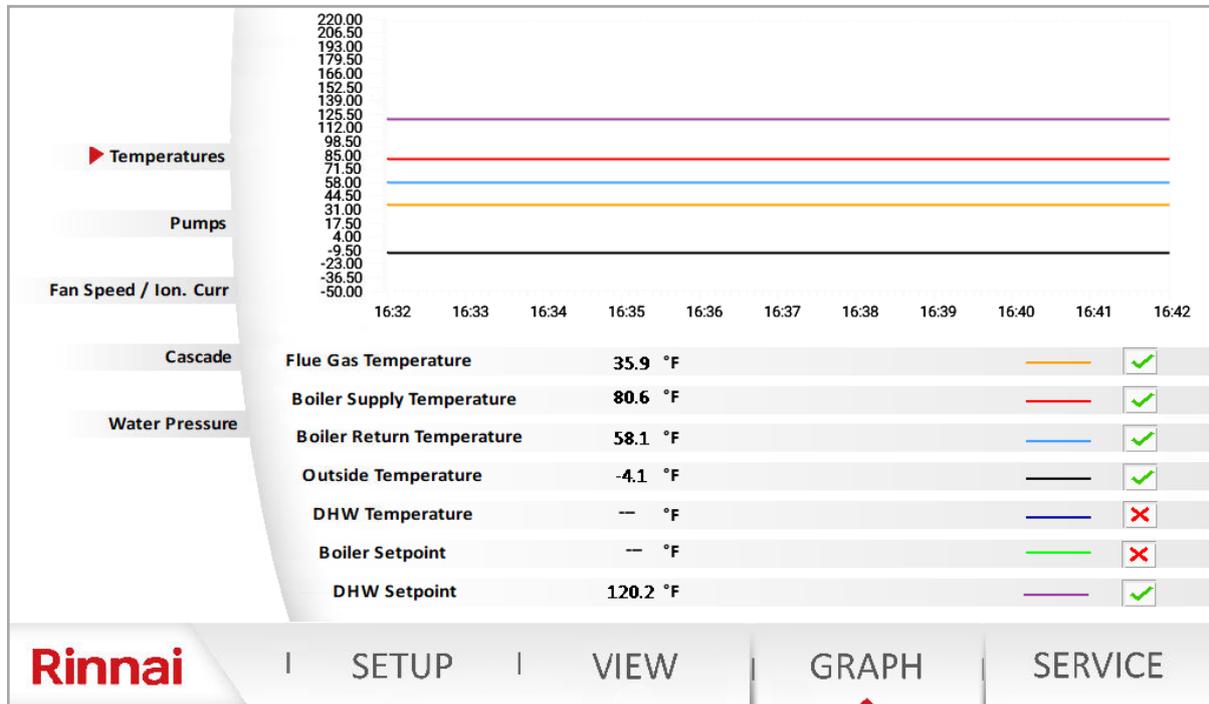


NO.	DESCRIPTION	FUNCTION
VIEW - Info		
1	MAC ID	Displays boiler MAC ID for Wi-Fi connection
2	HMI Version	Displays the firmware version of the touch panel—HMI
3	Webserver Card Version	Displays the firmware version of the webserver card (located on the bottom of the boiler)
4	LMS14 Parameter Version	Display the parameter file version of the main control board (LMS14)
5	Device Model	Displays the boiler model (301 or 399)
6	Fuel Type	Displays the fuel type NG or LP
7	Elevation (ft)	Displays the elevation setting

Graph Page

The graph function can be used to monitor boiler operation and aid in troubleshooting.

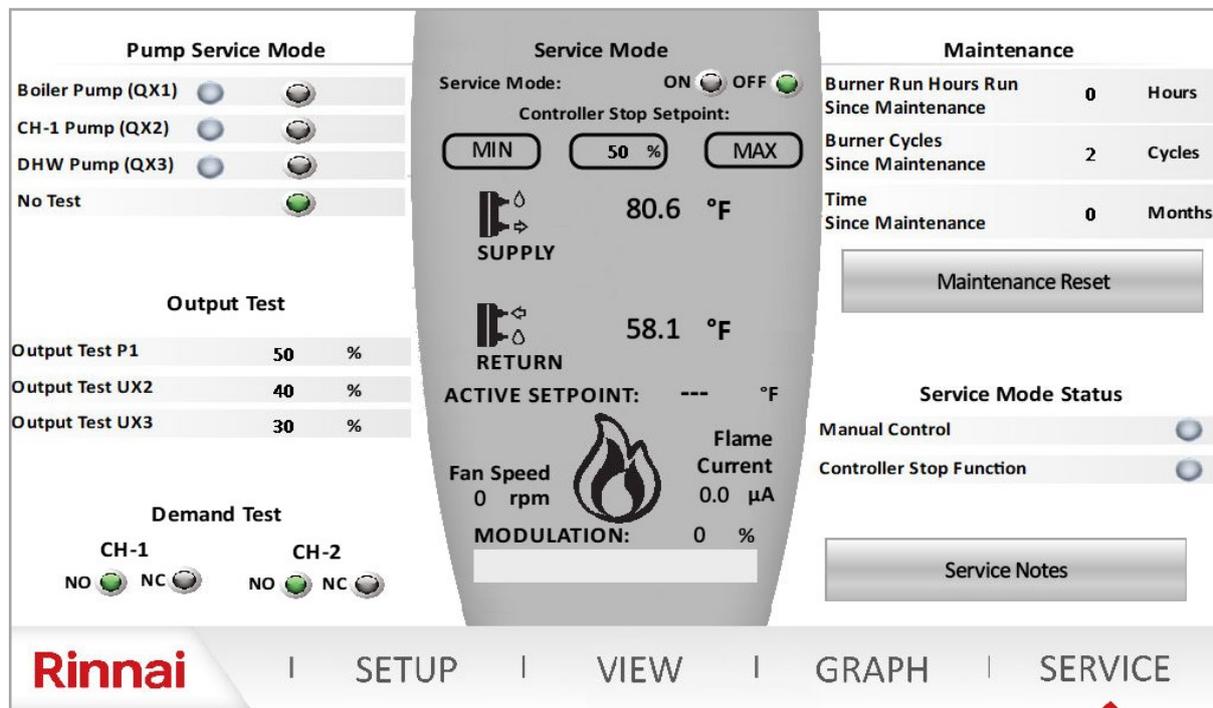
NOTE: Password is not required to access this page.



In order to activate each data point the boxes next to each parameter needs to be activate with a check mark. As long as the current graphical page remains active a total of 10 minutes data will be shown on the screen. Once the user leaves the screen the graph will clear and start from the current time. There are four different graphs (Temperatures, Pumps, Fan Speed / Ion. Curr., Cascade, and Water Pressure), and ONLY one of the graphs can be viewed at once.

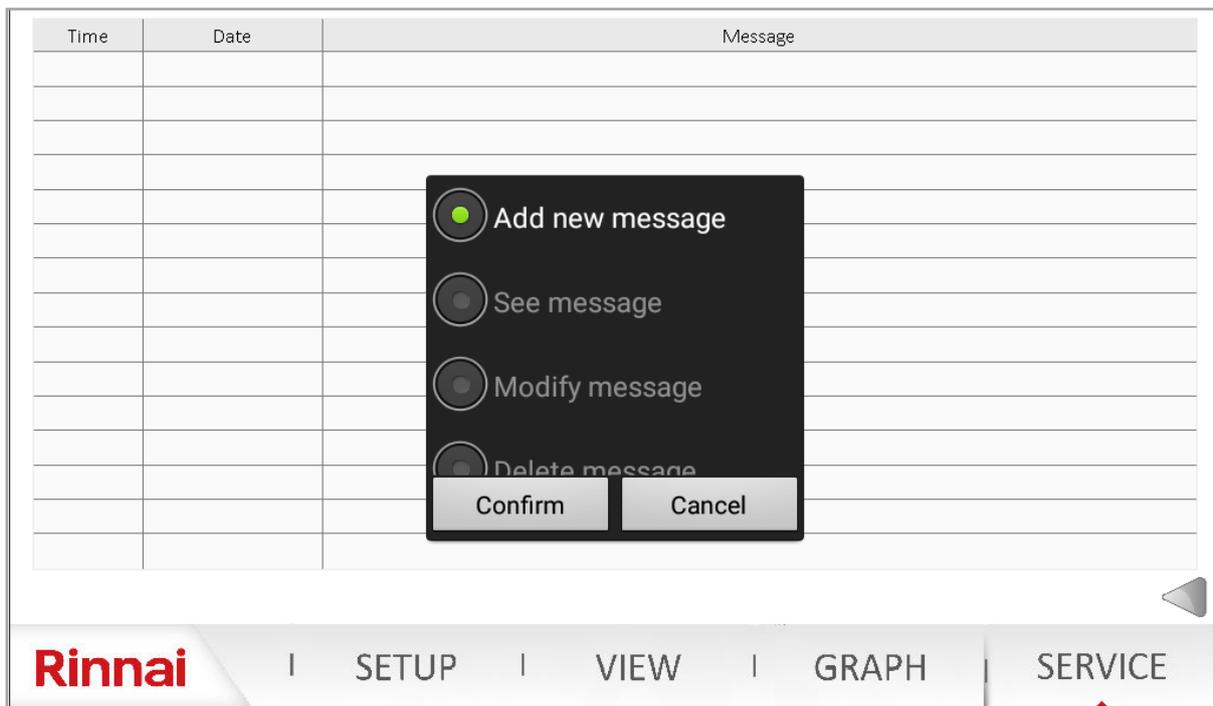
Service Page

The service page can be used during boiler commissioning. This is useful to manually run the pumps and remove air from the system. Also, it can be used for combustion analysis by running the unit at minimum and maximum firing rate or any other firing rate in between. **NOTE:** The service mode operation will automatically end after 4 hours unless it is manually turned off by the user. **NOTE:** It is extremely important to turn-off the service mode after boiler commissioning to avoid issues during normal operation.



NO.	DESCRIPTION	FUNCTION
LEFT PANE		
1	Pump Service Mode	This function is used to manually run each one of the pumps individually. This is a useful mean to ,check pumps for operation and remove air from the system durian deaeration process. NOTE: ONLY one pump can be energized at the time. Once the testing is completed No test should be selected to stop the test.
2	Output Test	This function can be used to test the operation of 0-10V and PWM output signals. The values are in terms of percentage. For instance if the user is looking for 4V, then 40% should be entered. The readable values can be confirmed from VIEW - Pumps page.
3	Demand Test	This function can be used to test functionality of room thermostat connection without any wiring connected to the boiler terminals. These contacts are normally open (NO). By clicking on Normally Closed (NO), this will close the room thermostat connection and the boiler will get a demand for heat. NOTE: It is very critical to return these values to the default setting (NO) once the testing is completed.

NO.	DESCRIPTION	FUNCTION
CENTER PANE		
4	Service Mode	<p>Service mode can be used to manually fire the unit and adjust its firing rate. Press on the ON icon in front of Service mode to activate a call for heat. Once the demand for heat is active the two LED lights under Service Mode Status (right pane) will illuminate. The firing rate can be adjusted by clicking on MIN (this will bring the boiler to the minimum firing rate), MAX (this will bring the boiler to its maximum firing rate), or percentage box (will prompt the user to enter a value between 0% and 100%). NOTE; The boiler target setpoint will be 180F once this mode is active. It is important for the user to ensure there is enough head load connected to the boiler to dissipate the heat. During this mode all 3 pumps will be energized, it is also critical to ensure not to overheat an indirect tank that is connected to the boiler.</p> <p>The remaining information on the center pane are to view ONLY.</p>
RIGHT PANE		
5	Maintenance	The information showing (Burner Run Hours Since Maintenance, Burner Cycles Since Maintenance, and Time Since Maintenance) are used to display boiler operation since last maintenance service. Once the service has been performed, the user can click on Maintenance Reset box to reset the counter.
6	Service Mode Stats	This is a read only information. Once the service mode has been activated both LED indicators will turn green to confirm operation.
7	Service Notes	Click on Service Notes box to enter notes, contact information for the record. See info below for more details.



To add new notes, double tap the screen on an empty line under the message. A confirmation box will pop-up. Click on confirm, then a new text box will pop up to for the user to type the information. Once the information has been entered, click on confirm to save the content.

To edit previous messages, double click on the desired message. It will be highlighted in blue and confirmation will pop-up. Click on Modify Message to make changes to current message, or Delete Message to delete current selected message.

4.3 Error and Diagnostic Codes



WARNING

Some of the checks below should be performed by a licensed professional. Consumers should never attempt any action that they are not qualified to perform.

The list of error codes with occurrence day and time and with clear date and time are saved in the History page. This information can be accessed via the boiler controller by clicking on VIEW - History.

Error Code	Message	Remedies NOTE: The numbers in parenthesis are diagnostic codes associated with each error codes
10	Outdoor sensor fault (B9)	<p>The error will auto-reset once the issue is resolved (610)</p> <p>NOTE: This error code does not prevent boiler operation; However, it will prevent any other error codes to show on the home page.</p> <ol style="list-style-type: none"> 1- Check the outdoor sensor connection to ensure it is not open or not connected (if not connected, the jumper should remain in place - supplied from the factory) - check continuity 2- Check outdoor sensor wiring to ensure it is connected properly (1 kOhm sensor supplied from the factory) - check continuity 3- Check the resistance of the outdoor sensor and compare to the value shown on the resistance value table 4- Replace the outdoor sensor if malfunction is detected 5- If the issue persists, replace the main control board
20	Boiler Supply temperature sensor fault (B2)	<p>The error will auto reset once the issue is resolved (unless the diagnostic code is 2- manual reset required)</p> <ol style="list-style-type: none"> 1- Check supply temperature sensor wiring to ensure it is connected properly (10 kOhm sensor) - check continuity 2- Check supply temperature sensor to ensure it is not short or open (2) 3- Check the resistance of the supply temperature sensor and compare to the value shown on the resistance value table (737, 591, 249, 552) 4- Replace the supply temperature sensor if malfunction is detected. 5- If the issue persists, replace the main control board
26	Cascade temperature sensor fault (B10)	<p>The error will auto-reset once the issue is resolved</p> <p>NOTE: This error code does not prevent boiler operation; However, it will prevent any other error codes to show on the home page.</p> <ol style="list-style-type: none"> 1- Check cascade temperature sensor wiring to ensure it is connected properly (10 kOhm sensor) 2- Check cascade temperature sensor to ensure it is not short or open 3- Check the resistance of the cascade temperature sensor and compare to the value shown on the resistance value table 4. The cascade temperature sensor is ONLY required on the Master boiler. Confirm the cascade address is set correctly. Ensure the cascade sensor is set correctly on SETUP - cascade setup page. If everything is set correctly, use the save sensor option on SETUP - system setup to configure this sensor. 4- Replace the supply temperature sensor if malfunction is detected. 5- If the issue persists, replace the main control board

Error Code	Message	Remedies NOTE: The numbers in parenthesis are diagnostic codes associated with each error codes
28	Flue gas temperature sensor fault (BX3)	<p>The error will auto reset once the issue is resolved (unless the diagnostic code is 0 or 540 - manual reset required)</p> <ol style="list-style-type: none"> 1- Check flue gas temperature sensor wiring to ensure it is connected properly (10 kOhm sensor) - check continuity 2- Check flue gas temperature sensor to ensure it is not short (543 or 0) or open (544 or 540) 3- Check the resistance of the flue gas temperature sensor and compare to the value shown on the resistance value table 4- Replace the flue gas temperature sensor if malfunction is detected. 5- If the issue persists, replace the main control board
40	Return temperature sensor fault (B7)	<p>The error will auto reset once the issue is resolved (unless the diagnostic code is 0- manual reset required)</p> <ol style="list-style-type: none"> 1- Check return temperature sensor wiring to ensure it is connected properly (10 kOhm sensor) - check continuity 2- Check return temperature sensor to ensure it is not short (441) or open (442) 3- Check the resistance of the return temperature sensor and compare to the value shown on the resistance value table (52, 738, 250, 0) 4- Replace the return temperature sensor if malfunction is detected. 5- If the issue persists, replace the main control board
50	DHW temperature sensor/ thermostat fault (B3)	<p>The error will auto-reset once the issue is resolved (55)</p> <p>NOTE: This error code does not prevent boiler operation; However, it will prevent any other error codes to show on the home page.</p> <ol style="list-style-type: none"> 1- Check what type of device is used to control the indirect tank temperature (sensor or aquastat). Verify that the settings on the boiler (SETUP-DHW Setup) matches the application 2- Check the DHW temperature sensor connection to ensure it is not open or not connected (if an aquastat is being used ensure the correct setting is used on SETUP-DHW setup page) 3- Check DHW temperature sensor wiring to ensure it is connected properly (10 kOhm sensor) - check continuity 4- Check the resistance of the DHW temperature sensor and compare to the value shown on the resistance value table 5- Replace the DHW temperature sensor / Aquastat if malfunction is detected 6- If the issue persists, replace the main control board
81	LPB short-circuit or no bus power supply	<p>The error will auto-reset once the issue is resolved (67)</p> <ol style="list-style-type: none"> 1- Check cascade communication cable to ensure the wires are not shorted 2- Ensure the cable connection from cascade module to the main control board is connected properly and secured 3- If the problem persists and the unit is not cascaded with other units, disconnect the cascade module from the main controller. <p>NOTE: LPB is the cascade bus (the power comes directly form the main controller)</p>
82	LPB address collision	<p>The error will auto-reset once the issue is resolved (67)</p> <p>NOTE: This error code will ONLY happens if there are two or more units connected with each other.</p> <ol style="list-style-type: none"> 1- Check to ensure the cascade addresses for the units in the cascade system are unique. For instance if there are one or more units set as Master, the LPB address collision error code will be displayed.

Error Code	Message	Remedies NOTE: The numbers in parenthesis are diagnostic codes associated with each error codes
83	BSB-Wire short-circuit or no communication	The error will auto reset once the issue is resolved (595) 1- Ensure the wiring from the Webserver card/Wi-Fi Module and LMS is not jumped or disconnected. NOTE: BSB is the communication between the Webserver card/Wi-Fi Module and main controller.
91	Data loss in EEPROM	The error will auto reset once the issue is resolved (618) This error code should only happen during flashing of the main controller at the factory. 1- Loss of data on EEPROM - replace the main control board
105	Maintenance message	The error will auto reset once the maintenance interval has been reset (87) 1- Perform the boiler service as recommended by the manufacturer 2- Once the service has been performed, access the SERVICE page and perform a maintenance reset.
110	SLT lock-out SLT - Safety Limit Thermostat (electronic)	This error code requires a manual reset 1- Boiler return temperature not possible (< 32°F [0°C]) - (424) 2- Boiler supply temperature not possible (<32°F [0°C]) - (422) 3- Boiler supply temperature not possible (>255°F [124°C]) - (422, 809) 4- Safety Limit Thermostat (SLT) is open (551, 412) - check continuity of thermofuse, burner door switch and jumper on high voltage terminal block) 5- Boiler return temperature > 208°F (98°C) - (425) 6- Boiler Supply Temperature > 208°F (98°C) - (419, 430, 432) 7- Boiler temperature rises faster than allowed (5.4°F [3°C]) - (426, 437) 8- Reset criteria (boiler temperature less than boiler temperature setpoint and Delta-T less than 72°F [40°C] for error 426 not reached - (427) 9- Delta T (difference between supply and return) is higher than 101°F (56°C) - (428) 10- Reset criteria (Delta-T less than 36°F [20°C] after error 433 not reached)-(429) 11- Boiler return temperature is higher than boiler supply temperature + 27°F (15°C) - (420, 431) 12- Boiler return temperature is higher than/equal to boiler supply temperature + 31°F (17°C) - (420) 13- Supply temperature increases after the burner is off - residual heat (436) 14- Delta-T (difference between supply and return) is greater than 72°F [40°C] - (433, 438) 15- Supply temperature exceeds 208°F (98°C) - (432)
111	Temperature limiter safety shut-down	The error will auto reset once the supplied temperature is below 203°F (95°C) (264) 1- Supply temperature has exceeded 203°F (95°C) (264)
117	Water pressure too high (H1)	The error will auto reset once the water pressure decreases to less than 83 PSI (5.7 bars) (566) 1- Ensure the water pressure in the system does not exceed 87 PSI (6 bar). This is very unlikely since the maximum setting on the factory supplied pressure relieve valve is 75 PSI 2- If the actual pressure in the system has been confirmed to be below 87PSI, replace the water pressure sensor.
118	Water pressure too low (H1)	The error will auto reset once the water pressure is at least 16 PSI (1.1 bar) (566) NOTE: The boiler will reduce the output power when pressure in the system is between 12 PSI (0.8 bar) - 20 PSI (1.4 bar). The boiler will continue to operate and an error code will be displayed on the home screen. When the pressure increases above 20 PSI (1.4 bar) the error will disappear. If the pressure decreases below 12 PSI (0.8 bar) the boiler will shut-down and keep the error code. 1- Ensure the water pressure in the system is at least 12 PSI (0.8 bar). Check the pressure setting on the water auto feed to the boiler loop. Check for water leaks in the system piping. 2- If the pressure in the system is still below 16 PSI (1.2 bar), replace the water pressure sensor.

Error Code	Message	Remedies NOTE: The numbers in parenthesis are diagnostic codes associated with each error codes
125	Maximum boiler temperature exceeded Boiler pump and fan will continue to run to dissipate the heat.	The error will auto reset once the boiler supply temperature decreases below 203F (95C) minus the boiler switch on differential, 20°F (11°C) - default settings. NOTE: The boiler will start reducing the firing rate when supply temperature reaches 190°F (88°C) 1- The boiler temperature has reached 203F (95C) (286, 500, 740) 2- No temperature change on supply sensor after flame (501) 3 - No temperature change on return sensor after flame (502)
128	Loss of flame in operation (10 times)	This error code requires a manual reset 1- Loss of flame in operation (625) 2- Ionization current has fallen below 0.8uA (854) 3- Ensure the boiler electrical connection is properly grounded to the ground source. 4- Monitor the gas pressure to the unit while in operation. The gas pressure should be within the limits specified in this manual. 5 - Check the flame signal on the display. It should be above 0.8uA when the burner is lit. The flame current should be stable after the boiler has been firing for at least one minute and it is normally between 3 - 7uA. if the flame current is less than 0.8uA, disassemble the burner door and check the ionization probe quality and distance to the burner (clean if necessary).
130	Flue gas temperature maximum limit exceeded (BX3)	This error code will automatically reset if the issue is resolved within 10 minutes. Otherwise a manual reset is required. 1- Ensure the proper setting is being used for the flue pipe venting material. If the flue temperature for the application is higher than 149°F (65C), vent material other than PVC must be used and the setting for the flue gas temperature limit must be set to other on the controller (SETUP-Boiler Setup). 2- The control will limit the flue temperature to 149°F (65°C) for PVC pipe and 207°F (97°C) for other venting materials. The boiler will automatically start to modulate when the vent temperature reaches 140F (60°C for PVC and 194°F (90°C) for other venting material. The control will shut down and monitor the vent temperature for 10 minutes. If the temperature exceeds the value shown here after 10 minutes the control will lock-out. 3- Check flue gas temperature resistance and compare to the value listed on the resistance table 4- Ensure the correct gas type is used. If the unit is Natural Gas and Propane gas is connected to the unit this will cause boiler overheating and unsafe conditions.
133	Safety time for establishment of flame exceeded (4 times)	This error code requires a manual reset 1- The boiler failed to ignite four times during one heat call (625) 2- Check electrical connection to the unit and check for proper grounding and polarity. 3 - Check the ignition transformer wiring connection for reverse polarity. 4- Check for sparks through the sight glass on the burner door. 5- If there is spark but no flame, monitor the static gas pressure to ensure it is within the limits specified in this manual 6- Check for vent or condensate blockage. 7- If the problem persists, remove the burner door and inspect the ignition electrodes (check for gaps and distance to the burner. Clean if necessary)

Error Code	Message	Remedies NOTE: The numbers in parenthesis are diagnostic codes associated with each error codes
151	BMU internal fault	This error requires a manual reset Internal error on the main controller (630) 1- Error at closing(330) or opening (331) ignition relay 2- Error at closing (332) or opening (333) gas valve relay 1 3- Error at closing (336) or opening (337) the safety relay 4- Replace the main controller
152	Parameterization error	This error will auto-reset once the issue is resolved unless diagnostic code is 780, 781, 782, 851, 840 or 853 - manual reset required This error happens when setting parameters on the main controller. For instance if the fan speeds are not set within the min and max range set on the main controller.
153	Unit manually locked	This error code requires a manual reset (press reset button for less than 10 seconds) 1- Unit manually locked (reset button pressed more than 10 seconds)
160	Fan speed threshold not reached	This error code requires a manual reset NOTE: These error codes happen in case the impeller on the fan gets stuck. 1- Fan speed threshold not reached: home run (377) 2- Fan speed threshold not reached: standby (378) 3- Fan speed threshold not reached: ignition (379) 4- Fan speed threshold not reached: pre-purge (380) 5- Fan speed threshold not reached : post-purge (381) 6- Fan speed threshold not reached : in operation (233, 749)
162	Air pressure switch does not close	This error code requires a manual reset (9) 1- Air pressure switch is normally closed and will open in case of condensate or vent blockage. 2- Check the pressure switch wiring—check continuity. 2- Check vent pipe and condensate trap for blockage. Disconnect the hose from the air pressure switch and check for operation. If the unit operates normal, either condensate on vent pipi is blocked. If the unit does not operate check pressure switch. 3- Check the pressure switch wiring to ensure it is normally closed when the unit is on standby. 4- If the issue persists check replace the air pressure switch.
183	Unit in parameterization mode	This error code requires a manual reset 1- Unit in parameterization mode (301) 2- Unit in parameterization mode (770 - parameter stick)

Error Code	Description	Remedies NOTE: The numbers in parenthesis are diagnostic codes associated with each error codes
217	Sensor fault	This error code will auto-reset once the issue is resolved 1- Short-circuit of ionization electrode (765, 766). The ionization current is shorted to ground. 2- Check the condensate trap to ensure the condensate is draining properly. If there is water in the heat exchanger in contact with the ionization electrode this error code will appear.
317	Grid frequency OOR	This error code will auto-reset once the frequency is back within the range NOTE: This error code happens when the power frequency is out of the range [42 Hz - 72 Hz] 1- Mains frequency outside specification (275, 461)
353	Cascade temperature sensor missing (B10)	This error code will auto-reset once the issue is resolved NOTE: On a cascade system, a cascade temperature sensor is required to be installed on the system loop. Once a sensor is connected to the unit, the main controller recognized the sensor. If the sensor gets disconnected this error code will be shown. If the unit is no longer set as a cascade, the sensor must be disabled from the cascade setup menu, and save sensor function must be applied from the system setup menu. 1- Cascade temperature sensor missing (B10) (139)
384	Extraneous light	This error code requires a manual reset (625) NOTE: This error code happens if unit detects fan while the gas valve is not energized (false flame)
385	Main undervoltage	This error code will auto-reset once the voltage is back within the range NOTE: This error code happens when the voltage is out of the range [102V - 132V] 1- Voltage outside of the range (554, 555)
386	Fan speed tolerance	This error code requires a manual reset 1- Fan speed out of tolerance (+/-300 rpm): home run (387) 2- Fan speed out of tolerance (+/-300 rpm) standby (388) 3- Fan speed out of tolerance (+/-1200 rpm): ignition (374, 382, 383) 4- Fan speed out of tolerance (+/-1200 rpm): pre-purge (389,531) 5- Fan speed out of tolerance (+/-1200 rpm) : post-purge (390, 532, 534) 6- Fan speed out of tolerance (+/-1200 rpm) : in operation (232, 750, 375, 385, 386)

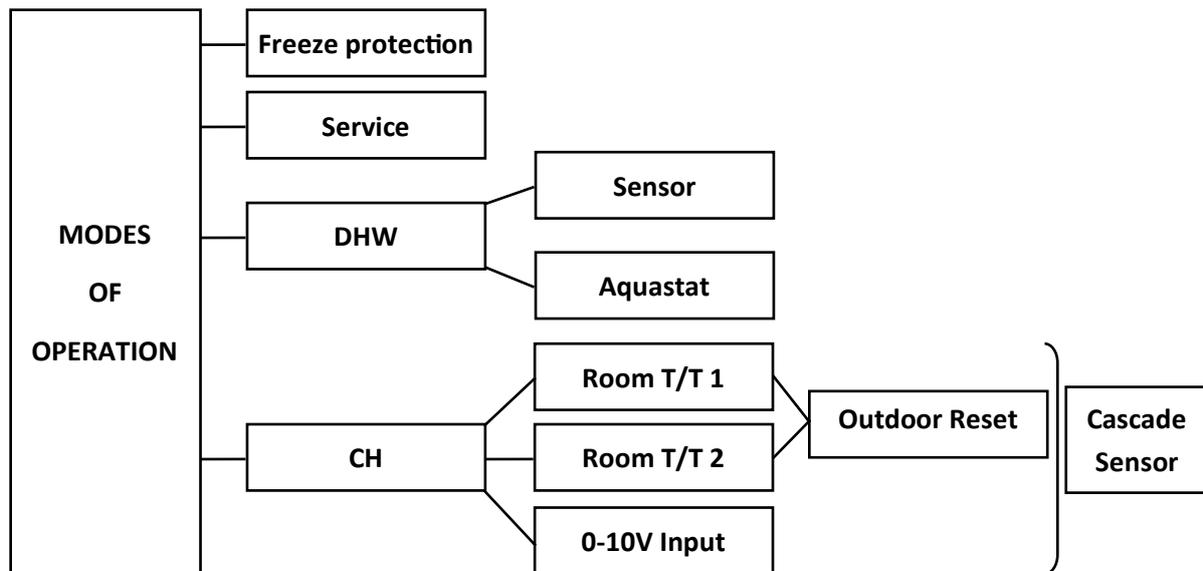
Other possible issues without an error code:

1. There is call for heat, pumps are running however the unit is not firing. Check boiler active setpoint and compare with boiler actual supply temperature values. The boiler will ONLY fire when the active setpoint is equal or higher than the boiler actual temperature plus the differential.
2. The main screen is blank. Ensure the CAT5 cable is properly connected to the main screen (it must be connected to port RS485). Check the webserver card/Wi-Fi Module located on the bottom of the unit to ensure it is getting power. If so, please check the wiring from webserver card/Wi-Fi Module to the HMI for proper connection (see wiring diagram for details).
3. The temperature values on the main screen are all zeros. Ensure the webserver card/Wi-Fi Module is properly connected to the main controller and is getting power.

Temperature vs. Resistance Table

Supply Temperature Sensor Return Temperature Sensor Flue Temperature Sensor Cascade System Sensor DHW Temperature Sensor		Outdoor Temperature Sensor	
Temperature [°F]	Resistance [Ω]	Temperature [°F]	Resistance [Ω]
		-22	13034
		-13	9889
		-4	7578
		5	5861
		14	4574
		23	3600
32	32555	32	2857
41	25339	41	2284
50	19873	50	1840
59	15699	59	1492
68	12488	68	1218
77	10000	77	1000
86	8059	86	827
95	6535	95	687
104	5330	104	575
113	4372	113	483
122	3605	122	407
131	2989		
140	2490		
149	2084		
158	1753		
167	1481		
176	1256		
185	1070		
194	915		
203	786		
212	677		

4.5 Operating Information



Freeze Protection (priority 1):

The electronic management system of the boiler includes protection against frost. If the water temperature falls below 41°F [5°C], the burner starts up and the boiler pump runs to provide a water temperature of 46°F [8°C] + Boiler Offset 9°F [5°C] + Boiler Differential 20°F [11°C]. Once the target temperature has been reached the burner will turn off, the boiler pump will continue to run and turn off after post purge period. This function only works if boiler is turned on, the gas supply is ON and the water pressure is correct. **NOTE:** The boiler will not engage in freeze protection mode if there are any soft or hard lockout error codes.

Service (priority 2):

When service mode is activated, the relays are no longer energized and deenergized according to the control state, but are set to a predefined manual control state in accordance with their functions (For instance: QX1- Boiler Pump; QX2 - CH-1 Pump; QX3 -DHW pump). The relay outputs are set to a state where heat is provided, independent of their hydraulic function. When a service mode is activated for a heat call, all three pumps will be energized. It is important to ensure that there is sufficient heat load connected to the appliance before operating the unit at full firing rate. With service mode each pump can be run independently to either purge air from the system or test the relays for proper operation.

Domestic Hot Water (DHW) (priority 3):

The boiler can be connected to an indirect tank to provide domestic hot water (DHW). The control allows for a tank sensor or aquastat (thermostat) connection to the low voltage terminal. The boiler is shipped with **aquastat** as a default setting to control an indirect tank. Ensure to set the DHW temperature to match the setting of the mechanical aquastat installed on the tank. When a tank **sensor** is connected, the DHW sensor option on the boiler setup page needs to be changed to sensor. The control has an offset parameters that will set the boiler supply temperature to a higher temperature in order to meet the demand of the indirect tank (default is + 20°F [11°C]). For instance if the indirect tank is set to 120°F, the boiler will supply 140°F to the indirect tank coil.

DHW Pump (QX3):

When either a sensor or aquastat is connected to the low voltage signal, the boiler will acknowledge the demand and will run the DHW pump to satisfy the DHW demand. If an indirect tank is not used, this pump can be assigned to run when there is a call for room thermostat 2. When an indirect tank is piped on the system loop, there is an option on the DHW setup page to enable boiler pump to run during a DHW call. **NOTE:** It is critical to protect a low temperature zone with a mixing valve when the boiler temperature for DHE is higher than the low temperature zone setpoint.

Central Heating (CH) (priority 4):

Room Thermostat

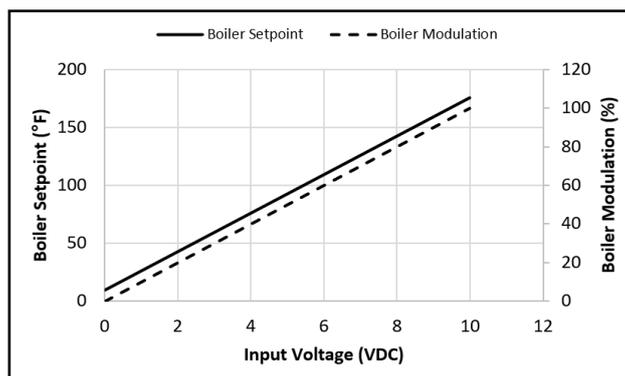
There are two head demands connections available on this control. These inputs commands the boiler to provide hot water for central heating. Each demand has its own setpoint and outdoor reset curves. The first room thermostat connection is enabled from the factory. The second room thermostat is disabled from the factory. In case an indirect tank is not being used, the DHW pump can be assigned for room thermostat 2 (CH-2 pump) from Setup Pump Setup page. When there are multiple demands active, the control will give priority to the demand with the highest set point. **NOTE:** It is very critical to protect a low temperature zone to avoid overheating or damages to the heating system. For instance, Assume room thermostat 1 setpoint is 160°F, room thermostat 2 setpoint is 120°F, and both have a call for heat. The boiler will deliver a temperature of 160°F until both demands are satisfied or will deliver 120°F once demand from room thermostat 1 is satisfied.

Outdoor Reset Curve:

Outdoor reset is a built-in function to help maximize the efficiency of the boiler. The design of this function is to adjust the target temperature of the boiler relative to the outdoor ambient temperature via the outdoor reset curve options included in the boiler setup page. The outdoor ambient temperature is observed via the provided outdoor temperature sensor. There are two outdoor reset options available on the setup page, one for each room thermostat connections.

0-10VDC Input (Boiler Setpoint or Boiler Modulation):

The boiler can be controlled and activated via a Building Management System (BMS) using a 0-10VDC signal. There are two possible options to control the boiler via this signal: Boiler Setpoint and Boiler Modulation. These functions are predefined with two fixed points (min. voltage / min. setpoint or modulation), (max. voltage / max. setpoint or modulation). The request for heat becomes active when the applied voltage is 200mV and will remain active as long as the voltage is a minimum of 150 mV. **NOTE:** It is critical to keep the 0-10V input voltage wiring away from the line voltage wiring to avoid induced voltage which may cause the boiler to be energized when not desired. The following graphs are linear representation of the 0-10V operation.



Boiler Pump (QX1):

The boiler pump will run anytime there is a central heating demand. This pump will also run during a freeze protection or service mode. There is an option in the controller to enable boiler pump to run during a DHW demand (in case an indirect tank is piped on the system loop).

CH-1 Pump (QX2):

The CH-1 pump will run when there is a call for heat from room thermostat 1 or there is a demand from 0-10V input with boiler modulation option. In case 0-10V input with boiler setpoint is desired the Pump Assignment QX2 needs to be Q15 under Setup - Pump page.

Cascade:

When multiple boilers are installed they can be wired and programmed to work in a cascade system. A maximum of eight units can be controlled from a single control. In this application one boiler would be assigned as a Master control and all others would be assigned as follower controls. The Master control sequences the operation of other members in the cascade system using the efficiency optimization control method. The room thermostat connections, 0-10V input, outdoor sensor, cascade system sensor get connected on the Master boiler. Once a call for heat is received, the control will determine the system setpoint. Each boiler in the cascade system will have a setpoint up to 20F [11C] higher than the system setpoint to account for heat loss on the primary loop piping. Once the actual system temperature gets close to the target system temperature each boiler setpoint will be lowered accordingly to maintain the required temperature on the system loop.

Similar approach can be used for DHW operation. If the entire cascade system will be used to satisfy DHW demand, the indirect tank sensor / aquastat only needs to be connected to the Master boiler and will control the DHW demand accordingly. In this application, the boiler temperature for each unit will be the indirect tank setpoint + DHW offset + Cascade Setpoint Compensation. If desired, the DHW offset can be set to zero in this case. If only certain units are intended for the DHW application, there is a parameter in the setup-cascade page to set DHW as a separate circuit. In this case each unit intended to be dedicated for DHW application needs to have DHW separate circuit parameter set to ON. If only one unit is dedicated for DHW application either a sensor or an aquastat can be used and must be connected on this specific unit. If more units are dedicated for DHW, an aquastat must be used and connected in parallel to each unit. In this application, the boiler temperature for each unit will be the indirect tank setpoint + DHW offset.

To establish a cascade system:

- 1 Set the address of each unit under Setup Cascade page. The Master must be addressed as Master, the followers can be addressed from Follower 1 thru Follower 7. **NOTE:** The addressed must be unique otherwise there will be an error code.
- 2 Enable the cascade system sensor on the Master boiler ONLY. Connect the cascade system to the master boiler low voltage signal. **NOTE:** The cascade sensor must be installed on the system supply piping as close as possible to the low loss heater or closely spaced tees. The cascade sensor (10kOhm) is surface mount type and it might need to be insulated in case of heat loss.
- 3 Connect units to each other using 18 or 20 gauge wires (maximum total length for 18 gauge wire is 262 ft [80 m]; for 20 gauge wire is 131 ft [40 m]). The Master and last follower units will take a pair of wires, all other units in between will take 2 pair of wires to create a daisy chain connection.
- 4 The units are set from the factory to rotate every 50 hours in order to balance the run hours. All other parameters in the cascade setup are optional depending on the system application.

Boiler Safety Features:

Gradient limiting:

During operation, if the boiler supply temperature is rising too quickly, the control will start to modulate down and reduce the firing rate down to the lowest setting to prevent overheating (in case of no flow conditions).

Reverse flow detection:

During operation, the boiler will monitor both supply and return temperatures to ensure the return temperature is not much higher than the supply temperature (in case of reverse flow or malfunction of either supply or return thermistors).

Water pressure monitoring

The boiler is equipped with a water pressure sensor to ensure the boiler operates safely. The boiler will shutdown in case the water pressure is too high (>87 Psi [6 bar]) or too low (< 12 Psi [0.8 bar]). The boiler will operate in reduced power mode in case the water pressure drops below 15 Psi [1 bar] and will return to normal once the water pressure exceeds 19 Psi [1.3 bar].

Supply Temperature, and Flue Temperature Supervision

The control monitors the boiler supply temperature thermistor, when this temperature exceeds 190°F [88°C] the control will reduce the output power. If this temperature continues to rise and exceeds 203°F [95°C] the control will shutdown the burner until it cools off. The control will shutdown and lockout if the supply temperature exceeds 2008°F [98°C] - manual reset required.

The flue temperature is monitored by a sensor located on the secondary heat exchanger. There are two settings on the controller to monitor this temperature based on the material used for venting. The following table explains the limits and control behavior for each selection. The boiler will modulate to maintain the flue temperature below the settings shown in the table below. In case the temperature exceeds the maximum limit, the boiler will shutdown and run the fan in post-purge mode. If the temperature drops within ten minutes the boiler will return to normal operation, otherwise it will go into a lockout state.

Vent Material	Flue gas temperature output reduction	Flue gas temperature output reduction to	Flue gas temperature switch off limit
PVC	140°F [60°C]	145°F [63°C]	149°F [65°C]
OTHERS	198°F [92°C]	203°C [95°C]	207°F [97°C]

Air pressure switch, Burner door limit switch, and thermal fuse

The control is equipped with a pressure switch to monitor the vent pressure and condensate trap water level. In case the pressure in the vent exceeds 4" WC or the condensate trap water level is 4 inches above the air pressure switch connection port the unit will shutdown and go into an error state.

The boiler is equipped with a switch located on the burner door and thermal fuse located on the back of the heat exchanger set to 500°F [260°C], and 605°F [318°C], respectively. These switches prevent overheating in case of abnormal operation of the appliance or premature deterioration of the insulation disk located on the back of the combustion chamber.

5. Maintenance

WARNING

- Maintenance is required to maintain safe operation of the boiler.
- The boiler must be inspected annually by a licensed professional. Repairs and maintenance shall be performed by a licensed professional. The licensed professional must verify proper operation after servicing.
- Keep the boiler area clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
- To protect yourself from harm, before performing maintenance:
 - Turn off the electrical power supply by unplugging the power cord or by turning off the electricity at the circuit breaker. (The boiler controller does not control the electrical power.)
 - Turn off the gas at the manual gas control valve, usually located immediately below the boiler.
 - Turn off the incoming water supply. This can be done at the isolation valve immediately below the boiler or by turning off the water supply to the building.

5.1 Owner Maintenance

WARNING

If you encounter a problem that is difficult to solve, stop the operation and immediately contact a licensed professional.

MONTHLY

Boiler Area

- Verify the area is free of combustible materials, gasoline and other flammable vapors and liquids.
- Verify the area is clean from dust and obstructions
- Verify the air intake area is free of any contaminants listed in the boiler Installation and Operation Manual. Any contaminants in the boiler intake air vicinity must be removed. If they cannot be removed, contact a licensed professional.

Piping

- Inspect all water, gas, and condensation piping for leaks. Look for signs of leaking lines or corrosion.
- Confirm the condensation line is not blocked. If a condensation drain pump is used, confirm the condensation drain pump operates correctly.

Venting

- Verify the boiler vent discharge and air intake is clean and free of obstructions.
- Check for leakage, damage, or deformation of venting.

Boiler

- Verify the boiler is free from any abnormal situations, such as diagnostic error codes, loud noises, leakage or other potential issues.
- Check that the pressure on the controller display or external pressure gauge indicates 20-70 psi (138-483 kPa).

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