



This manual must be left with owner and should be hung on or adjacent to the boiler for reference.



HIGH EFFICIENCY FIRETUBE CONDENSING GAS BOILER

MODELS CHS-85 through CHS-399

– APPENDIX A – CONTROLLER AND DISPLAY INSTRUCTIONS



IMPORTANT

READ ALL OF THE FOLLOWING WARNINGS AND STATEMENT SYMBOLS AND DEFINITIONS BEFORE READING THE INSTALLATION INSTRUCTIONS

⚠ DANGER

Danger Sign: Indicates a hazardous situation which, if not avoided, will result in serious injury or death.

⚠ WARNING

Warning Sign: Indicates a hazardous situation which, if not avoided, could result in serious injury or death.

⚠ CAUTION

Caution Sign plus Safety Alert Symbol: Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

Caution Sign without Safety Alert Symbol: Indicates a hazardous situation which, if not avoided, could result in property damage.

NOTICE

Notice Sign: Indicates a hazardous situation which, if not avoided, could result in property damage.

⚠ WARNING

This Boiler must be installed by a licensed and trained Heating Technician or the Warranty is Void. Failure to properly install this unit may result in property damage, serious injury to occupants, or possibly death.

Table of Contents

1.0	INTRODUCTION	1
1.1	Clearing a Lockout	1
1.2	Keypad.....	1
1.3	Home Screen	2
2.0	I-INFORMATION SCREEN (MAIN MENU).....	4
2.1	Quick Start.....	5
2.2	Login	6
2.3	Test	6
2.3.1	Forced Rate.....	7
2.3.2	Manual Burner and Pump Operation.....	8
2.4	Advanced Setup.....	9
2.4.1	CH Config	10
2.4.1.1	CH Config – CH Config	10
2.4.1.2	CH Config - Outdoor Reset Config	12
2.4.1.3	CH Config - Warm Weather Shutdown.....	13
2.4.2	DHW Config	14
2.4.3	Lead Lag Config.....	15
2.4.3.1	Lead Lag Master Config	16
2.4.3.2	Use of 4-20mA Input	17
2.4.3.3	Lead Lag Slave Config	18
2.4.3.4	Lead Lag Outdoor Reset	19
2.4.4	System Config	20
2.4.4.1	System ID & Access	20
2.4.4.2	Pump Config.....	22
2.4.4.3	Statistics Config.....	23
2.4.4.4	High & Stack Limits	24
2.4.4.5	System Config.....	25
2.4.5	Modulation Config	26
2.4.6	Delta T & T-rise Limits	27
2.4.7	Frost Protection Config	28
2.4.8	Burner Control Ignition and Timings & Rates	29
2.5	Diagnostics	30
2.5.1	History	31
2.6	Display Setup	32

1.0 INTRODUCTION

The Controller and Display, together, form the control system of the Slant/Fin CHS boiler. All control configuration parameters are stored in non-volatile memory in the CHS controller. Access to controller status and configuration is achieved with the display. Interaction with the display is performed by physically touching the buttons on the display keypad. Communication between the CHS controller and display is via EIA-485 interface using the Modbus RTU protocol.

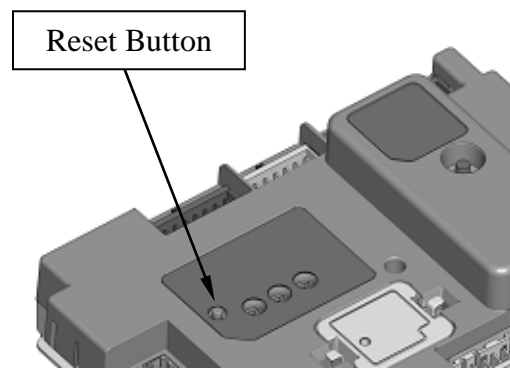
When the appliance is powered there is a brief interval while the display retrieves data from the boiler control. The display then shows the Home Screen (Summary screen) similar to the one depicted in Figure 1-2. The Home Screen provides a summary of the overall operational status of the boiler. A series of menus, entered by pressing the “i-Information” button, provide access to all boiler configuration parameters, information and diagnostics.

1.1 Clearing a Lockout

Figure 1-1 Clearing a Lockout

Clearing a Lockout – Any of the following methods can be used to clear a Lockout:

1. Display - Clear the lockout from the display Home Screen; press “OK” button on the keypad (see Figure 1-2).
2. Controller - Clear the lockout by pressing the RESET button situated on the boiler controller near the indicator lights (see Figure 1-1).
3. Switch - Cycle power to the boiler using the power on/off switch situated on the display console.



1.2 Keypad

See Figure 1-2 and Table 1-1 for a complete description of the functions of each keypad button.

Directional Arrow Buttons – are used to quickly navigate through the menu structures and within each individual screen.

OK Button – Confirms/enters an item selection.



Back Button – returns the user to the previous screen.



i-Information Button – accesses the Main Menu where all control settings, diagnostics, etc are accessed via a series of sub-menus.

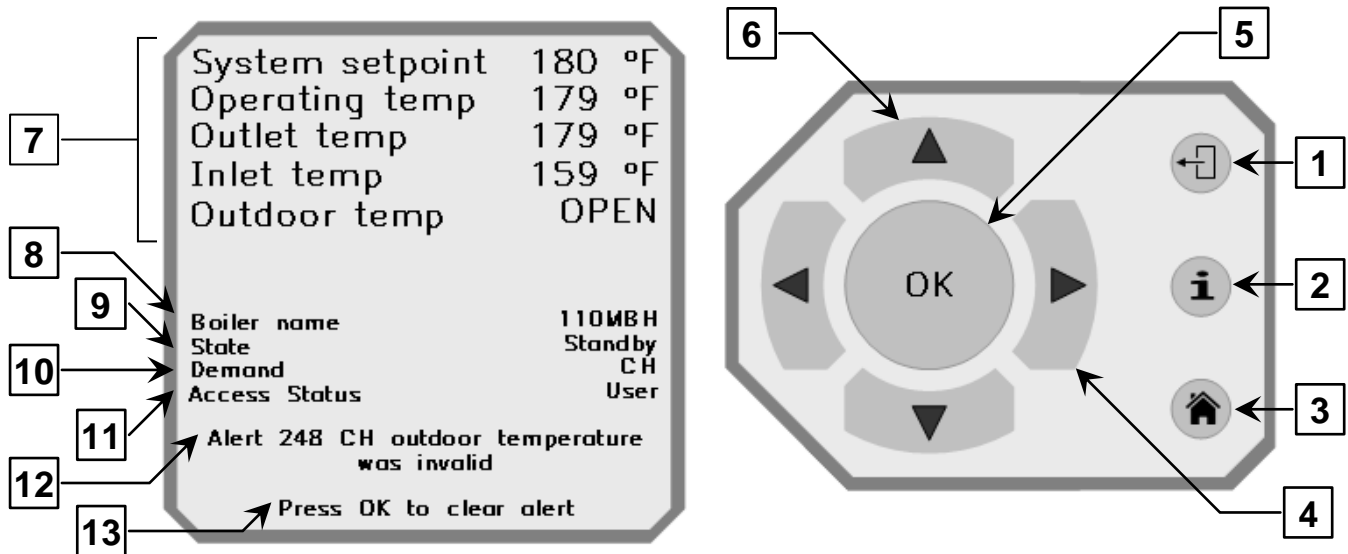


Home Button – immediately returns the display to the Home Screen.

1.3 Home Screen

The Home Screen is displayed following initial power-up and can be displayed at anytime by simply pressing the “Home” button. The Home Screen provides a summary of the current boiler status, most recent Alert or Lockout, and readings from chosen boiler sensors. Figure 1-2 below, identifies each Home Screen and keypad item; Table 1-1 describes them.

Figure 1-2 Home Screen & Key Pad Identification



From the Home Screen the display offers easy access to diagnostic screens through the use of the horizontal directional buttons (◀ ▶) on the display keypad. Pressing either of the horizontal buttons advances you through the Analog Sensor I/O (inputs/outputs), Digital I/O, and then back to the Home Screen.

Figure 1-3 Diagnostic Screens

Analog Sensors I/O

Outlet temp	70 °F
Inlet temp	70 °F
Delta T	1 °F
DHW temp	OPEN
Stack temp	71 °F
Outdoor temp	OPEN
Fan speed	LOW
Flame signal	0.00 µA
Firing rate	0 RPM
4–20mA input	OPEN
System sensor	Outlet

Digital I/O

Boiler pump (B)	off
CH pump (C)	off
DHW pump (A)	off
Blower/HSI	off
Eternal ignition	off
Pilot valve	off
Main valve	off
Alarm	off
Interlock (ILK)	on
Pre-ignit interlock (PTI)	off
Load control input (LCI)	off
STAT (Demand)	off
Time Of Day	off
Safety relay	off

Table 1-1 Home Screen & Key Pad Description (Reference Figure 1-2)

Item	Name	Description
1	Back button	Returns the display to the previous screen in the menu structure.
2	i-Information button	Displays the Main Menu screen, where all control settings, diagnostics, etc are accessed via a series of sub-menus.
3	Home button	Returns the display to the Home Screen (screen illustrated in Figure 1-2).
4	Directional buttons (horizontal)	Left and right buttons (◀ ▶) allow navigation within some display screens. Also provide access, via the Home Screen, to controller input and output diagnostic screens.
5	OK button	Used to select highlighted display items, necessary for confirming settings.
6	Direction buttons (vertical)	Up and down buttons (▲ ▼) allow navigation within display screens.
7	Boiler summary	Provides the status of five (5) boiler readings (i.e. sensor inputs or boiler operating conditions). From a list of 15 readings, the user can select which 5 will be displayed /summarized on the Home Screen, see Section 2.6 Display Setup
8	Boiler name	Provides the name of the boiler, i.e. 110MBH; user can choose to change the name, see Section 2.4.4.1 System ID & Access .
9	State	Indicates the current state of burner operation: <ul style="list-style-type: none"> • Initiate • Standby delay • Standby • Safe startup • Prepurge - Measured purge time • Prepurge - Drive to lightoff rate • Pre ignition test • Direct Burner ignition • Run • Postpurge • Lockout
10	Demand	Indicates the current heat demand source: <ul style="list-style-type: none"> • OFF (no heat demand) • CH (Central Heat demand – CH1) • LL [Lead Lag heat demand – CH2 (LL) • DHW (Domestic Hot Water demand) • CH frost protection • DHW frost protection • LL frost protection
11	Access Status	Indicates the present level of access: <ul style="list-style-type: none"> • User (indicates that no password has been entered – adjustment of certain settings will be blocked. • Installer (indicates that the installer password, “sola” has been entered, allowing adjustment of all field adjustable parameters).
12	Lockout/alert/hold	Indicates the most recent Alert, or a current Hold or Lockout.
13	Clear	When selected, clears the most recent Alert from the Home Screen; also resets and clears a current Lockout.

2.0 i-Information Screen (Main Menu)

Figure 2-1 i-Information Screen

i **i-Information** – Main Menu screen, accessed by pressing the “i” button, lists the major sub-menus. Use the arrow buttons to navigate the menu options; when the desired option is highlighted it will appear at the top of the screen (i.e. Quick Start in the example right); select by pressing the “OK” button.

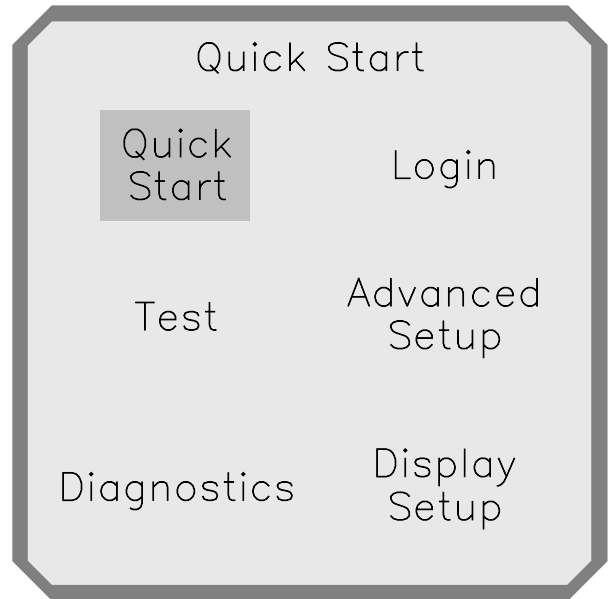


Table 2-1 i-Information Screen Menu Options

Menu Item	Description	Reference
Quick Start	Provides a summary of the most common settings for installer adjustment.	Section 2.1
Login	Provides access to a keypad for entry of the installer password – many parameters are installer level password protected.	Section 2.2
Test	Allows the installer to test specific firing rates and pump operation manually.	Section 2.3
Advanced Setup	Provides access to all parameter settings (including those in Quick Start), for more advanced settings.	Section 2.4
Diagnostics	Lists the status of all controller inputs and outputs (i.e. sensors and switches); also provides access to a history of Alerts and Lockouts.	Section 2.5
Display Setup	Allows the installer to set what information (i.e. sensor status) is displayed on the Home Screen.	Section 2.6

2.1 Quick Start

Figure 2-2 Quick Start Screen

Quick Start – screen, accessed by selecting “Quick Start” from the “i-Information” screen, provides a summary of the most common settings that will need to be adjusted (or considered) when initially setting up the boiler. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

Each of the parameters under Quick Start are also listed under separate setting groups under “Advanced Setup”; where more advanced settings can be accessed..

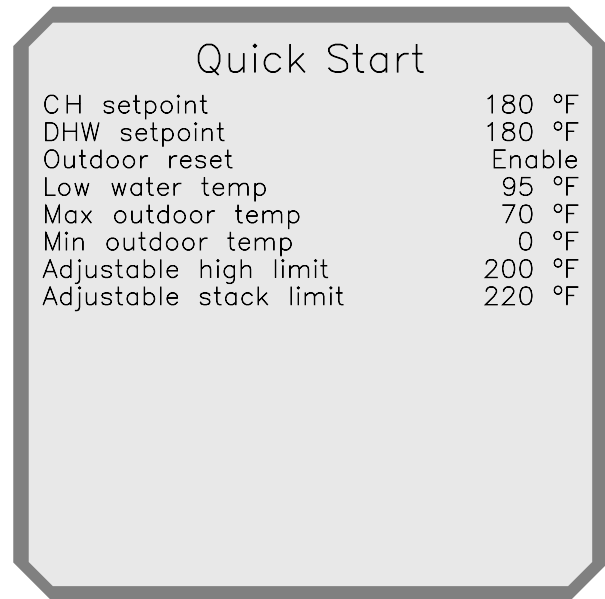


Table 2-2 Quick Start Configuration Parameters

Parameter	Description	Factory Setting
CH setpoint	Setpoint value for CH modulation. If “Outdoor reset” is set to “Disable”, this is the target temperature at the “Modulation sensor”. If “Outdoor reset” is set to “Enable”, this is the maximum target temperature at the “Modulation sensor” (Setpoint for CHI heat input).	180°F
DHW setpoint	Boiler setpoint for DHW modulation. Range 60°F to 190°F	180°F
Outdoor reset	Enables or disables CH outdoor reset function for CH1 heat inputs.	Enable
Low water temp	Minimum boiler setpoint; occurs when the outdoor temperature is equal to or greater than the “Max outdoor temp”. Range 60°F to 140°F	95°F
Max outdoor temp	Outdoor temperature that corresponds to the “Low water temp” setting. <i>Example:</i> If the “Low water temp” setting is 95°F, and the “Max outdoor temp” setting is 70°F, the boiler setpoint will be 95°F when the outdoor temperature is 70°F or higher. Range 50°F to 95°F	70°F
Min outdoor temp	Design Temperature - Outdoor temperature that corresponds to the “CH setpoint” setting. <i>Example:</i> If the “CH setpoint” is 180°F, and the “Min outdoor temp” setting is 0°F, the boiler setpoint will be 180°F when the outdoor temperature is 0°F or lower. Range -40°F to 40°F	0°F
Adjustable high limit	Outlet water temperature high limit. Controller will not permit burner operation above this setting. Recommend leaving configured as 200°F. Range 100°F to 200°F	200°F
Adjustable stack limit	Stack exhaust gas high limit. Controller will lockout if exhaust gas temperature exceeds this setting. Range 145°F to 220°F	220°F

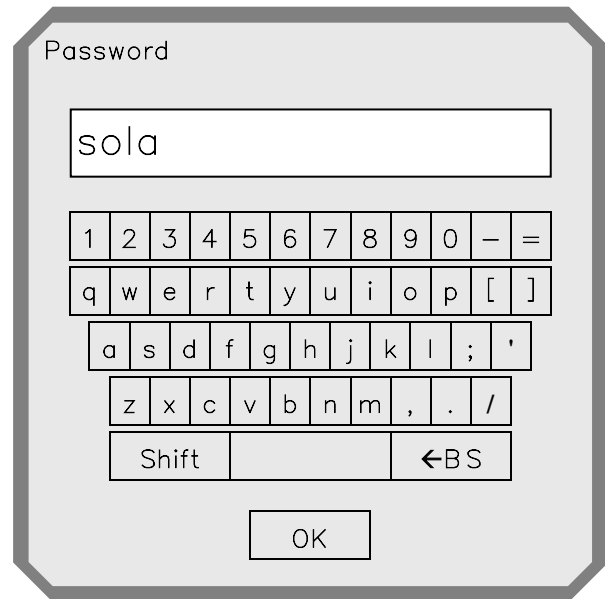
2.2 Login

Figure 2-3 Login Screen

Login - Parameters that are password protected require an installer to enter the password before they can be changed. A message indicating this may appear when a password protected parameter is selected. To enter the password, touch the “i-Information” button and select Login to access the keyboard screen.

Use the horizontal and vertical directional buttons (▼▲◀▶) on the keypad to navigate the keyboard screen. Once the desired letter or number is selected/highlighted, press the round “OK” button on the keypad to confirm selection.

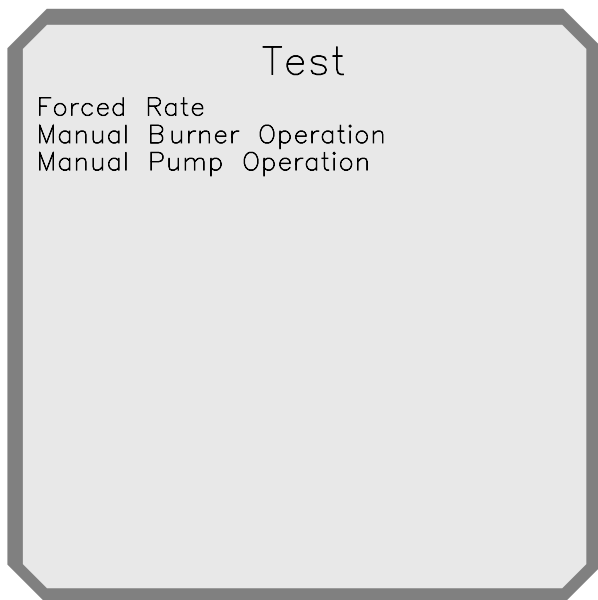
Once the password is filled in, select/highlight “OK” on the keyboard, and press the round OK button on the keypad to confirm selection.



Password - Many of the configuration parameters are password protected. The required case-sensitive password is "sola" and must be entered in lower-case letters.

2.3 Test

Figure 2-4 Test Screen Menu



Test – menu screen, accessed by selecting “Test” from the “i-Information” screen, lists the three test screen options. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

2.3.1 Forced Rate

Figure 2-5 Forced Rate Test Screen

Forced Rate – test screen, permits the installer to force the burner to operate at “high fire” or “low fire” for the purpose of combustion setup and diagnoses. Set the “Manual firing rate” to high or low fire by using the up and down (▲▼) buttons to highlight either “Set high fire” or “Set low fire”; then select it by pressing the “OK” button.

When the test is complete, select “Stop test” to return firing rate control to automatic.



The burner **MUST** be firing to initiate “Start test”.

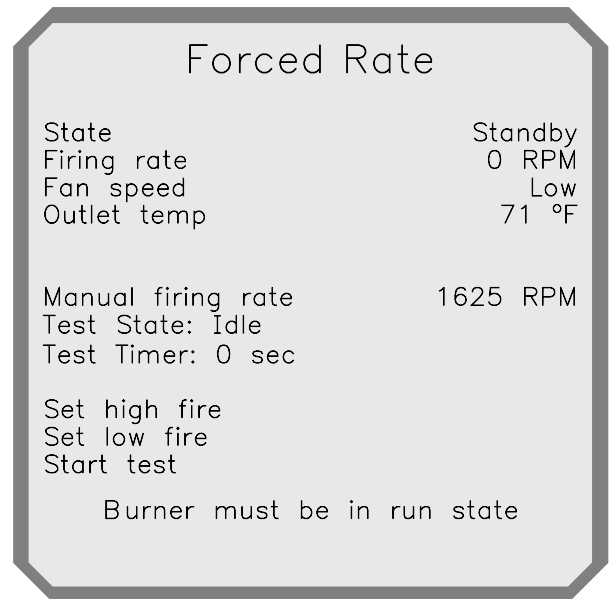


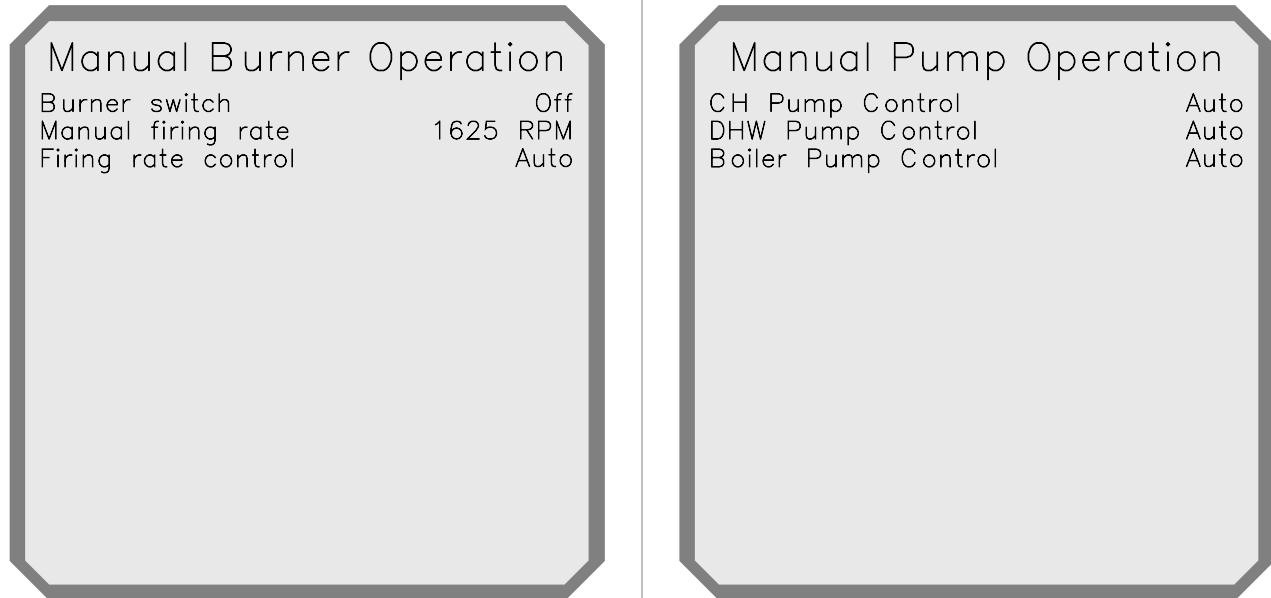
Table 2-3 Forced Rate Parameters

Parameter	Description
Set high fire *	When selected, sets “Manual firing rate” setting equal to the maximum modulation rate of the boiler.
Set low fire *	When selected, sets “Manual firing rate” setting equal to the minimum modulation rate of the boiler.
Start test *	When selected, initiates the forced rate test, burner will operate at the “Manual firing rate” setting indicated on the screen. To stop test select “Stop test”; which will be displayed in place of “Start test” once the test is initiated.

* = Password protected

2.3.2 Manual Burner and Pump Operation

Figure 2-6 Manual Burner and Pump Operation Test Screens



Manual Burner Operation – test screen, allows the installer to manually control the firing rate of the burner. Using the up and down (▲▼) buttons to highlight the menu options, and the “OK” button to select them, set “Firing rate control” to “Manual”, then adjust “Manual firing rate” to the desired value.

Manual Pump Operation – test screen, allows the installer to manually turn the individual pumps on. Using the up and down (▲▼) buttons to highlight the menu options, and the “OK” button to select them, set the desired “Pump Control” to “On”.



The burner MUST be firing to initiate Manual Burner Operation.



Setting “Burner switch” to “Off” will inhibit burner operation, regardless of the operating conditions.



When the test is complete, return the settings to “Auto” to allow the control to automatically turn the circulators off and on and modulate the burner firing rate as needed.

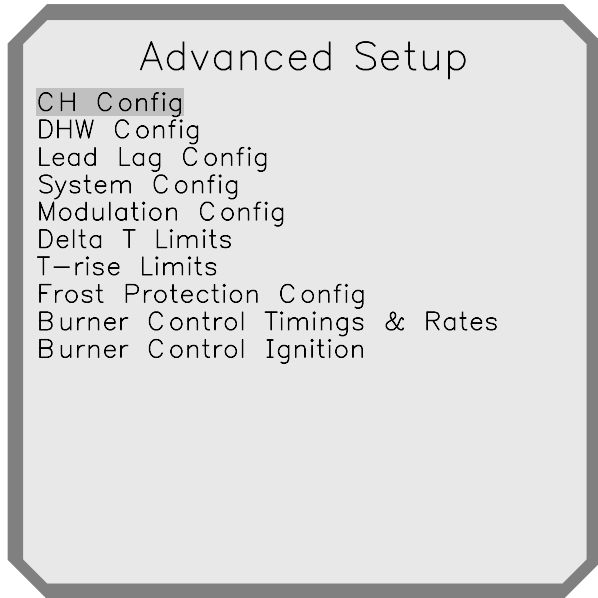
Table 2-4 Manual Burner Operation Parameters

Parameter	Description	Default
Burner Switch *	Allows the installer to manually switch the burner off and on.	On
Manual firing rate *	Establishes the burner firing rate (blower RPM) when “Firing rate control” is set to “Manual in Run” or “Manual in Run & Standby”. Feature may be useful as a diagnostic tool; i.e. to test burner operating characteristic at a specific firing rate.	N/A
Firing rate control *	Establishes the firing rate control of the boiler: <ul style="list-style-type: none"> • Auto (firing rate – blower RPM is controlled by the boiler control) • Manual in Run (blower RPM is set to the “Manual firing rate” setting; only when burner is running). • Manual in Run & Standby (blower RPM is set to the “Manual firing rate” setting). 	Auto

* = Password protected

2.4 Advanced Setup

Figure 2-7 Advanced Setup (Menu) Screen



Advanced Setup – menu screen, accessed by selecting “Advanced Setup” from the “i-Information” screen, lists all of the configuration parameter groups. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

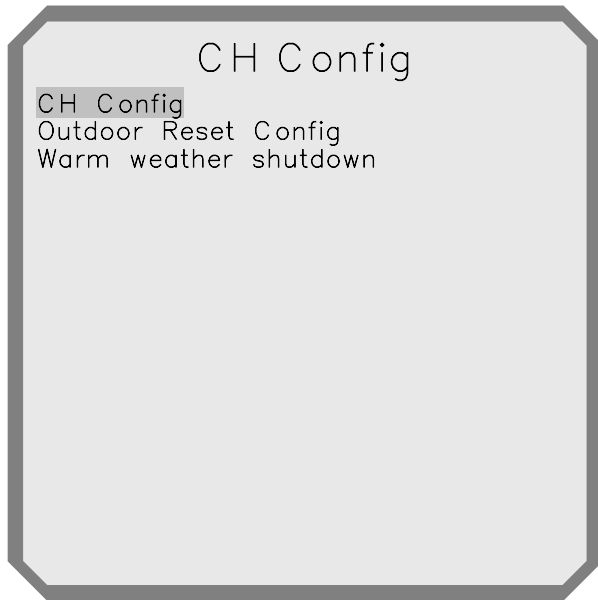
Login – adjustment of many of the advanced settings will prompt the user to login.

Table 2-5 Advanced Setup Menu Options

Name	Description	Reference:
CH Config	Edit Central Heat settings; CH1 heat input.	Section 2.4.1
DHW Config	Edit Domestic Hot Water settings.	Section 2.4.2
Lead Lag Config	Edit Lead-Lag Master and Slave settings; CH2 (LL) heat input.	Section 2.4.3
System Config	Edit temperature units, anti-short-cycle time, alarm silence time.	Section 2.4.4
Modulation Config	Edit burner modulation settings.	Section 2.4.5
Delta T Limits	Edit delay time for delta-t limit.	Section 2.4.6
T-rise Limits	Edit delay time for T-rise limit.	Section 2.4.6
Frost Protection Config	Enable/disable CH, DHW and LL frost protection	Section 2.4.7
Burner Timings & Rates	Read only, for information only.	Section 2.4.8
Burner Control Ignition	Read only, for information only.	Section 2.4.9

2.4.1 CH Config

Figure 2-8 Central Heat Configuration Main Menu Screen



CH Config – main menu screen, accessed by selecting “CH Config” from the “Advanced Setup” screen, lists the sub-menus specific to the Central Heat Configuration. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

The settings under “CH Config” are specific to boiler operation given a local central heat demand, i.e. CH1 heat input.

2.4.1.1 CH Config – CH Config

Figure 2-9 Central Heat Configuration Sub-menu Screen

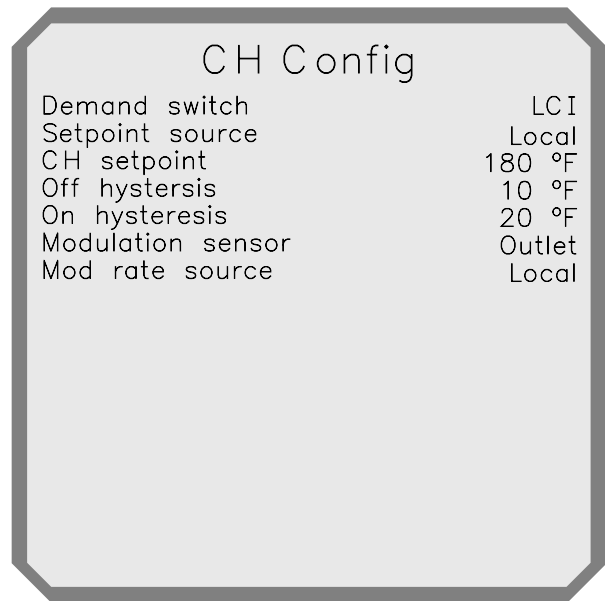
CH Config – sub-menu screen, allows the installer to set parameters specific to the boiler response and operation for local (i.e. non Lead Lag) Central Heat demands. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

Demand switch - Central heat demand can be initiated by a contact closure to CH1, “LCI”, or by boiler temperature, “Sensor only”.

Setpoint source – The boiler setpoint can be “Local”, i.e. the “CH setpoint” set from the display, or “4-20mA” set from an external source.

Modulation sensor – With the “Setpoint source” set to “Local”, the control can be set to use either the “Outlet”, “Inlet” or “S10” (pipe) sensor for regulation of burner modulation.

Mod rate source – The burner modulation can either be controlled by the boiler control, “Local”, or by an external source, “4-20mA”.



Use of 4-20mA Input

Setpoint source – If “Local” is selected as the “Setpoint source”, the “CH setpoint” value entered on the screen, depicted in Figure 2-10, is used for control. If 4-20mA is selected as the “Setpoint source”, the boiler determines its setpoint from the 4-20mA signal. The setpoint is calculated from a factory-set scale between 60°F corresponding to 4mA, and 190°F corresponding to 20mA. If the 4-20mA input signal is invalid, out of range, or absent, the “CH setpoint” is used until the signal is valid again. Regardless of the “Setpoint source”, “Local” or “4-20mA”, the controller’s internal PID algorithm modulates the burner.

Mod rate source – The Slant/Fin CHS controller supports two methods of burner modulation for CH, selected by the “Mod rate source” parameter, depicted on Figure 2-10; the factory set method is by internal PID algorithm. The installer has the option to use a 4-20mA signal from an external control to directly modulate the burner. Rates vary (see Section 2.4.5 Modulation Config) from minimum at 4mA to CH maximum at 20mA.

The 4-20mA signal does not create burner demand; a call for heat must be present; i.e. CHI input made when “Demand Switch” = LCI.

Table 2-6 Central Heat Configuration Parameters

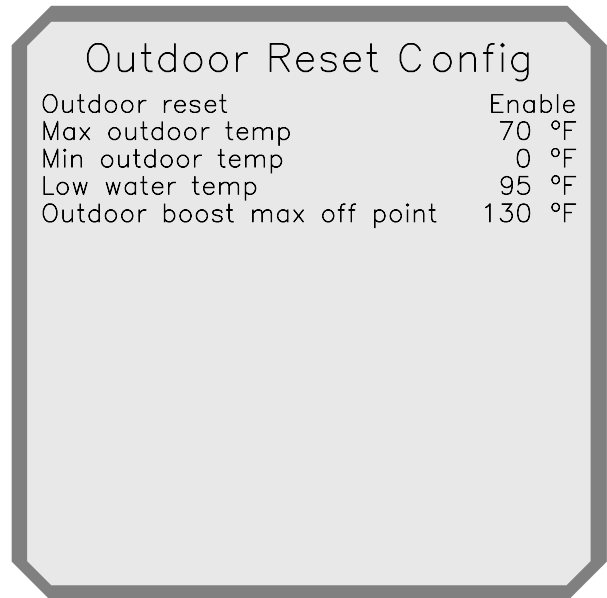
Parameter	Description	Factory Settings
Demand switch *	Source of CH demand: <ul style="list-style-type: none"> • Sensor only (modulation sensor – no contact closure required) • LCI (contact closure of “CH1” to “R”, i.e. via a thermostat) 	LCI
Setpoint source *	Select the Central Heat setpoint source: <ul style="list-style-type: none"> • Local (control references “CH setpoint” setting) • 4-20mA with sensor on/off [remote source] 	Local
CH setpoint	Setpoint value for CH modulation. If “Outdoor reset” is set to “Disable”, this is the target temperature at the “Modulation sensor”. If “Outdoor reset” is set to “Enable”, this is the maximum target temperature at the “Modulation sensor” (see Section 2.4.1.2 Outdoor Reset Config). Range 60°F to 190°F	180°F
Off hysteresis	Value added to CH setpoint to determine water temperature at which the burner will shut off e.g. if CH setpoint is 180°F, and CH off hysteresis is 10°F, the burner will be shut off at 190°F. Range 2°F to 20°F	10°F
On hysteresis	Value subtracted from “CH setpoint” to determine water temperature at which the burner will fire e.g. if “CH setpoint” is 180°F, and “CH on hysteresis” is 20°F, the burner will fire at 160°F. Range 2 °F to 40°F	20°F
Modulation sensor *	Select which sensor Central Heat will modulate to: <ul style="list-style-type: none"> • Outlet • Inlet • S10 [System (pipe) temperature sensor] 	Outlet sensor
Mod rate source *	Select which source controls the modulation rate: <ul style="list-style-type: none"> • Local [PID control] • 4-20mA with sensor on/off [remote source] 	Local

* = Password protected

2.4.1.2 CH Config - Outdoor Reset Config

Figure 2-10 Outdoor Reset Configuration Screen

(CH Config) Outdoor Reset Config – sub-menu screen, allows the installer to set parameters specific to the effect the outdoor temperature has on the operation of the boiler during local (i.e. non Lead Lag) Central Heat demands. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

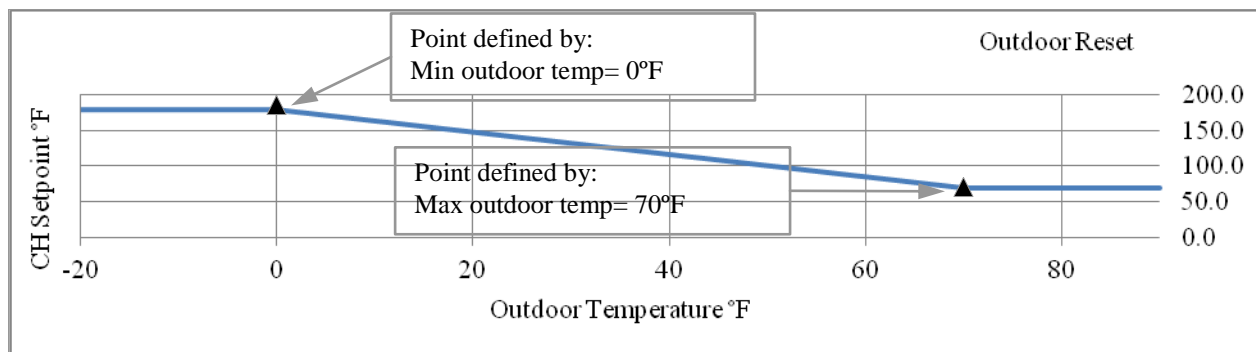


Outdoor Reset is in effect only if the following two conditions are met: “Outdoor reset” is set to “Enable”, and an outdoor temperature sensor is connected to the boiler. The “Outdoor Reset Config” parameters, together with the “CH Config” parameters, define the relationship of boiler temperature setpoint to outdoor temperature. Refer to Figure 2-12 for an example of the relationship between outdoor temperature and boiler temperature, with a given set of settings.

Table 2-7 Outdoor Reset Configuration Parameters

Parameter	Description	Factory Settings
Outdoor reset enable	Enables or disables Outdoor reset	Enabled
Max outdoor temp	Outdoor temperature that corresponds to the “Low water temp” setting. <i>Example:</i> If the “Low water temp” setting is 95°F, and the “Max outdoor temp” setting is 70°F, the boiler setpoint will be 95°F when the outdoor temperature is 70°F or higher. Range 50°F to 95°F	70°F
Min outdoor temp	<i>Design Temperature</i> - Outdoor temperature that corresponds to the “CH setpoint” setting. <i>Example:</i> If the “CH setpoint” is 180°F, and the “Min outdoor temp” setting is 0°F, the boiler setpoint will be 180°F when the outdoor temperature is 0°F or lower. Range -40°F to 40°F	0°F
Low water temp	Minimum boiler setpoint; occurs when the outdoor temperature is equal to or greater than the “Max outdoor temp”. Range 60°F to 140°F	95°F
Outdoor boost max off point	Read only – functional in future revisions.	130°F

Figure 2-11 Outdoor Reset Graph



2.4.1.3 CH Config - Warm Weather Shutdown

Figure 2-12 WWSD Configuration Screen

(CH Config) Warm Weather Shutdown (WWSD) – sub-menu screen, allows the installer to enable the WWSD function for local (i.e. non Lead Lag) Central Heat demands, and define at what outdoor temperature it is initiated. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

When “Warm weather shutdown” is set to one of the “Shutdown” options, and the outdoor temperature is above the “Warm weather shdn setpoint”, CH operation is inhibited.

CH operation is restored when the outdoor temperature drops below the WWSD setpoint by a fixed value of 4°F.

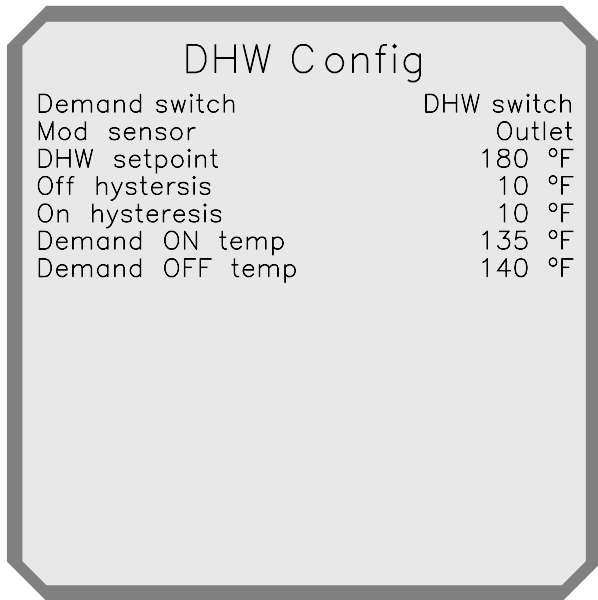


Table 2-8 Warm Weather Shutdown Configuration Parameters

Parameter	Description	Factory Settings
Warm weather shutdown	Enable or Disable Warm Weather Shutdown and select shutdown options <ul style="list-style-type: none"> • Shutdown after demand ends • Shutdown immediately • Disable 	Disable
Warm weather shdn setpoint	Temperature at which local Central Heat operation is inhibited. Not applicable when “Warm weather shutdown” is set to “Disable”. Range 50°F to 120°F	60°F

2.4.2 DHW Config

Figure 2-13 Domestic Hot Water Configuration Screen



DHW Config – menu screen, accessed by selecting “DHW Config” from the “Advanced Setup” screen, lists the configuration parameters specific to boiler operation for a DHW demand. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

Demand switch - DHW demand can be initiated by a contact closure, “DHW switch”, or by a tank temperature sensor, “DHW Sensor with On/Off Temp”.

Mod sensor – The control can be set to use the “Outlet” or “Inlet” sensor for regulation of burner modulation.



When “Demand switch” is set to “DHW Sensor with On/Off Temp”, demand is determined by the Demand ON and OFF temp settings.

Table 2-9 DHW-Domestic Hot Water Configuration Parameters

Parameter	Description	Factory Settings
Demand switch *†	Select which sensor is the DHW demand source: <ul style="list-style-type: none"> • DHW switch • DHW Sensor with On/Off Temp (If “DHW Sensor with On/Off Temp” is selected, a tank sensor must be used to generate a demand.)	DHW switch
Mod sensor *	Select the DHW modulation sensor: <ul style="list-style-type: none"> • Outlet • Inlet 	Outlet
DHW setpoint	Setpoint for DHW modulation. If “Mod sensor” is set to “DHW” or “Inlet”, reduce setting accordingly. Range 60°F to 190°F	180°F
Off hysteresis *	Value added to “DHW setpoint” to determine water temperature at which the burner will shut off e.g. if “DHW setpoint” is 180°F, and “Off hysteresis” is 10°F, the burner will be shut off at 190°F. Range 5°F to 70°F	10°F
On hysteresis *	Value subtracted from “DHW setpoint” to determine water temperature at which the burner will fire e.g. if “DHW setpoint” is 180°F, and “On hysteresis” is 10°F, burner ignition occurs at 170°F. Range 2°F to 40°F	10°F
Priority time *	Time period during which a DHW demand has priority. If override time has elapsed, the boiler and CH pump (Pump C) will service a CH demand regardless of DHW demand. Value=0 inhibits DHW priority. Range 0 to 18 hours.	2 hour
Demand ON temp *	DHW demand is switched ON when DHW tank temperature is ≤ this setting. Applied when “Demand switch” is set to “DHW Sensor with on/off temperatures”. Range 60°F to 165°F.	135 °F
Demand OFF temp *	DHW demand is switched OFF when DHW tank temperature is ≥ this setting. Applied when “Demand switch” is set to “DHW Sensor with on/off temperatures”. Range 65°F to 170°F.	140 °F

* = Password protected

† = If “Demand switch” is set to “DHW Sensor with On/Off Temp”, demand is determined by the Demand ON and OFF temp settings.



DHW tank sensor **MUST** be used in conjunction with a DHW temperature safety shutoff switch. Failure to provide such a switch may result in property damage, serious injury to occupants, or possibly death.

2.4.3 Lead Lag Config

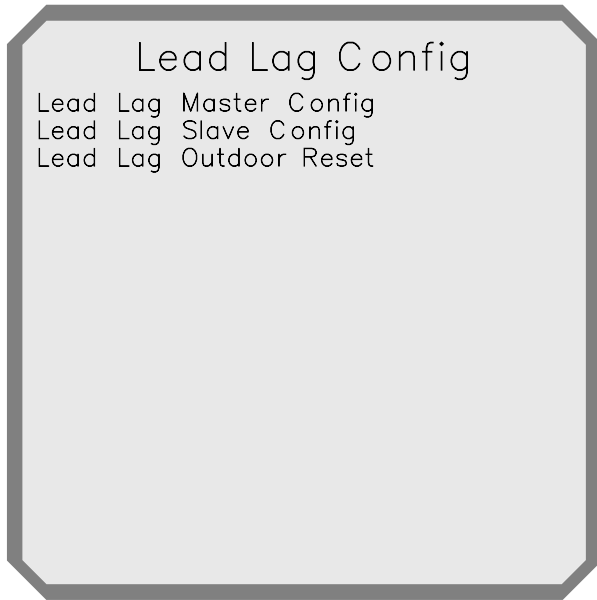
The CHS boiler can be used as a stand-alone unit or as part of a cascaded arrangement with as many as 8 CHS boilers. The Lead Lag Configuration parameters determine the boiler's (or group of boilers) behavior during a Lead Lag heat demand [i.e. CH2 (LL) heat input]. Only a demand on CH2 (LL) will initiate Lead-Lag, or "staging", of cascaded boilers. For stand-alone boilers, the CH2 (LL) demand simply behaves as a second heat input (CH1 being the first). Note: a demand for central heat from CH1, takes priority over a demand for central heat from CH2 (LL).

To enable, or allow the use of Lead-Lag function and the CH2 (LL) input, the "Lead Lag Master Config" parameter "Master enable", must be set to "Enable"; see Section 2.4.3.1 Lead Lag Master Config. In Lead Lag cascade boiler arrangements, only one boiler has "Master enable" set to "Enable", the others are set to "Disable" (factory default).

Check List for Lead Lag Installation:

1. All Boilers in Cascade
 - a. Wire boilers together – Daisy-chain Data Communication wiring between boilers. See Installation and Operating Instructions (Not applicable for stand-alone boiler applications).
 - b. Lead Lag Slave Configuration Settings (Optional) – Adjust the "Lead Lag Slave Config" setting "Slave mode", as desired. See Section 2.4.3.2.
 - c. MB2 Modbus address – set a unique "MB2 Modbus address" for each boiler. See Section 2.4.4.1 System ID & Access.
2. Master Boiler in Cascade
 - a. Set "Master enable" to "Enable" – Select one boiler in the cascade to be Master; set its "Master enable" setting to "Enable". Other boilers are left as "Disable" (factory default). For stand-alone boilers the lone boiler must have "Master enable" configured as "Enable". See Section 2.4.3.1 Lead Lag Master Config.
 - b. Lead Lag Master Configuration Settings – Adjusted the "Lead Lag Master Config" and "Outdoor Reset" settings to the desired values on the boiler with "Master enable" configured as "Enable". No need to adjust these settings on other boilers.
 - c. Heat Demand Input [CH2 (LL)] – Wire the head demand input to CH2 (LL) of the boiler with "Master enable" configured as "Enable".
 - d. System Sensor (Optional) – Wire the system (pipe) sensor to the boiler with "Master enable" configured as "Enable".
3. Any Boiler in Cascade
 - a. Outdoor Sensor (Optional) – Wire the outdoor sensor to any boiler within the cascade. Note: only one outdoor sensor is required for a multiple boiler application.
 - b. System Pump Control (Optional) – With "CH pump use for LL master" set to "On". The respective boiler will operate the CH pump (Pump C) anytime there is a Lead Lag heat demand. See Section 2.4.4.2 Pump Config.

Figure 2-14 Lead Lag Configuration Main Menu Screen



Lead Lag Config – main menu screen, accessed by selecting “Lead Lag Config” from the “Advanced Setup” screen, lists the sub-menus specific to the Lead Lag Configuration. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

2.4.3.1 Lead Lag Master Config

Figure 2-15 LL Master Configuration Screen

Lead Lag Master Config – sub-menu screen, allows the installer to set parameters specific to the boiler response and operation for Lead Lag CH2 (LL) demands. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

Master enable – must be set to “enable” in order for the boiler to respond to a CH2 (LL) demand (only one boiler in the cascade can have “Master enable” set to “Enable”).

Setpoint source – The boiler LL setpoint can be “Local”, i.e. the “Setpoint” set from the display, or “4-20mA” set from an external source.

System Sensor – When using the optional system (pipe) sensor; the controller automatically uses it as the modulation sensor – reduce the “Setpoint” accordingly.

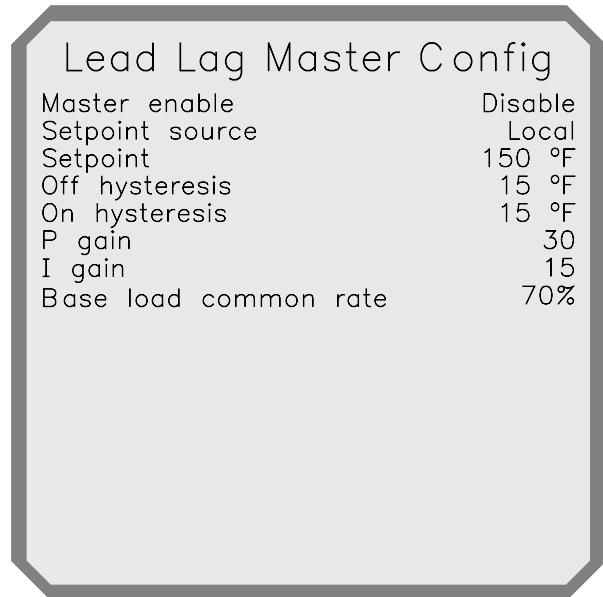


Table 2-10 Lead Lag Master Configuration Parameters

Parameter	Description	Factory Settings
Master enable *	Enable or Disable Lead Lag Master. One (and only one) unit must be set to "Enable" for Lead Lag operation to function.	Disable
Setpoint source *	Select the Lead Lag setpoint source: <ul style="list-style-type: none"> Local (control references "Setpoint" setting) 4-20mA (control references 4-20mA signal from an external control). "Outdoor reset enable" must be set to "Disable" when using a 4-20mA signal; see Section 2.4.3.3 Lead Lag Outdoor Reset. 	Local
Setpoint	Setpoint value for Lead Lag modulation. Range 60°F to 190°F.	150°F
Off Hysteresis *	Value added to the "Setpoint" to determine water temperature at which the burner will shut off. <i>Example:</i> If "Setpoint" is 150°F, and "Off hysteresis" is 15°F, the burner will be shut off at 165°F. Range 5 °F to 70°F.	15°F
On Hysteresis *	Value subtracted from "Setpoint" to determine water temperature at which the burner will fire. <i>Example:</i> If "Setpoint" is 150°F, and "On hysteresis" is 10°F, burner ignition occurs at 140°F. Range 2°F to 40°F.	10°F
P Gain *	Gain applied to the proportional term of the LL PID control algorithm. Range 5 to 50 (no units). Decrease to slow rate of control response.	30
I Gain *	Gain applied to the integral term of the LL PID control algorithm. Range 5 to 50 (no units). Decrease to slow rate of control response.	15
Base load common *	Maximum modulation rate of all firing units when other units are still available and idle. Range 25 - 100%.	70%

* Password protected

Use of 4-20mA Input

Setpoint source – If "Local" is selected as the "Setpoint source", the "Setpoint" value entered on the screen, depicted in Figure 2-16, is used for control. If 4-20mA is selected as the "Setpoint source", the boiler determines its setpoint from the 4-20mA signal. The setpoint is calculated from a factory-set scale between 60°F corresponding to 4mA, and 190°F corresponding to 20mA. If the 4-20mA input signal is invalid, out of range, or absent, the "Setpoint" is used until the signal is valid again. Regardless of the "Setpoint source", "Local" or "4-20mA", the controller's internal PID algorithm modulates the burner. **The 4-20mA signal does not create burner demand; a call for heat must be present at the CH2 (LL) input.**

2.4.3.2 Lead Lag Slave Config

Figure 2-16 LL Slave Configuration Screen

Lead Lag Slave Config – sub-menu screen, allows the installer to set the “Slave mode” which establishes the order in which the boiler is chosen during the staging sequence of a Lead Lag demand.

Use First – This mode has priority over all others. A unit with its “Slave mode” set to "Use First", will always fire first before any other slave in the cascade and it will be the last one dropped.

Equal run time – This mode stages the units based on run time equalization where the unit with the least burner hours fires first and the most burner hours fires last. Only "Use First" has higher priority.

Use Last – This mode has the lowest priority. A unit with its “Slave mode” set to "Use Last", will always fire last after every other slave in the cascade is running. It will be the last slave to fire and the first one dropped.

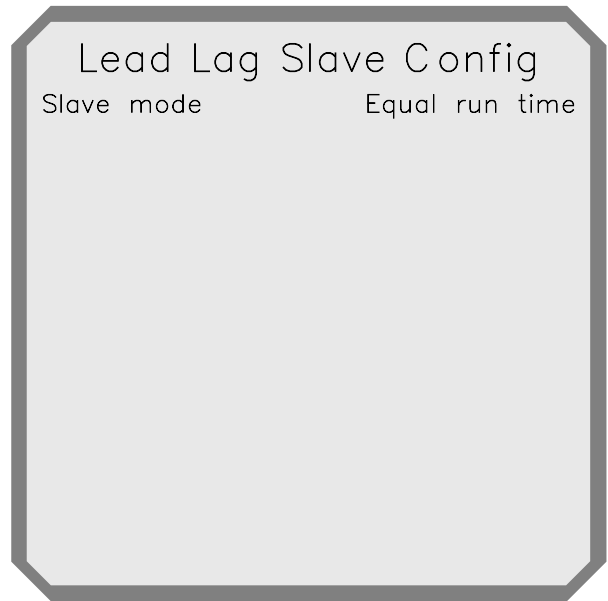


Table 2-11 Lead Lag Slave Configuration Parameters

Parameter	Description	Factory Settings
Slave mode *	Select slave mode from drop down list: <ul style="list-style-type: none"> • Use First • Equal run time • Use Last 	Equal run time

* Password protected

2.4.3.3 Lead Lag Outdoor Reset

Figure 2-17 LL Outdoor Reset Screen

(LL Config) Outdoor Reset Config – sub-menu screen, allows the installer to set parameters specific to the effect the outdoor temperature has on the operation of the boiler during a CH2 (LL) demand. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

Outdoor Reset is in effect only if the following two conditions are met: “Outdoor reset enable” is set to "Enable", and an outdoor temperature sensor is connected to the boiler. The “Lead Lag Outdoor Reset” parameters, together with the “Lead Lag Master Config” parameters, define the relationship of boiler temperature setpoint to outdoor temperature. Refer to Figure 2-12 for an example of the relationship between outdoor temperature and boiler temperature, with a given set of settings.



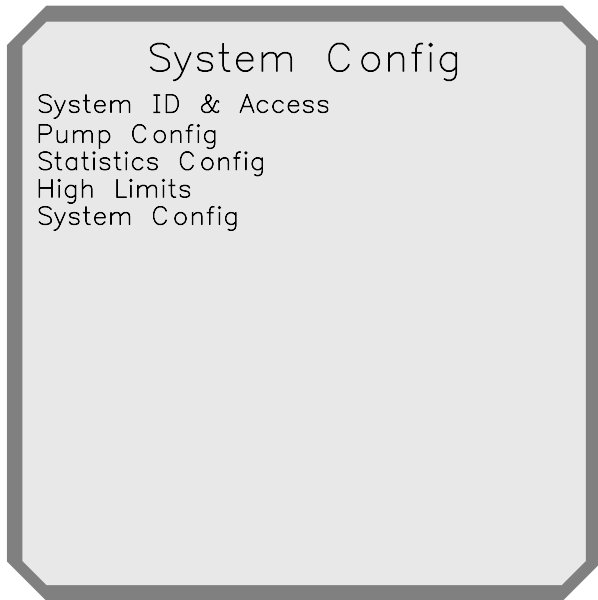
Table 2-12 Lead Lag Outdoor Reset Config Parameters

Parameter	Description	Factory Settings
Outdoor reset enable *	Enables or disables Outdoor reset	Enabled
Max outdoor temp *	Outdoor temperature that corresponds to the “Low water temp” setting. <i>Example:</i> If the “Low water temp” setting is 85°F, and the “Max outdoor temp” setting is 70°F, the boiler setpoint will be 85°F when the outdoor temperature is 70°F or higher. Range 50°F to 95°F	70°F
Min outdoor temp *	Design Temperature - Outdoor temperature that corresponds to the “Setpoint” setting. <i>Example:</i> If the “Setpoint” is 150°F, and the “Min outdoor temp” setting is 0°F, the boiler setpoint will be 150°F when the outdoor temperature is 0°F or lower. Range -40°F to 40°F	0°F
Low water temp *	Minimum boiler setpoint; occurs when the outdoor temperature is equal to or greater than the “Max outdoor temp”. Range 60°F to 140°F	85°F
Outdoor boost max off point *	Read only – functional in a future revision.	130°F

* = Password protected

2.4.4 System Config

Figure 2-18 System Configuration Main Menu Screen



System Config – main menu screen, accessed by selecting “System Config” from the “Advanced Setup” screen, lists the sub-menus specific to the System Configuration. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

2.4.4.1 System ID & Access

Figure 2-19 System Identification & Access Screen

System ID & Access – sub-menu screen contains information about the CHS controller; it also provides the installer with the ability to change the “Boiler name” as it appears on the display, and the “Modbus address”, which is necessary for configuring Lead Lag multiple boiler installations. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

MB2 Modbus address – each boiler in a Lead Lag multiple boiler installation, must have a unique MB2 Modbus address.

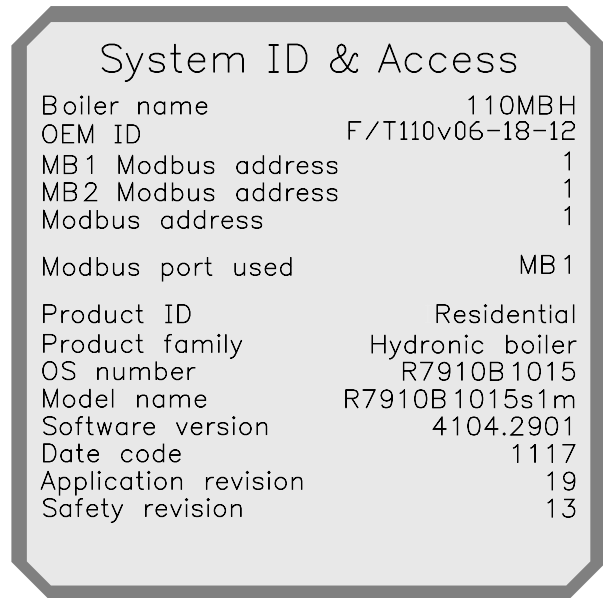


Table 2-13 System Identification & Access Parameters

Parameter	Description	Factory Settings
Boiler name *	Name describing the specific boiler. Limited to 20 characters.	e.g.: 110MBH
OEM ID	Name identifying factory configuration settings; field is read only.	N/A
MB1 Modbus address *	Modbus communication address used by the display to identify the attached controller. No need to change this setting. Range: 1 – 8.	1
MB2 Modbus address *	Unique controller I.D. needed when multiple boilers are connected together in a Lead Lag cascade configuration. Each boiler in a Lead Lag cascade configuration must have a unique setting. Range: 1 – 8.	1
Modbus address	Displays the “MB1 Modbus address” setting – do not adjust this setting.	1
Modbus port used	Identifies the Modbus port used by the display to controller; field is read only.	MB1
Product ID	Controller type identification; field is read only.	Residential
Product family		Hydronic boiler
OS number	Controller model identification; field is read only.	R7910B1015
Model name		
Software version	Controller software version identification; field is read only.	N/A
Date code	Controller date code; field is read only.	N/A
Application revision	Controller application revision; field is read only.	N/A
Safety revision	Controller safety revision; field is read only.	N/A

* = Password protected

2.4.4.2 Pump Config

Figure 2-20 Pump Configuration

Pump Config – sub-menu screen allows adjustment of the individual pump overrun times; also allows the individual pumps to be manually turned on for testing purposes. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

CH pump use for LL Master – for Lead Lag multiple boiler configurations; set this parameter to “On” on the boiler that is controlling the System pump with the Pump C output.

NOTICE **pump control** – This may be used to manually override automatic control of the pumps for testing purposes. If used in this manner, ensure that it is set back to “Auto”; otherwise, the selected pump(s) will remain powered on indefinitely.

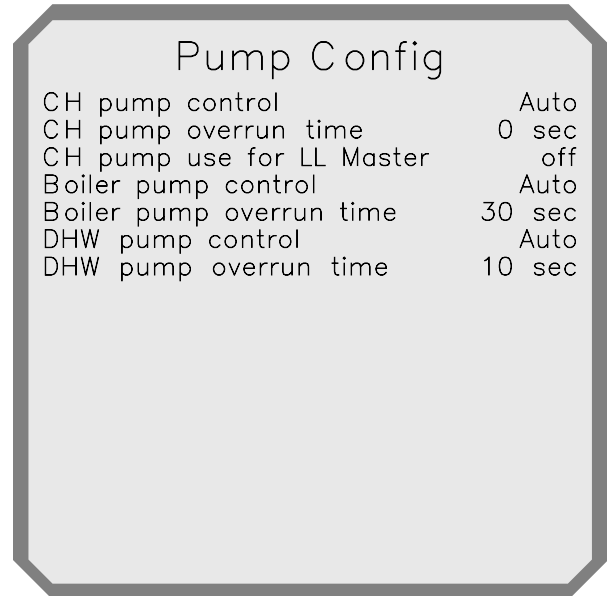


Table 2-14 Pump Configuration Parameters

Parameter	Description	Factory Settings
CH pump control *	Switches CH pump (Pump C) control from Automatic to ON.	Auto
CH overrun time *	Amount of time the CH pump (Pump C) will continue to run after a CH [CH1 or CH2 (LL)] demand ends. Range 0 to 1080 minutes.	0 sec
CH pump use for LL master *	Check box used to allocate Pump C output as the system pump operator for Lead Lag applications.	off
Boiler pump control *	Switches Boiler pump (Pump B) control from Automatic to ON.	Auto
Boiler pump overrun time *	Amount of time the Boiler pump (Pump B) will continue to run after burner shutdown. Range 0 to 1080 minutes.	30 sec
DHW pump control *	Switches DHW pump (Pump A) control from Automatic to ON.	Auto
DHW pump overrun time *	Amount of time the DHW pump (Pump A) will continue to run after a DHW demand ends. Range 0 to 1080 minutes.	10 sec

* = Password protected

2.4.4.3 Statistics Config

Figure 2-21 Statistics Configuration Screen

Statistics Config – sub-menu screen displays the number of burner and pump cycles, as well as burner run time. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

Pump cycle counts can be reset by the installer, for example when a circulator is replaced.

NOTICE

Burner cycles and Burner run time counters cannot be reset.

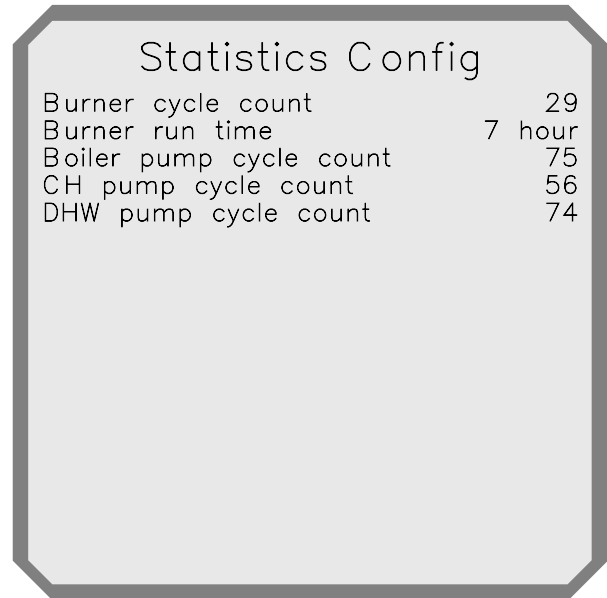


Table 2-15 Statistics Configuration Parameters

Parameter	Description	Factory Settings
Burner cycle count	Number of burner cycles on controller. Not resettable by the installer. Range 0 to 999,999.	0
Burner run time	Total number of hours of burner operation. Range 0 to 999,999 hours.	0 hour
Boiler pump cycle count *	Number of Boiler pump (Pump B) cycles since last reset. Range 0 to 999,999.	0
CH pump cycle count *	Number of CH pump (Pump C) cycles since last reset. Range 0 to 999,999.	0
DHW pump cycle count *	Number of DHW pump (Pump A) cycles since last reset. Range 0 to 999,999.	0

* = Password protected

2.4.4.4 High Limit

Figure 2-22 High Limit Screen



High Limit – sub-menu screen displays the outlet limit response. This value is “read only” and cannot be adjusted.

Table 2-16 High & Stack Limit Parameters

Parameter	Description	Factory
Outlet high limit response	Indicates controller response to an outlet temperature exceeding the “Outlet high limit setpoint”. Parameter is read only.	Recycle & Hold

2.4.4.5 System Config

Figure 2-23 System Configuration Screen

System Config – sub-menu screen allows the operator to set the temperature units (°F/°C) and the burner “Anti short-cycle time”. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

NOTICE **Anti short-cycle time** - This feature does not apply to Domestic Hot Water demand or recycle events.

The Anti short-cycle feature is designed to prevent excessive burner on/off cycling due to short or rapid thermostat cycles, low heating load, etc.

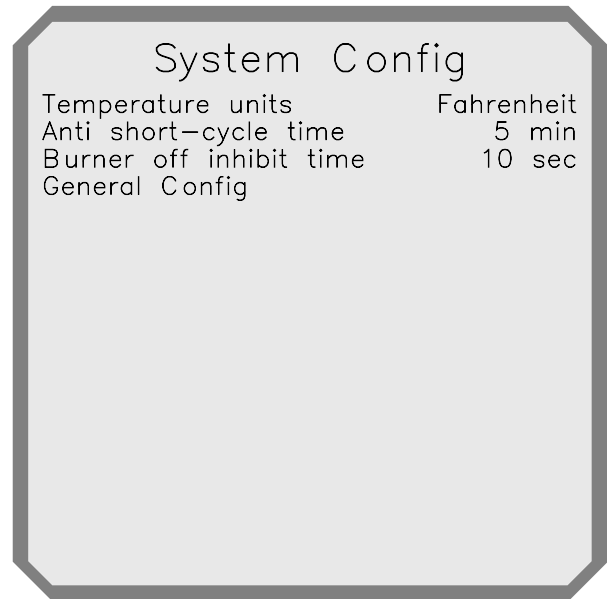


Table 2-17 System Configuration Parameters

Parameter	Description	Factory Settings
Temperature units	Select which temperature units to display: <ul style="list-style-type: none"> • Fahrenheit • Celsius 	Fahrenheit
Anti short-cycle time *	Whenever the burner is turned off due to no demand the anti-short-cycle timer is started and the burner remains in a Standby Delay condition waiting for this time to expire. Range 0 to 60 minutes (1 hour).	5 min
Burner off inhibit time *	If demand changes from a high-temperature setpoint to a lower setpoint (e.g. from DHW to CH), water temperature may exceed the burner off point for the new demand. This value determines how long the control will ignore the burner off hysteresis or threshold before shutting down the burner, in order to reduce burner cycling. Range 0 to 30 minutes.	10 sec
General Config	Allows for advanced parameter configuration modifications – only use when instructed by Slant/Fin technical support.	N/A

* Password protected

2.4.5 Modulation Config

Figure 2-24 Modulation Configuration Screen

Modulation Config – menu screen, accessed by selecting “Modulation Config” from the “Advanced Setup” screen, allows for adjustment of the min. and max. modulation rates of the boiler. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

Modulation rates are listed by model number:

CH and DWH Max Modulation Rate	Min Modulation Rate
CHS-85 = 6300	85 = 1525
CHS-110 = 7000	110 = 1625
CHS-155 = 3700	155 = 900
CHS-175 = 4100	175 = 900
CHS-200 = 4650	200 = 900
CHS-250 = 5900	250 = 900
CHS-300 = 5000 (4800 on LP)	300 = 1500
CHS-399 = 6900 (6600 on LP)	399 = 1500

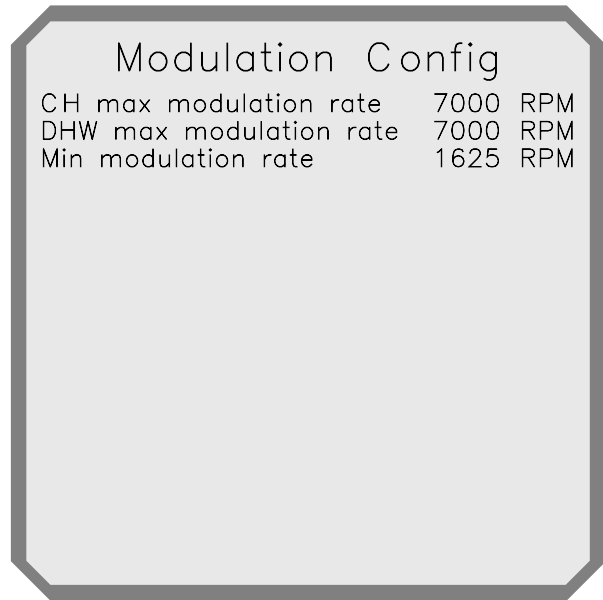


Table 2-18 Modulation Configuration Parameters

Parameter	Description	Factory Settings
CH max modulation rate *	Maximum permissible blower speed during CH demand [CH1 or CH2 (LL)]. Range is model dependent.	Model dependent
DHW max modulation rate *	Maximum permissible blower speed during DHW demand. Range is model dependent.	Model dependent
Min modulation rate *	Minimum permissible blower speed. Range is model dependent.	Model dependent

* = Password protected

2.4.6 Delta T & T-rise Limits

Delta T Limits – accessed by selecting “Delta T Limits” from the “Advanced Setup” screen; Delta T is the difference in water temperature between Inlet and Outlet of the boiler. If the temperature difference (Delta T) is greater than 60°F the burner is shut off for the time specified before firing again. An initial cycle and two recycles are allowed before Lockout occurs.

T-rise Limits – accessed by selecting “T-rise Limits” from the “Advanced Setup” screen; T-rise is the rate of increase of the boiler Outlet temperature. If the boiler outlet temperature increases by a rate greater than 4°F/second the burner will recycle with a delay equal to the “Outlet T-rise delay” setting. An initial cycle and two recycles are allowed before Lockout occurs.

Figure 2-25 Delta T & T-rise Limits Screens



Table 2-19 Delta T & T-rise Limits Parameters

Parameter	Description	Factory Settings
Delta T delay *	Delay time between burner cycles when Delta T limit is exceeded. Range 1 to 60 minutes.	5 min
Outlet T-rise delay *	Delay time between burner cycles when T-rise limit is exceeded. Range 1 to 60 minutes.	5 min

*=Password Protected

2.4.7 Frost Protection Config

Figure 2-26 Frost Protection Screen

Frost Protection Config – accessed by selecting “Frost Protection Config” from the “Advanced Setup” screen. Provides optional freeze protection for the boiler system. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

When set to “Enable”, causes the respective circulators to operate when the inlet temperature drops below 45°F; and the burner to fire (at the min. modulation rate) when the outlet temperature drops below 38°F.



Table 2-20 Frost Protection Configuration Parameters

Parameter	Description	Factory Settings
CH frost protection *	Enable or Disable frost protection for central heat (i.e. Pumps B and C).	Enabled
DHW frost protection *	Enable or Disable frost protection for DHW (i.e. Pumps A and B).	Disabled
Lead Lag frost protection *	Enable or Disable frost protection for lead lag (i.e. Pumps B and C). Each slave detects frost protection and notifies the Master.	Disabled

* Password protected

2.4.8 Burner Control Ignition and Timings & Rates

Burner Timings & Rates – accessed by selecting “Burner Timings & Rates” from the “Advanced Setup” screen. Displays the Postpurge rate and time settings; values are “read only” and cannot be adjusted.

Burner Control Ignition – accessed by selecting “Burner Control Ignition” from the “Advanced Setup” screen. Displays the “Adjustable lightoff rate” setting.

Figure 2-27 Burner Control Ignition and Timings & Rates Screens



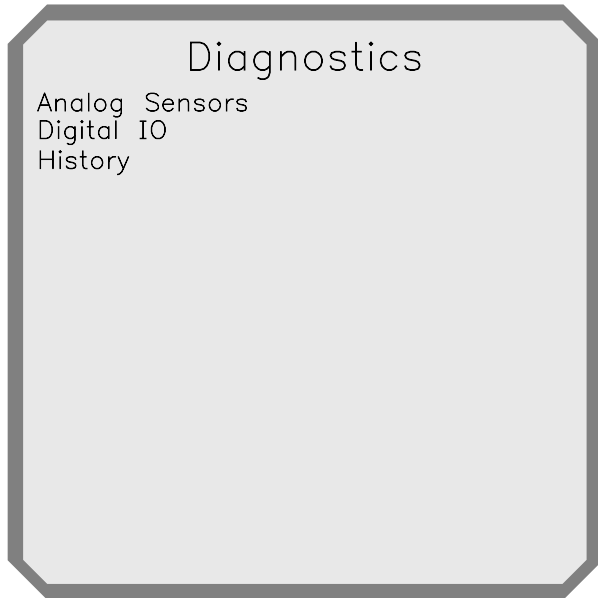
Table 2-21 Burner Control Ignition and Timings & Rate Parameters

Parameter	Description	Factory Settings
Postpurge rate *	Rate the blower will operate following the shutdown of the burner. Parameter is read only.	4500 RPM
Postpurge time *	Time the blower will operate following the shutdown of the burner. Parameter is read only.	25 sec
Adjustable lightoff rate *	Rate the blower will operate during burner ignition. Range 2500rpm to 5000 rpm.	4000 RPM

* Password protected

2.5 Diagnostics

Figure 2-28 Diagnostic Input/Output Screens



Diagnostics – menu screen, accessed by selecting “Diagnostics” from the “i-Information” screen, allows the user to view the operational status of the boiler. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

Analog Sensors – indicates the status of all temperature sensors, flame sensor, blower speed (both demanded and actual), and optional 4-20mA input signal; see Figure 2-31.

Digital IO – indicates the status of each on/off input and output, i.e. pump outputs and thermostat inputs; see Figure 2-31.

Figure 2-29 Diagnostic Screens

Analog Sensors

Outlet temp	70 °F
Inlet temp	70 °F
Delta T	1 °F
DHW temp	OPEN
Stack temp	71 °F
Outdoor temp	OPEN
Fan speed	LOW
Flame signal	0.00 µA
Firing rate	0 RPM
4–20mA input	OPEN
System sensor	Outlet

Digital IO

Boiler pump (B)	off
CH pump (C)	off
DHW pump (A)	off
Blower/HSI	off
Eternal ignition	off
Pilot valve	off
Main valve	off
Alarm	off
Interlock (ILK)	on
Pre-ignit interlock (PTI)	off
Load control input (LCI)	off
STAT (Demand)	off
Time Of Day	off
Safety relay	off

2.5.1 History

The CHS controller identifies and records two kinds of events and categorizes them as either Lockouts or Alerts. The bulleted lists below indicate the significance of each type of fault:

Lockouts:

- Cause the burner to shutdown and require manual intervention to reset the controller from Lockout
- Always cause the Alarm contacts to close
- Are logged in the Lockout History

Alerts:

- Events reported by the controller
- For informational purposes only

Figure 2-30 History Screen

History – sub-menu screen provides access to a log of past Lockouts and Alerts. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

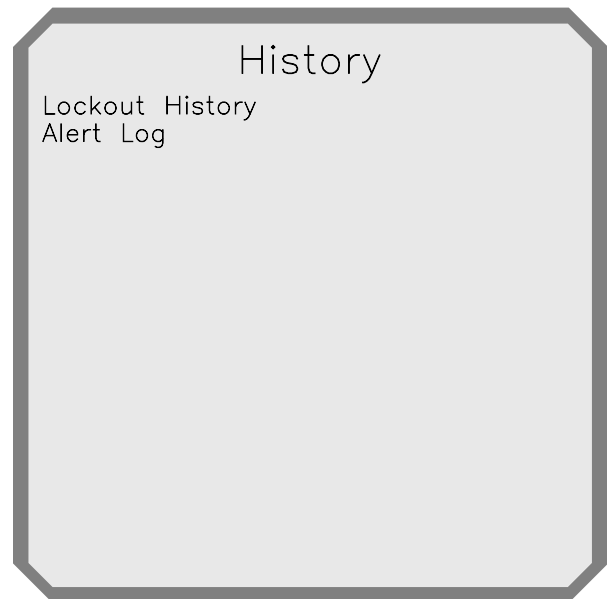


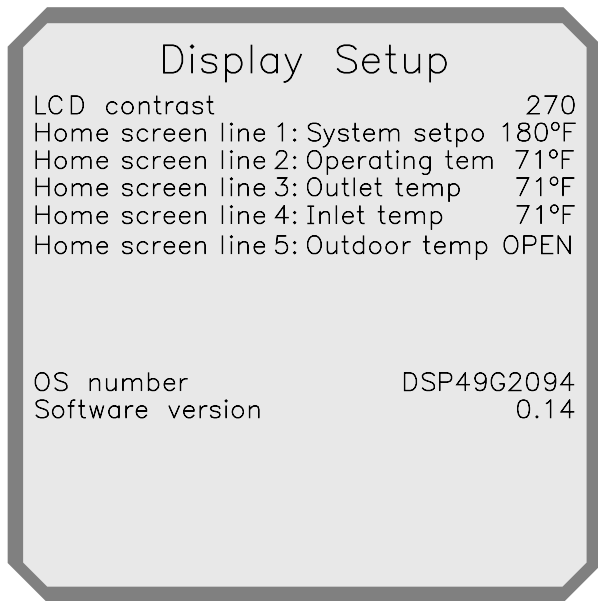
Figure 2-31 Example Lockout History Record Screen



Lockout/Alert Record – by selecting a Lockout or Alert event from the list of Lockouts/Alerts, the display provides specific information about the operating condition of the boiler during the Lockout/Alert (see example left). This information can be helpful for troubleshooting.

2.6 Display Setup

Figure 2-32 Display Setup User Customizable Screen



Display Setup – menu screen, accessed by selecting “Display Setup” from the “i-Information” screen, allows the user to select which value (operating parameter or sensor reading) is displayed on each of the first 5 lines of the Home Screen. Use the up and down (▲▼) buttons to navigate the menu options; when the desired option is highlighted select by pressing the “OK” button.

The comprehensive list of sensor I/O is identified in Table 2-22 below.

Table 2-22 List of Optional Values for Display on Home/Summary Screen

Value	Description
System setpoint	Indicates the actual local CH setpoint (i.e. for a CH1 demand); adjusts for outdoor reset.
Operating temp	Indicates the temperature at the sensor used for burner modulation during a local CH or DHW demand, i.e. boiler inlet, boiler outlet or system/pipe sensor.
Outlet temp	Indicates the temperature reading from the boiler outlet sensor.
Inlet temp	Indicates the temperature reading from the boiler inlet sensor.
Outdoor temp	Indicates the temperature reading from the outdoor sensor.
Delta T	Indicates the temperature difference between the boiler inlet and outlet sensors.
LL Operating temp	Indicates the temperature at the sensor used for burner modulation during a Lead Lag demand, i.e. boiler outlet or system/pipe sensor.
LL System setpoint	Indicates the actual Lead Lag setpoint [i.e. for a CH2 (LL) demand]; adjusts for outdoor reset.
Fan speed	Indicates the speed that the combustion blower is running at – tachometer reading.
Flame signal	Indicates the flame current sensed from the flame probe.
Firing rate	Indicates the speed that the combustion blower is being commanded to operate at.
DHW temp	Indicates the dhw tank temperature (if used) or OPEN/CLOSED for Aquastat switch status.
Stack temp	Indicates the temperature reading from the boiler stack sensor.
4-20mA input	Indicates the input signal from an external 4-20mA source (used for direct burner modulation or establishing temperature setpoint).
Lead Lag temp	Indicates the temperature reading from an optional system/pipe sensor.

