

Conductor Hydronic Sequencer

Instruction and Operation Manual

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Application

The Conductor Hydronic Sequencer (Control) manages multiple condensing and non-condensing, small and large heat output, new and/or existing boilers, and steam or hot water applications. The Control helps improve system efficiency by selecting and modulating the right boiler to match operating conditions.

The Conductor offers a single point boiler plant Energy Management System (EMS) interface including Modbus TCP/IP, Modbus RTU RS485, BACnet/IP and BACnet MSTP standard.

Intent

This instruction manual includes detailed functional, installation and setup information. The intended users are application engineers, I&O manual and brochure writers, development and specifying engineers and installing contractors.

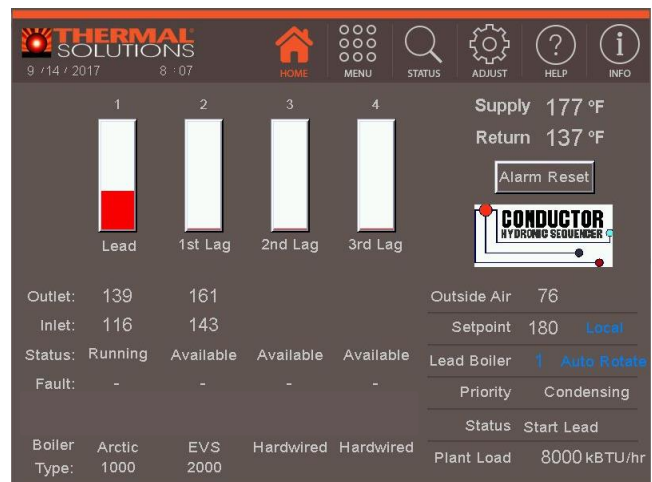


Figure 1: Conductor Touch Screen Display
(Showing Home Screen)


IMPORTANT INFORMATION – READ CAREFULLY

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


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

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

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

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

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

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

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

Overview

Conductor Hydronic Sequencer (Control)

The Control is a multiple boiler modulating Control for Steam or Hydronic applications. It includes a fresh air damper, isolation valve and primary/secondary pump Control, direct wiring for up to four boilers and communication interface for up to 8 Thermal Solutions boilers. Major features include:

- **Steam or Hot Water:**

The Control is field selectable as a Steam or Hot Water multiple boiler Control system. Steam applications include shell temperature monitoring, and Control and hydronic applications include isolation valve and primary/secondary pump Control options.

- **Condensing / Non-Condensing:**

When condensing boilers are operating, it is desirable to have more boilers running at low load to create conditions favorable for condensing. Conversely, when non-condensing boilers are operating it is better to run fewer boilers at higher modulation rates. Further, non-condensing boilers often have higher allowable water temperatures. The Control simply operates non-condensing boilers when higher water temperatures are desired and condensing boilers when lower water temperatures are desired. When water temperatures are low, non-condensing boilers are “Used Last” and not fired until load is high enough to require these boilers to be used. When a Non-Condensing boiler is commanded to fire the sequence setpoint minimum setting is increased to a non-condensing boiler minimum. When water temperatures are too high for condensing boilers they are blocked from running or system water temperature is limited to an acceptable value (parameter adjustable).

- **Unison or Sequential Modulation:**

When “Unison” modulation is selected active boilers fire at the same firing rate. When condensing boilers are active, the Control limits firing rate to a “Base Load Common Rate” to ensure peak modulating condensing boiler efficiency. The Control maintains this high limit until the last boiler is started or any non-condensing boiler is started. At this point, the “Base Load Common Rate” is released to allow boilers to modulate, as required, to meet plant load.

When “Sequential” modulation is selected, only the lead boiler is modulated to satisfy the load

while leaving lag boilers at a peak efficiency “Base Load” rate. The result is increased time that boiler operation is at the most efficient point. Non-condensing boilers have peak efficiency when running a approximately 80% firing rate.

- **Small Boiler Lead Selection:**

Boilers are “short cycled” when plant load is less than the minimum modulation of the lead boiler. The Control’s “Use First” feature automatically selects a smaller boiler to be lead to respond to small plant loads. Boiler numbers following this lead boiler will be next to fire.

- **Simply Connect Practically Any Commercial Boilers:**

The Control uses RJ45 and/or RJ11 cables to connect Thermal Solution brand boilers in a boiler peer-to-peer network for up to eight (8) boilers. RWF40, RWF55, TSBC and Concert Control systems are monitored and controlled over the network. Up to four (4) non-Thermal Solutions boilers may be connected using 0-10vdc/4-20mAdc firing rate and enable/disable demand contact outputs.

- **Single Point EMS Interface:**

The Control collects monitoring points from networked boilers, and offers the Energy Management System (EMS) a single-point connection via included Modbus TCP/IP, Modbus RTU RS485, BACnet/IP and BACnet MSTP protocols. Additionally, the Control accepts a 0-10vdc or 4-20mAdc setpoint input, an enable/disable contact input, and provides alarm and lockout contact outputs. LonWorks and Johnson Metasys N2 protocols are standard options.

- **Automated Setup:**

Simple question/answer prompts allow the user to easily select boiler models from a list to setup the Control for each site. Company brand and direct wired boilers parameters are automatically set. Connections between boilers and the Control can be made using standard communication cables.

Product Features

Hydronic Control

The Control is compatible with primary / secondary or variable flow applications. In both applications system supply temperature is measured and compared to setpoint to create boiler firing rate demand.

Active Setpoint

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

Central Heat

Upon a Central Heat call for heat, the active setpoint is either the user entered Operating Setpoint, or automatically adjusted by the Outdoor Air Reset, Energy Management System (EMS) supplied 4-20mA dc/0-10Vdc, or Modbus setpoint input.

Outdoor Air Reset

When selected, the modulation rate setpoint is automatically adjusted based on outdoor air temperature. Outdoor air "reset" setpoint saves fuel by adjusting the active setpoint of a heating boiler lower as the outdoor air temperature increases.

Domestic Hot Water (DHW) Setpoint

Upon a DHW call for heat, the active setpoint is the user entered DHW Setpoint. The optimal value of this setpoint is established based on the requirements of the indirect water heater. DHW demand ignores the Warm Weather Shutdown condition and continues to provide domestic hot water.

Warm Weather Shutdown (WWSD)

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

Isolation Valves

The Control has an option for four (4) isolation valve outputs. These valves are intended for use in variable flow systems (see Figure 3). These systems are not primary piped and boiler water flow is provided by system pumps. The isolation valves close when a boiler is not running to ensure system water is not

flowing through offline boilers. When a boiler is called to start, the isolation valve opens allowing flow through the boiler. If all boilers are off, the lead boiler's isolation valve remains open. Isolation valves may be opened and closed manually or set to automatic Control. Isolation valves are assigned to boilers in sequential order; A to Boiler 1, B to Boiler 2, etc. An optional relay board (PN 107311-02) is required to interface the Control to isolation valves. The optional relay board provides both normally open and normally closed contacts for each isolation valve. The output is designed to drive the valve open with the normally open contact and drive the valve closed with the normally closed contact.

Pump Control

The Control includes automatic alternating pump outputs. Either pump may be selected as the lead and the other as the backup. The system is designed to have one pump running at a time with the second pump available as a backup pump. If the lead pump fails to produce flow (sensed by a flow switch located in the individual pump piping), an alarm is generated and the backup pump is started. The backup pump will run as long as the lead pump is called to run, and does not produce required flow. Lead pump is rotated manually or based on run time hours. If auto rotation is selected, the lead pump runs for a field adjustable overrun time until the backup pump is proven. The pump runs when the Control is enabled, and there is no Warm Weather Shutdown.

Configurable Output

The Control may be used to sequence the domestic hot water pump or fresh air damper.

Load Monitoring

System load is measured using system supply temperature, system return temperature, and system pump speed feedback or pump status. Maximum GPM can be entered for a constant-speed primary pump, or GPM can be measured for a variable-speed pump via a 0-10Vdc or 4-20mA dc feedback input. For load monitoring to function all sensors (supply, return, and pump feedback) must be configured and have good data quality.

Product Features

Hydronic Control

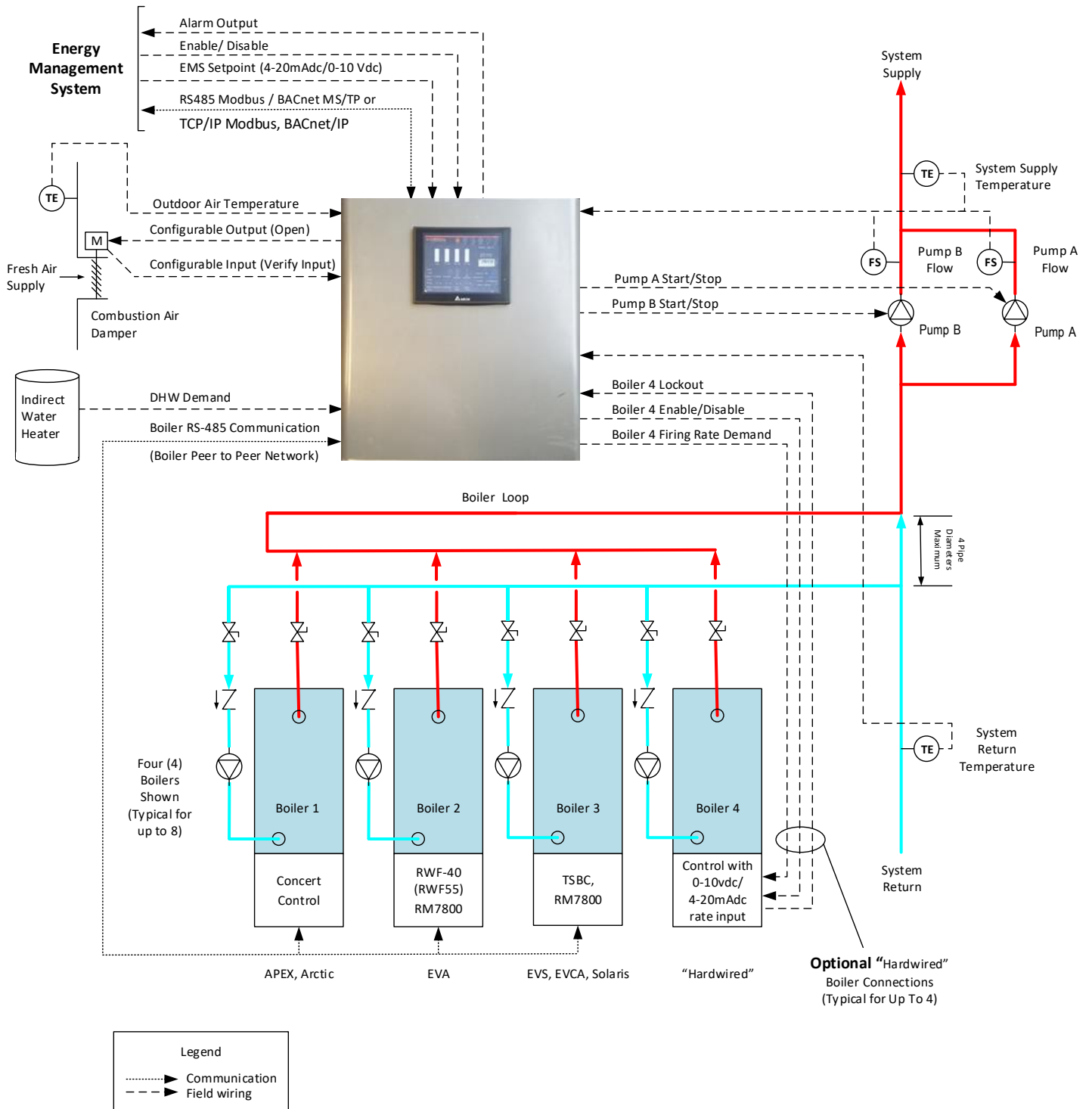


Figure 2: Conductor Hydronic Application, Primary / Secondary Piping

Product Features

Hydronic Control

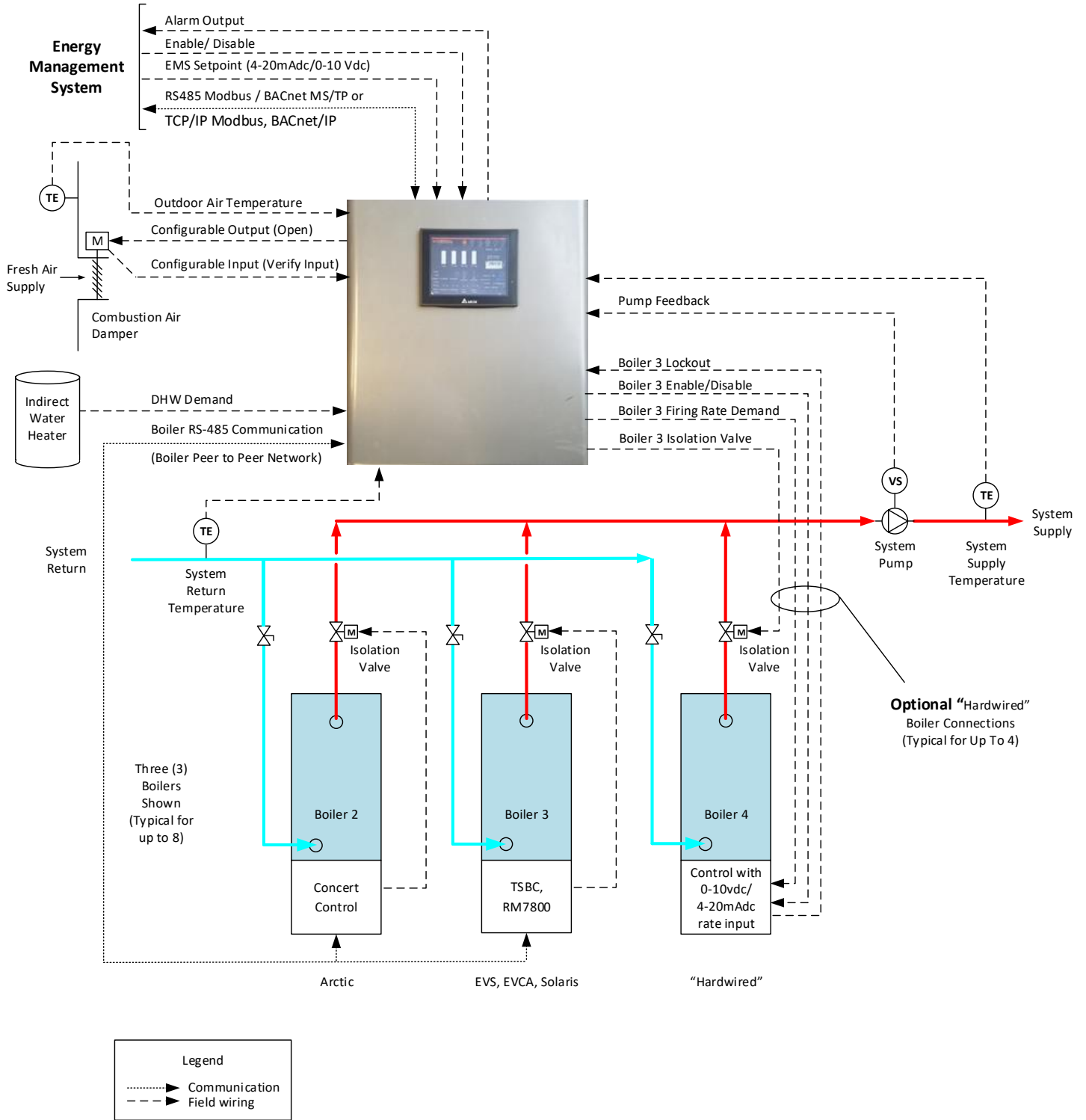


Figure 3: Conductor Hydronic Application, Variable Flow Piping

Product Features

Steam Control

Steam boilers are directly wired to the Control terminals using Enable/Disable and Firing Rate Demand terminals. A maximum of 4 steam boilers may be wired to the Control. Steam pressure is compared to setpoint to create firing rate demand. The Control includes low fire hold and warm standby features. Low fire hold can be accomplished with a low fire hold timer, or an optional shell temperature sensor. Warm standby is available when a temperature sensor, or switch, is connected. When a boiler is started, the firing rate is held at low fire for a low fire hold time, or until the shell temperature is above setpoint. When warm standby is selected, the next boiler to start is periodically started and held at low fire until it returns to the warm standby temperature.

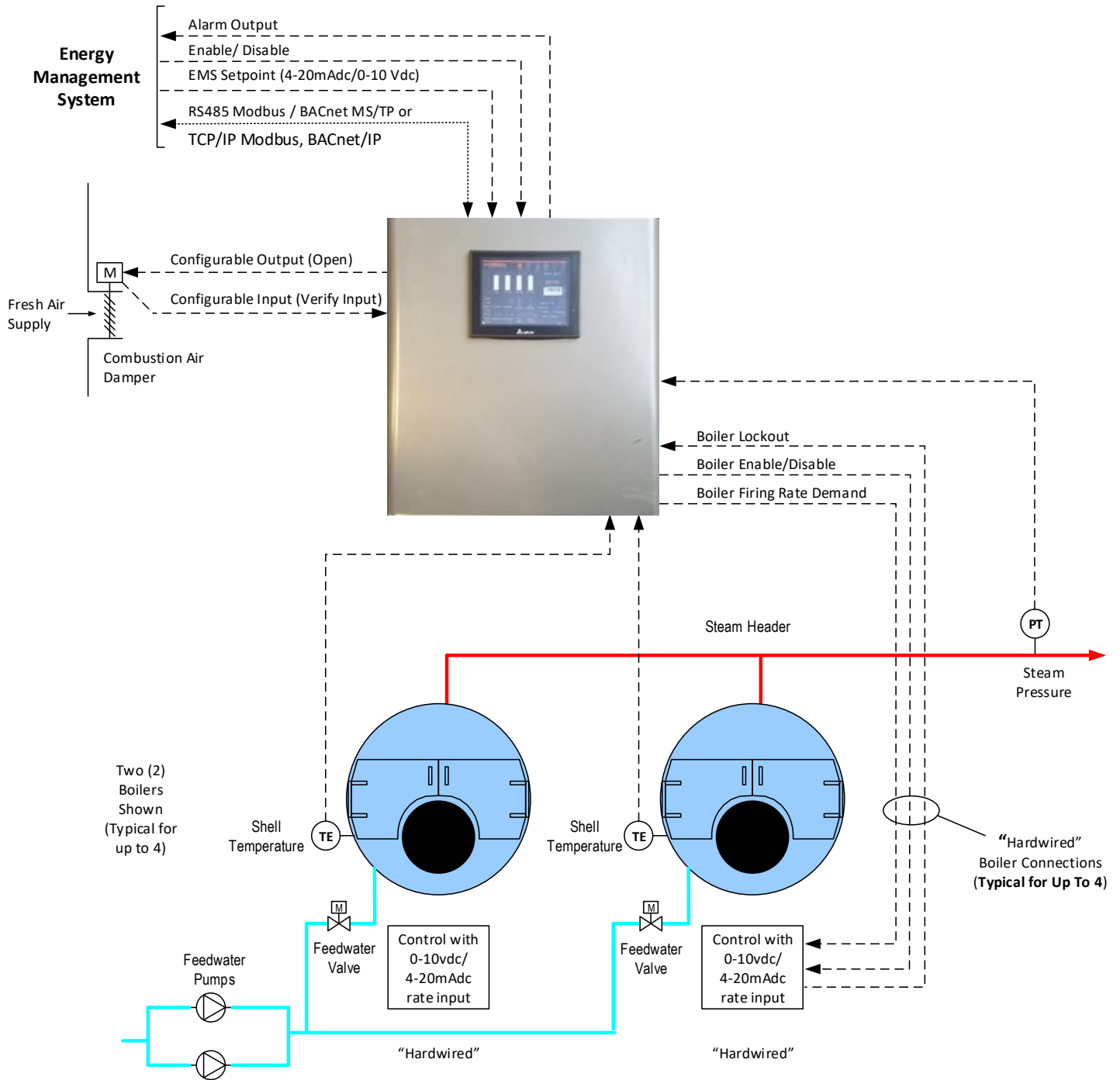


Figure 4: Conductor Steam Application

Product Features

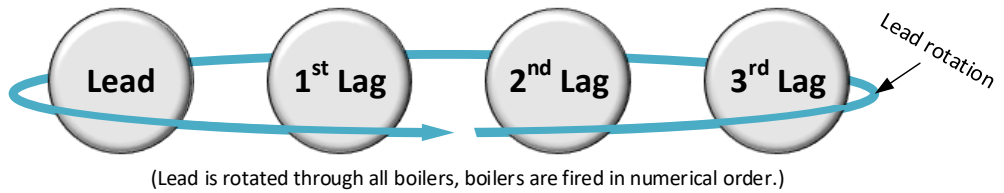
Adaptive Sequencer

The Control's sequencer "Adapts" to the hydronic system to automatically match active boilers to the system load and water temperature requirement. The "Boiler Type", "Boiler Sequence Order" and "High Temperature System" parameters determine the lead boiler selection and the firing rate order. The Boiler Type and Boiler Sequence Order parameters identify a boiler as "condensing", "non-condensing", "Use Last" and "Use First". "Use Last" boilers will only be used if load requires the additional boilers. "Use First" selects a small boiler to operate when load monitoring is enabled and plant load is less than the current lead boiler's minimum firing rate. The Adaptive Sequences allow condensing boilers to operate at high efficiency low return temperature, non-condensing boilers to service high temperature demands and help reduce excessive cycling by automatically selecting a small boiler to satisfy a small plant load. The following examples demonstrate these features:

Boiler 1 Boiler Type = Non-Condensing Sequence Order = "Use Last"	Boiler 2 Boiler Type = Non-Condensing Sequence Order = "Use Last"	Boiler 3 Boiler Type = Condensing Sequence Order = "Normal Order"	Boiler 4 Boiler Type = Condensing Sequence Order = "Use First"
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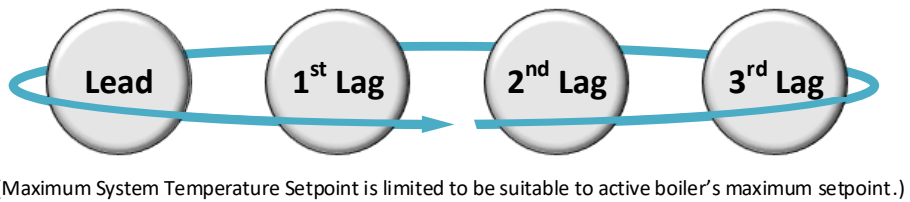
Normal Operation

Active Setpoint: 140-190 F
Example Load: 1 to 4 boilers
Result:
Lead Rotation: 1, 2, 3, 4
Firing Order: 1,2,3,4



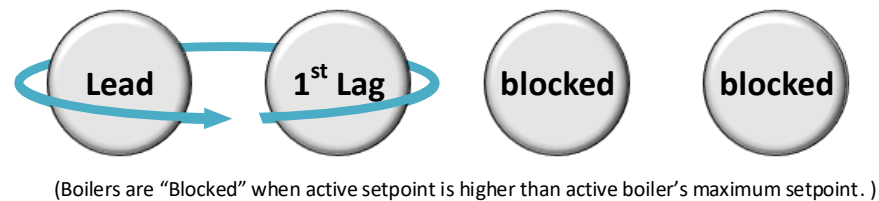
High Temperature Operation

Active Setpoint: > 195 F
Example Load: 2 boilers
High Temp System: Disabled
Result:
Lead Rotation: 1 & 2
Firing Order: 1 – 2 – 1 – 2



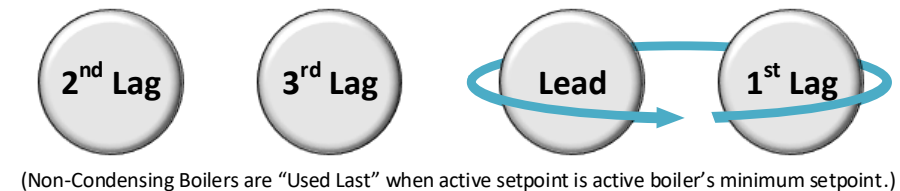
High Temperature Operation

Active Setpoint: > 195 F
Example Load: 2 boilers
High Temp System: Enabled
Result:
Lead Rotation: 1 & 2
Firing Order: 1 – 2 – 1 – 2



Low Temperature Operation

Active Setpoint: < 140 F
Example Load: 2 boilers
Result:
Lead Rotation: 3 & 4
Firing Order: 3 – 4 – 1 – 2



Less than 1 Boiler Load

System Temperature: 180 F
System Load: < 1 boilers
Boiler 4 is small size.
Result:
Lead Rotation: 4
Firing Order: 4, 1, 2, 3

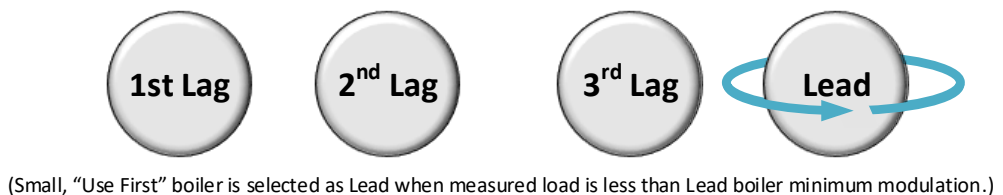


Figure 5: Adaptive Sequences Examples

Product Features

Adaptive Sequencer

Both system water temperature, and boiler firing rate percent are used to start and stop the lead and lag boilers. The Control starts and stops boilers when the water temperature is outside the user selected “Off Point” and “On Point” settings. Additionally, in order to minimize temperature deviations, the control adjusts the number of boilers running based on the firing rate. This combination allows the boilers to anticipate slow load changes before they disrupt water temperature, yet still respond quickly to sudden load changes. These special sequencer features help reduce energy-wasting system temperature swings, and unnecessary boiler cycling.

Lead Boiler Start

The lead boiler starts when water temperature is below the setpoint by more than the “On Point” differential and WWSD is not active.

Temperature Based Lag Boiler Start

A lag boiler will start when water temperature is below the setpoint by more than the “On Point” differential for longer than the adjustable time delay “Boiler On Delay” parameter. Firing rate is limited to an adjustable High Fire Limit parameter, so that fuel savings resulting from low flue gas temperatures can be realized.

Modulation Rate Based Lag Boiler Start

A lag boiler will start when the boiler modulation rate has been above the adjustable limit “Start Trigger” parameter for longer than the time delay “% FR On Delay” parameter. After the last boiler is started the High Fire Limit is released and the boilers are free to modulate as required to satisfy the plant load.

Boiler Start Fault Lag Boiler Start

When a lag boiler fails to start, the next lag boiler is automatically selected to take its place. After a boiler start is initiated, the boiler’s lockout state, limits input and running status is monitored for 15 minutes. A lockout will cause the next boiler to start immediately, and the limits and boiler running states are given field adjustable time delays to complete.

Temperature Based Lag Boiler Stop

Lag boilers are stopped when water temperature is above the setpoint by more than the “Off Point” differential for longer than the “Boiler Off Delay” parameter. After a lag boiler is stopped, the High Fire Limit is re-established and modulation rate is once again limited to allow fuel saving condensing operation.

Modulation Rate Based Lag Boiler Stop

A lag boiler will stop when the boiler modulation rate has been below the adjustable limit, “Stop Trigger” parameter, for longer than the time delay “% FR Off Delay” parameter.

Lead Boiler Stop

The last boiler remains online until it is at minimum firing rate and the water temperature is above the “Off Point” setpoint.

Stop All Boilers

All boilers are stopped without delay in response to any of the following conditions:

1. Warm Weather Shutdown (WWSD): When Outside air temperature is above the WWSD setpoint and the lead boiler has stopped the boiler, the system enters WWSD and will not allow boilers to start until the outside temperature is below the WWSD setpoint. Note, the Control requires the boiler to satisfy the temperature setpoint only. The enable contact may remain closed and the system will still go into WWSD.
2. High Temperature Stop: When header temperature exceeds the “High Temp Stop” parameter (default: 195°F (90.6°C)), all boilers are stopped without delay.
3. Conductor Disabled: Enable / Disable, discrete input, and EMS input is removed.
4. Master Auto/Off: Master Auto/Off switch is set to “Off”
5. Verify Input: Configurable Input is set to Verify, and the input is “Off”

Product Features

Unison Modulation

Unison modulation fires all boilers at the same modulation rate. When condensing boilers are installed, the Control limits firing rates to a “Base Load Common Rate” to ensure modulating condensing boiler peak operating efficiency. Lower firing rates boost efficiency by helping increase the amount of flue gas water vapor condensation. The Control maintains a “Base Load Common Rate” until the last lag boiler or a non-condensing boiler is started. At this point, the “Base Load Common Rate” is released to allow boilers to modulate as required to meet heat load.

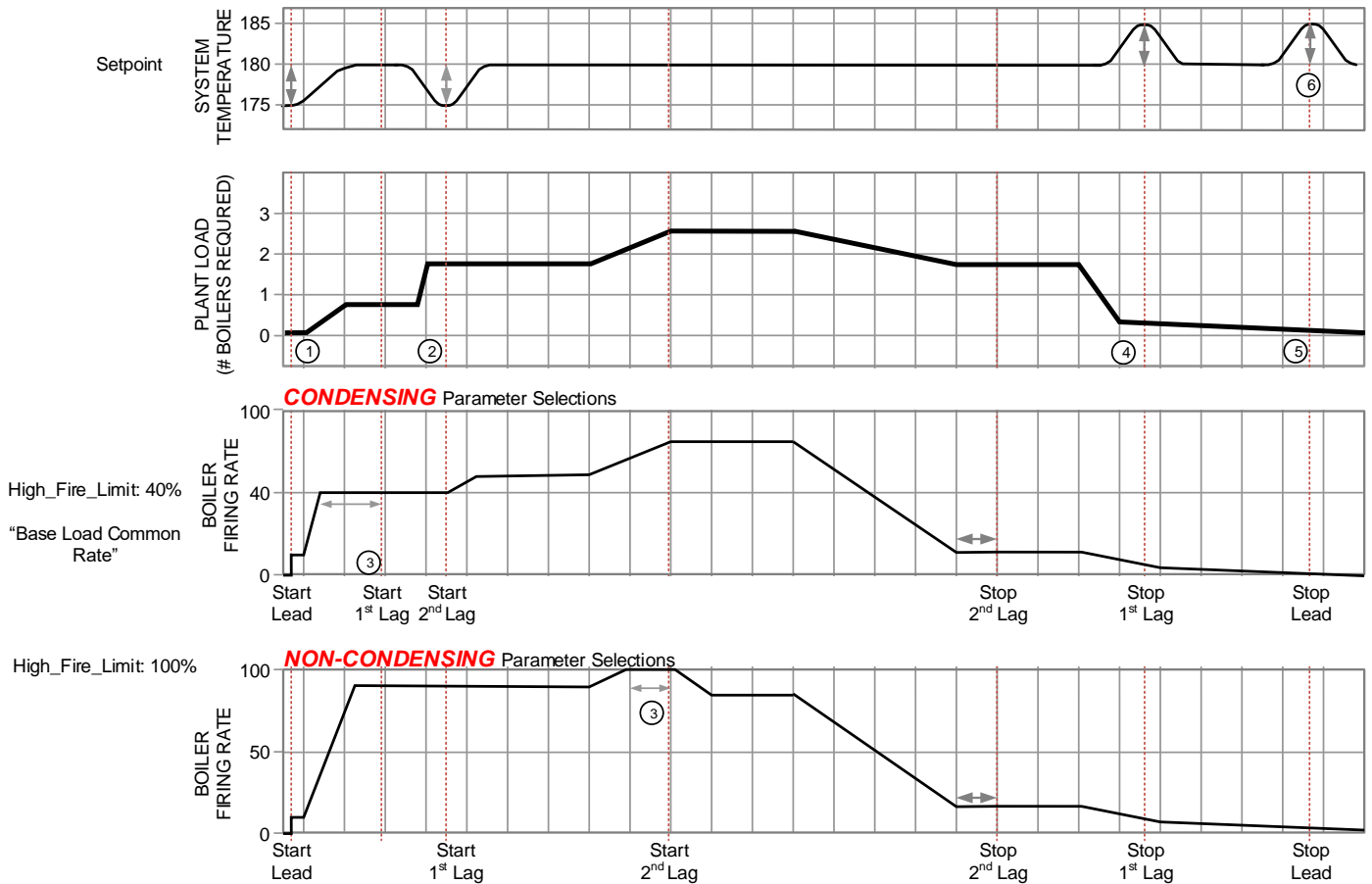


Figure 6: Unison Modulation Start and Stop Sequence

- ① - **Lead Boiler Start**
Water temperature is below the setpoint by more than the “On Point” differential
- ② - **Temperature Based Lag Boiler Start**
Water temperature is below the setpoint by more than the “On Point” differential for longer than the adjustable time delay (“Boiler On Delay” parameter).
- ③ - **Modulation % Based Lag Boiler Start**
The boiler modulation rate has been above the adjustable limit (“Start Trigger” parameter) for longer than the time delay.
- ④ - **Lag Boiler Stop**
The boiler modulation rate has been below the adjustable limit (“Stop Trigger” parameter) for longer than the time delay. Additionally, lag boilers are stopped when water temperature is above the setpoint by more than the “Off Point” differential for longer than the “Boiler Off Delay” parameter)
- ⑤ - **Lead Boiler Stop**
The last boiler remains on line until the water temperature is above the “Off Point” setpoint for longer than the time delay.

Product Features

Sequential Modulation

Sequential Modulation varies the modulation of only the lead boiler to satisfy the load demand while leaving lag boilers at a peak-efficiency “Base Load” rate. The result is increased time that boiler operation is at the most efficient point. When lag boilers are started they are set to a high efficiency “Base Load” rate (typically 80%). Non-condensing boilers have peak efficiency when running at approximately 80% rate.

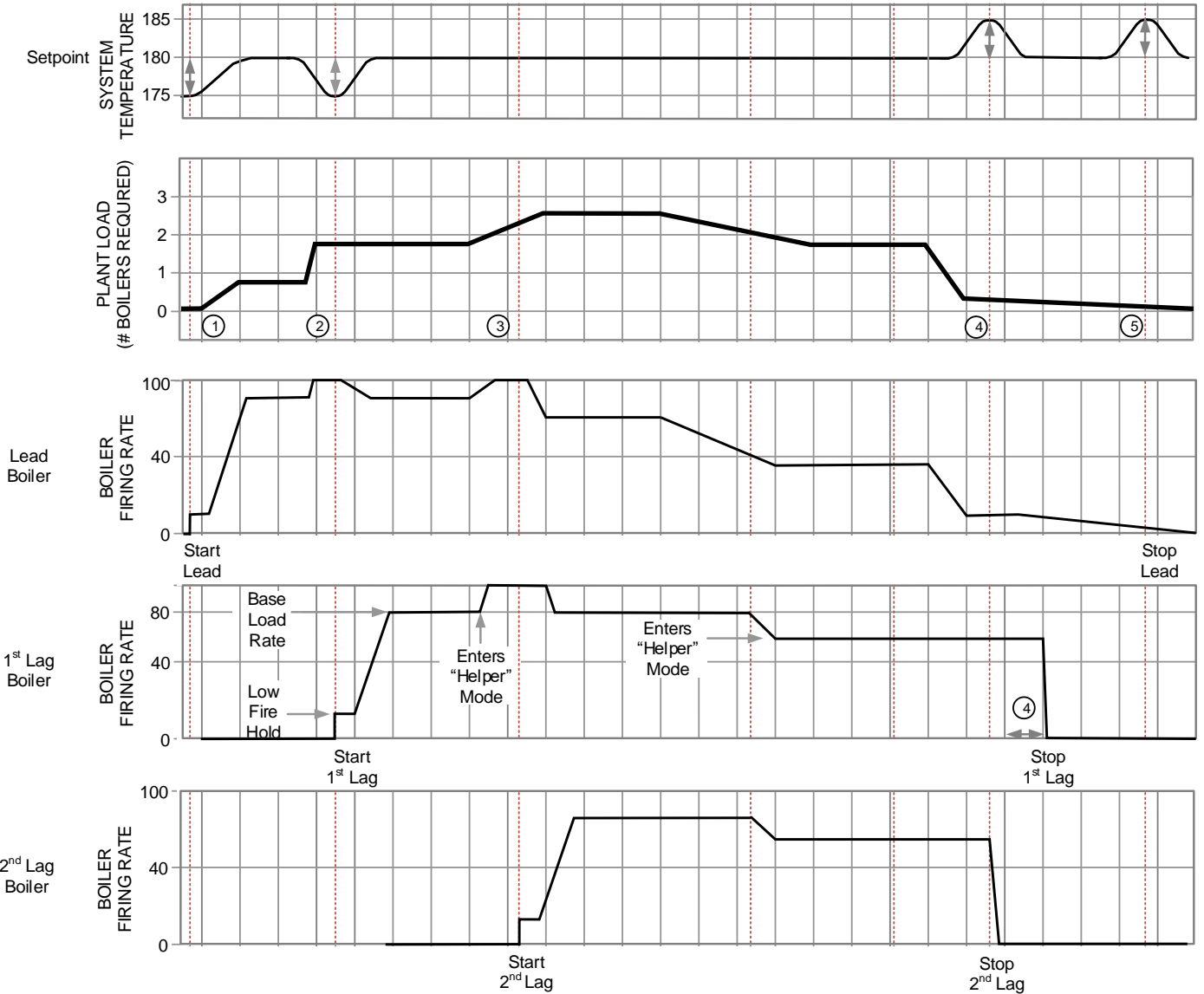


Figure 7: Sequential Modulation Start and Stop Sequence

Sequential Start and Stop

As boiler start is initiated, the boiler is first held at the hold rate for the purge time delay, and then released to modulate. When a lag boiler is started, it is first held at the Hold rate for the purge time delay. Then the boiler is fired at the Base Rate. When a boiler is stopped, it is once again driven to low fire rate.

Helper Mode

Sequential modulation includes “Helper Mode” logic in order to minimize boiler on/off cycling. When the

lead boiler’s firing rate approaches high fire, the lag boiler(s) will automatically modulate up from the base load firing rate to “help” the lead boiler without starting another lag boiler. If the lead boiler approaches low fire, the lag boilers will modulate toward low fire to “help” the lead boiler and prevent a short cycle of a lag boiler. When the lead boiler leaves the high or low fire position the lag boiler(s) resume firing at the normal base load for peak efficiency. If the load increase or decrease is long term, a lag boiler shall be cycled on or off as required.

Front Panel

Home Screen

Firing Rate Feedback

Rate commanded for each boiler's fan is presented numerically and on bar graphs as a % of firing rate range from low fire (0%) to high fire (100%).

Icon Based Navigation

Info Icon

Located throughout display to give information about what is shown. Parameter info screens tell about parameter being adjusted.

Alarm Reset Button
Reset alarm output for any fault.

Boiler Temperatures

Read measured supply and return temperature for each boiler all on one screen.

Local/Remote Switch
Touch to control setpoint source.

Lead Control

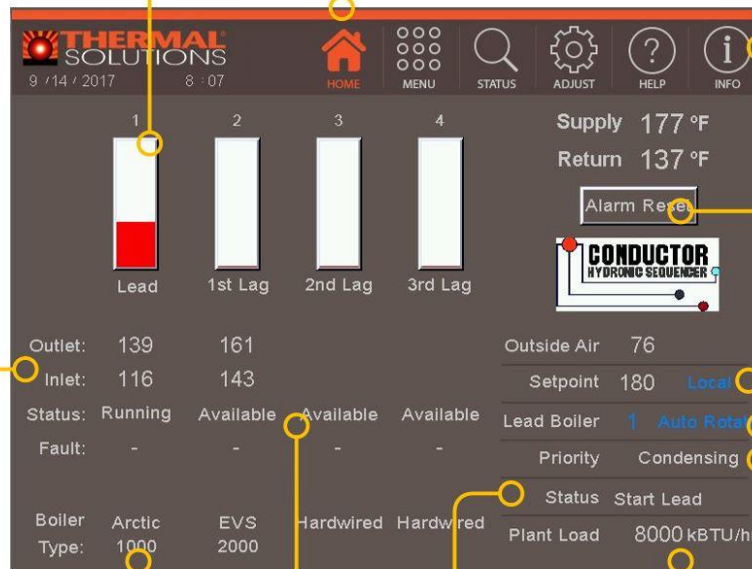
Touch to manually control which boiler is lead.

Boiler Type

Easily track which boiler is each position.

Sequence Priority

Disabled
Sequence Off
WWSD Both
WWSD Boiler
Non-Condensing
Condensing



Boiler State

Off Network
Disabled
Blocked
Available
Limit Hold
Add stage
Drive to Low
Fire
Running

Sequencer Status

Standby
Start Lead
Start 1st Lag
Start 2nd Lag
Start 3rd Lag
Start 4th Lag
Start 5th Lag
Start 6th Lag
Start 7th Lag

Plant Load

Based on Supply-Return
ΔT and pump speed GPM

Figure 8: Home Screen Details

Sequence Priority

The Conductor accepts a call for heat (demand) from multiple places, and responds according to the Priority. When more than one demand is present, the higher priority demand is used to determine active boiler settings. For example, when Non-Condensing has priority, the max setpoint, min setpoint, and high fire limit are taken from Non-Condensing selections. Active Priority is displayed on the Home Screen above. Priority Order is shown in Table 1.

Table 1: Order of Priority

Priority	Display	Boiler Responding to:
1 st	Disabled	The Control can be enabled and disabled by an EMS or physically at contacts A16 and A17.
2 nd	Sequence Off	The user has switched off the sequencer on the Master Sequencer Operations page.
3 rd	WWSD Both	Warm Weather Shut Down is active for boilers and pumps. The Control will not respond to CH demands. DHW demand is not blocked by WWSD.
4 th	WWSD Boiler	Warm Weather Shut Down is active for only the boilers. System pumps will continue to run. The Control will not respond to central heat demands. DHW demand is not blocked by WWSD.
5 th	Non-Condensing	The sequencer is in Non-Condensing Mode. Operating parameters are selected for safe and efficient operation of non-condensing boilers.
6 th	Condensing	The sequencer is in Condensing Mode. Operating parameters are selected for safe and efficient operation of condensing boilers.

Front Panel

General Navigation

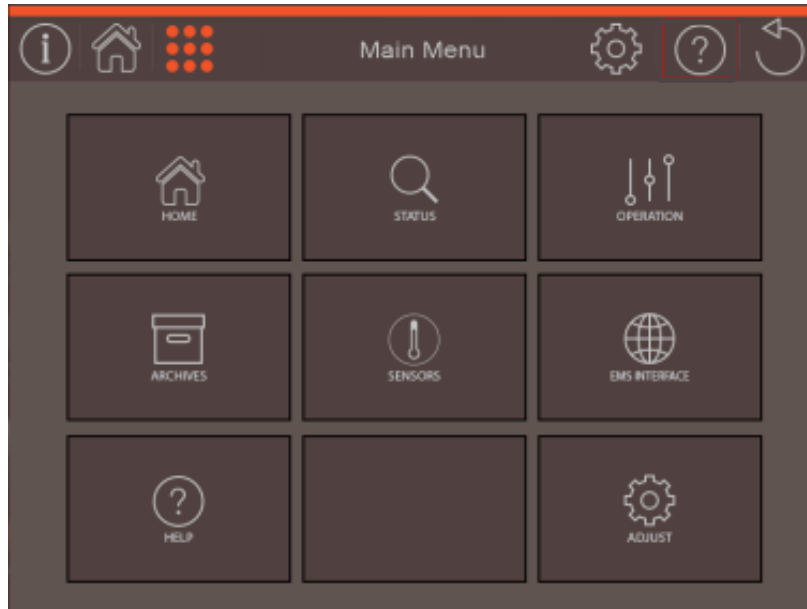


Figure 9: Main Menu

Main Menu

The Main Menu provides access to all display functions. It is accessible from the Home Screen. The following major user interface areas are accessed from the Main Menu:

Status

These screens provide an overview of boiler operation. The status screens include sensor and firing rate readings from each configured boiler in order to provide a complete picture of boiler status.

Operation

The operation screens allow the user to take manual or automatic control of the sequencer, and individual boilers. These screens are intended to allow a technician to set firing rate to support combustion testing, and provide trending and parameter adjusting to support fine tuning of the boilers response to load changes. Operation screens may be used to speed up or slow down the boilers' response to fast or slow system load changes.

Archives

The archives collect the history of how the boilers have operated and provide tools to review and improve system operation;

- A historical trend – up to four (4) months of data is collected and may be viewed on screen or saved to a thumb drive.

- Alarm history – provides data on boiler lockouts, boiler start faults, and system sensor faults. Data collected includes cause of alarm, run hour and status when alarm occurred.
- Boiler starts and rates – collects a summary of all boiler starts and firing rate trends.
- Thumb drive operation – these screens provide ability to save or load parameters as well as alarm and trend data.

Sensors

Status and details are provided on all sensors connected to the Control.

EMS interface

EMS setup options and status is provided.

Help

Active alarms and corrective actions are provided.

Adjust

Each adjustable parameter is presented for adjustment. Proper login is required.

Front Panel

Status Screens

The status screen shows data relevant to current boiler operation. All installed sensors are shown on this page as well as current modulation %, setpoint, active sensor, and much more. A detailed screen map is shown below.

Boiler Sensor Data

All installed sensor data shown. Flame represents current firing rate. The larger the flame the higher the firing rate. Sensors turn red if there is a fault.

Firing Rate Feedback

Displays actual boiler rate in kBTU/h.

Boiler Pump Data

Pump data is imported from each boiler control.

Annunciator Block

Glows yellow while fault is present. Returns to brown once fault is cleared.

Automatic/Manual

Displays Auto or Manual depending on what the boiler modulation is set to on Conductor. Touch to go to Operation menu.

Boiler Status

Displays all status states typical for boiler type.

Local limit

Appears when boiler rate commanded is less than control demand rate due to local restrictions.

Hold/Lockout

Displays all annunciated holds and lockouts typical for boiler type.

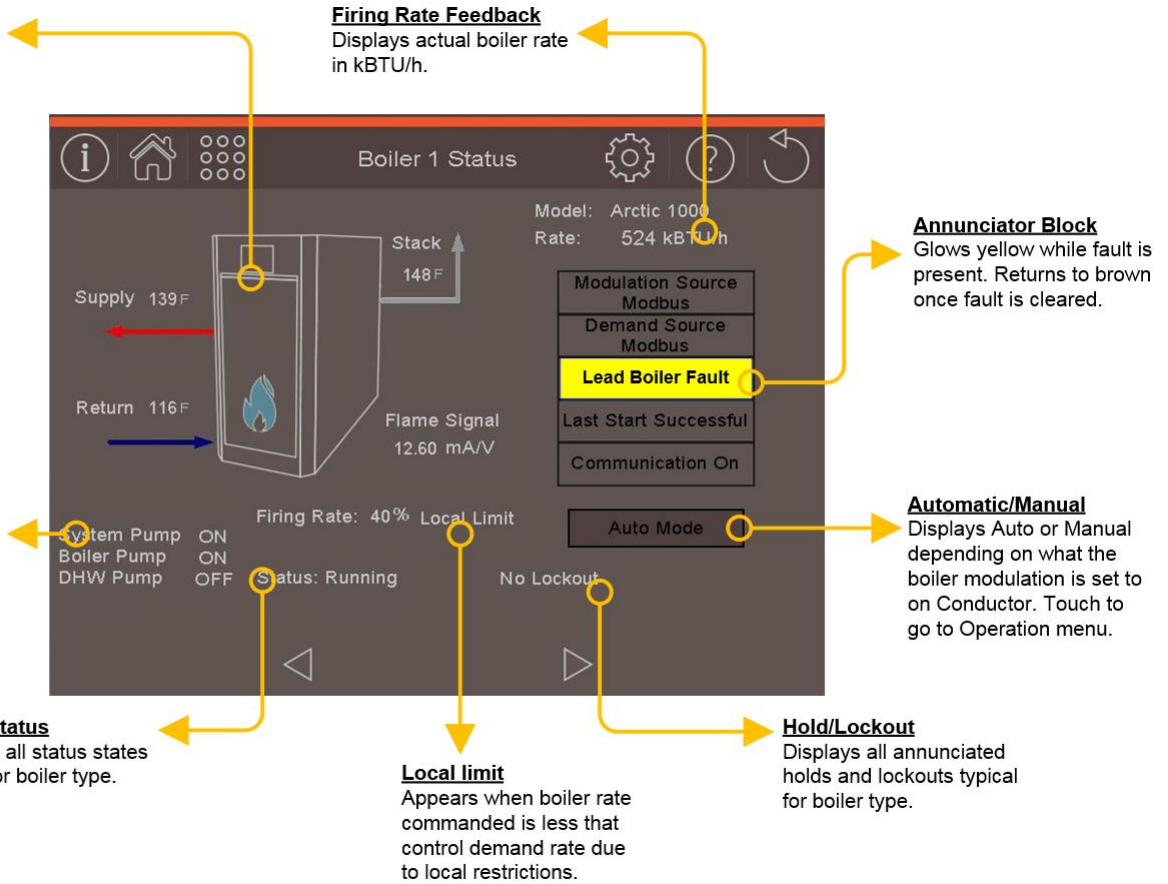


Figure 10: Status Screen Details

Installation

Unpacking



CAUTION

Do not lay panel down on touch screen. Panel weights approximately 33 lbs. Use proper lifting techniques when handling.

Inspection

Inspect the shipment carefully for any signs of damage. All equipment is carefully manufactured, inspected and packed before shipment. Our responsibility ceases upon delivery of the Conductor panel to the carrier in good condition. The consignee must file any claims for damage or shortage in shipment immediately against the carrier. Thermal Solutions Products, LLC will allow no claims for variances or shortages unless presented within thirty (30) days after receipt of equipment.

The Conductor system will include:

- (1) Panel with touch screen display.
- (2) PLC Control
- (3) PCB 10 and PCB 11 with spare fuse
- (4) 24 Vdc Power Supply
- (5) Ethernet Switch
- (6) 120Vac Breaker.
- (7) Modbus and BacNet Communication

The following parts are sold separately

- (1) System water temperature sensor and thermowell.
- (2) Outdoor air temperature sensor.
- (3) Isolation Valve Terminals, PCB 12
- (4) LonWorks and Johnson Metysis N2 Communication.

Panel Mounting

- a. The Conductor must be installed to conform with the requirements of the local and state authority having jurisdiction, or in the absence of such requirements, to the latest release of the National Electric Code, ANSI/NFPA 70.
- b. Provide clearance around panel for wiring conduit and access to panel.
- c. Allow 26" in front of panel to allow door to be opened and personnel access to touch screen.
- d. Allow 4" on bottom, top and sides to allow clearance for conduit.
- e. Mount in the vertical position. Door hinges on left side with touch screen facing out. See Figure 11 for physical size and details on mounting holes.

- f. Panel is rated for NEMA 1 service. Installation location should be away from sources of moisture, extreme heat, cold, or humidity, see specifications section for specific environmental requirements.
- g. Select a location near the boilers.
- h. Screw the enclosure to the surface through the mounting holes in the back of the enclosure.
- i. Use knockouts provided and DO NOT drill into enclosure.

System Supply Water Temperature Sensor

Mount the thermowell and sensor in a 3/4" coupling in the common header downstream of all boiler connections. Maintain a minimum distance of 10 pipe diameters for connections. See Figure 2 and 3.

Outdoor Air Temperature Sensor

Mount the temperature sensor on an outside wall out of direct sunlight, preferably a north facing wall. Do not mount sensor near exhausts of any kind, this may affect readings.



WARNING

Installation of this panel should be undertaken only by trained and skilled personnel from a qualified service agency.



WARNING

Carefully read all instructions before installing panel. Failure to follow all instructions in proper order can cause personal injury or death.

Installation

Mounting

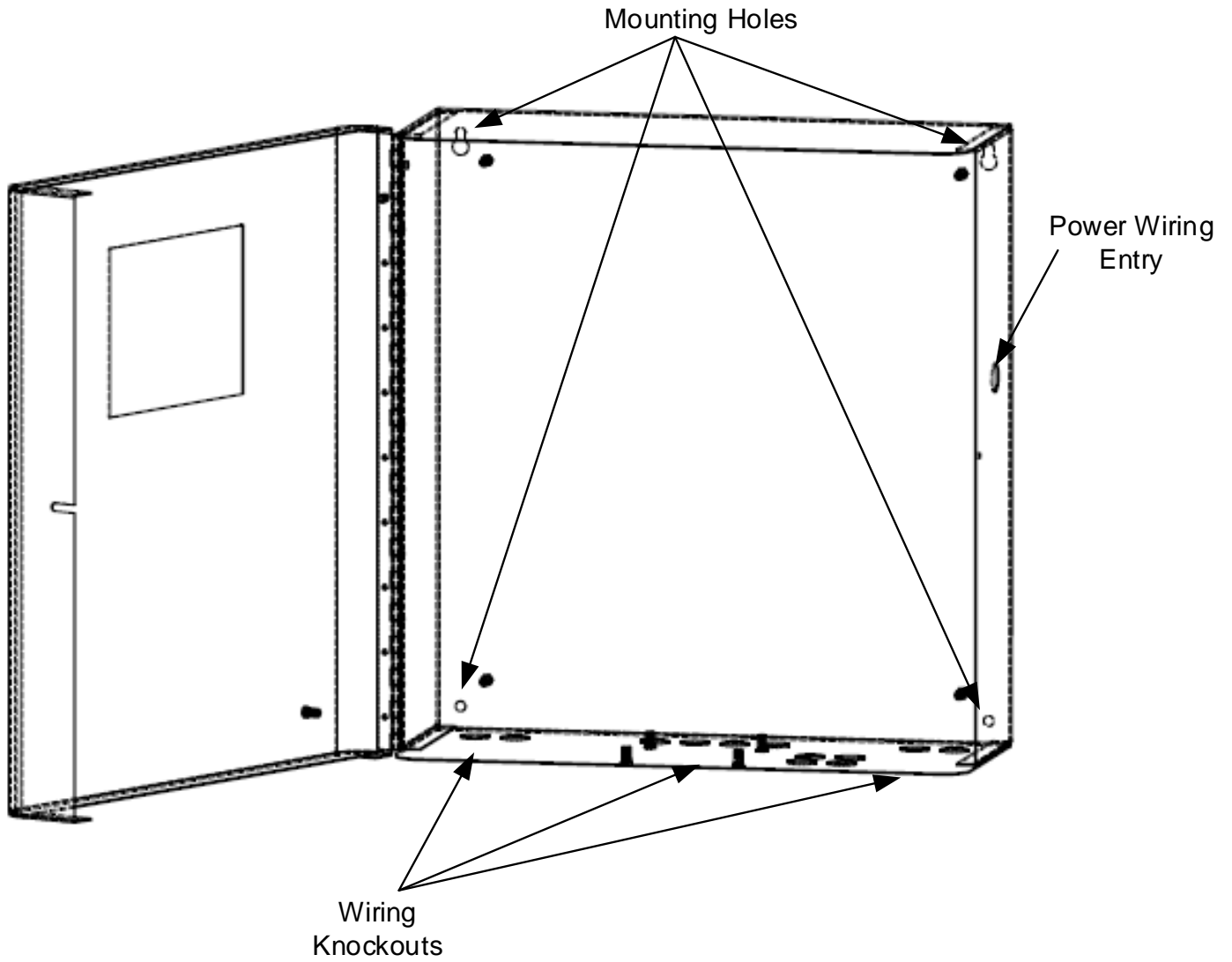


Figure 11: Enclosure Mounting

Installation

Electrical



DANGER

Always positively assure electrical power is disconnected before attempting work on or near electrical components or systems. Electrical shock will/can cause death or serious injury.

Never work on or near electrical components when the possibility of water contact exists. Electrical shocks will/can result.

Power may need to be disconnected at more than one location on one or more voltage supplies.

Electrical work must be performed by licensed, skilled and experienced personnel.

The wiring diagrams contained in this manual are for reference purposes only. Each Conductor is shipped with a wiring diagram inside the enclosure. Refer to this diagram and wiring diagrams with the boilers.

Consult manufacturer if problems or questions arise. Always positively assure electrical work is performed correctly according to the authority having jurisdiction before connecting the power supply.

General

- a. The Conductor must be installed to conform with the requirements of the local and state authority having jurisdiction, or in the absence of such requirements, to the latest release of the National Electric Code, ANSI/NFPA 70.
- a. Panel is built and labeled to UL508A standards.
- b. Refer to the wiring diagram supplied with the panel, the wiring diagram for the boiler, the system wiring diagram, and the Panel layout diagram for wiring information.
- c. Do not route the communication cable in conduit with line voltage circuits
- d. Maximum Communication bus length is 4000 ft.

Wiring Power Supply to Panel

- a. The Conductor panel requires 120Vac brought into the panel. Connect the 120V leg directly to the 4-amp breaker. The Neutral wire connects to the N terminal. The ground wire connects to the green/yellow terminal.

- b. 120Vac supply to the panel must be protected by a fused disconnect, maximum 15A (by others).

Wiring Panel to Boilers

- a. Following Wiring diagram provided with the Conductor panel (see figure 14 provided for reference purposes only.) when connecting wiring to the Conductor panel. The wiring diagram provides maximum acceptable load, acceptable wire size and type for each terminal.
- b. Boiler Communication Network Connections are made on PCB – 10 RJ11, RJ45 or terminals A1, A2 and A3. The wire must be wired from the closest boiler to the next boiler and repeated until the last boiler is reached. In other words this must be a continuous chain (daisy chain configuration). Refer to Figure 18 for acceptable configurations.

NOTICE

Sensor wiring is susceptible to electrical interference. Insure the shield on cable is grounded on one end only.

NOTICE

Low voltage conductors are not to be routed with line voltage conductors.

NOTICE

When making low voltage connections, make sure that no external power source is present. If such a power source is present, it could destroy the Conductor's PLC.

Installation Electrical

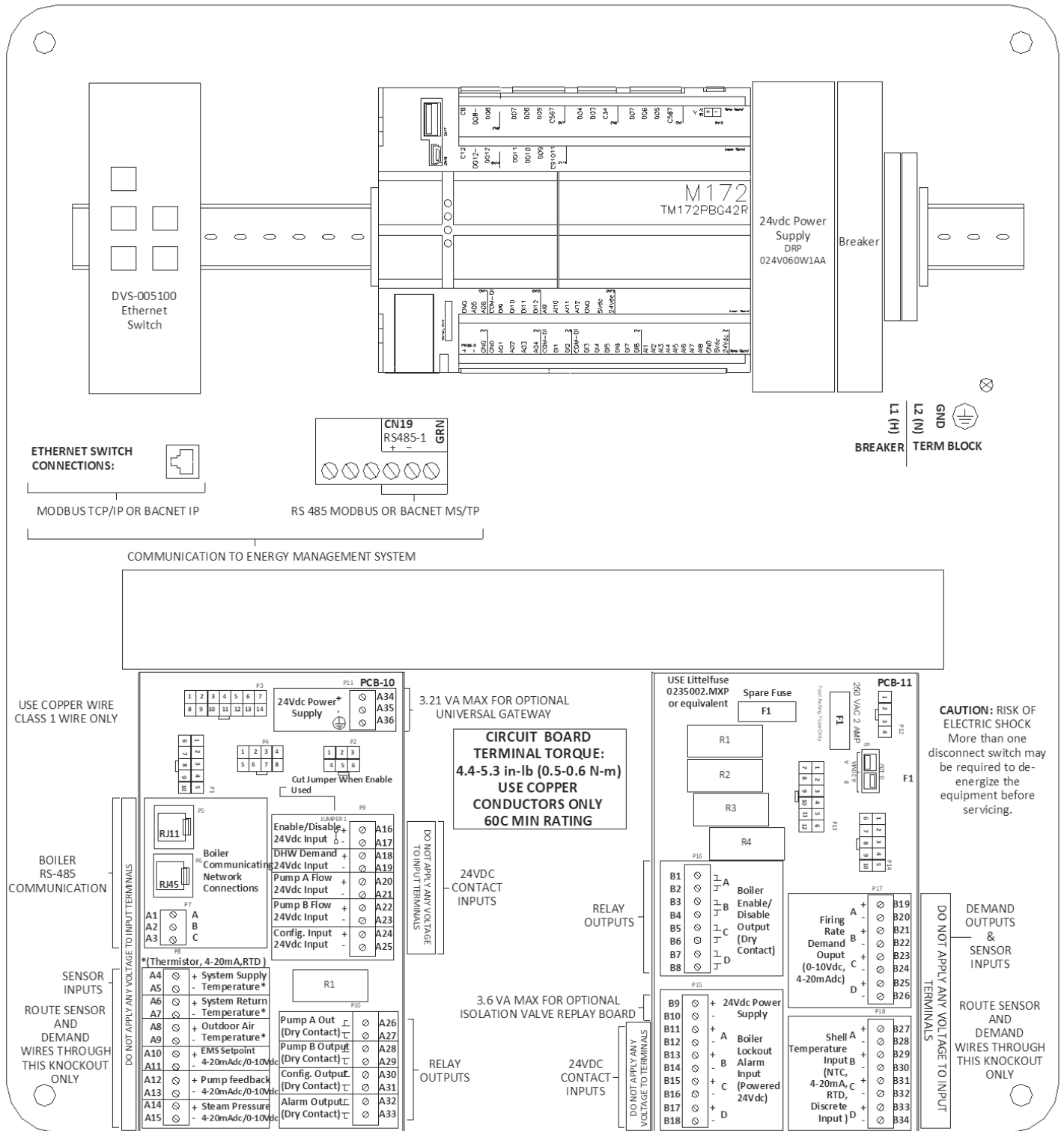


Figure 12: Panel Layout

Installation Electrical

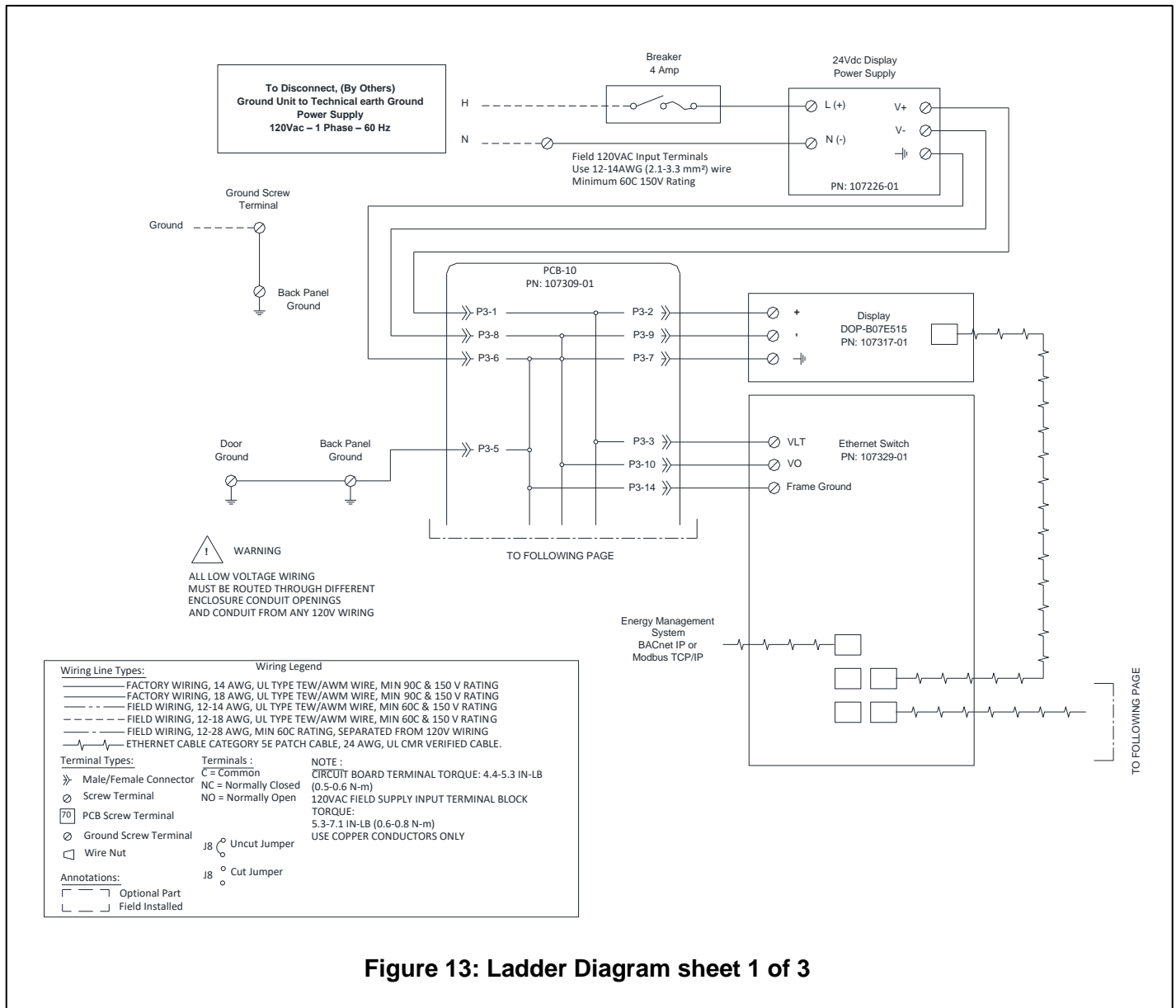


Figure 13: Ladder Diagram sheet 1 of 3

Installation Electrical

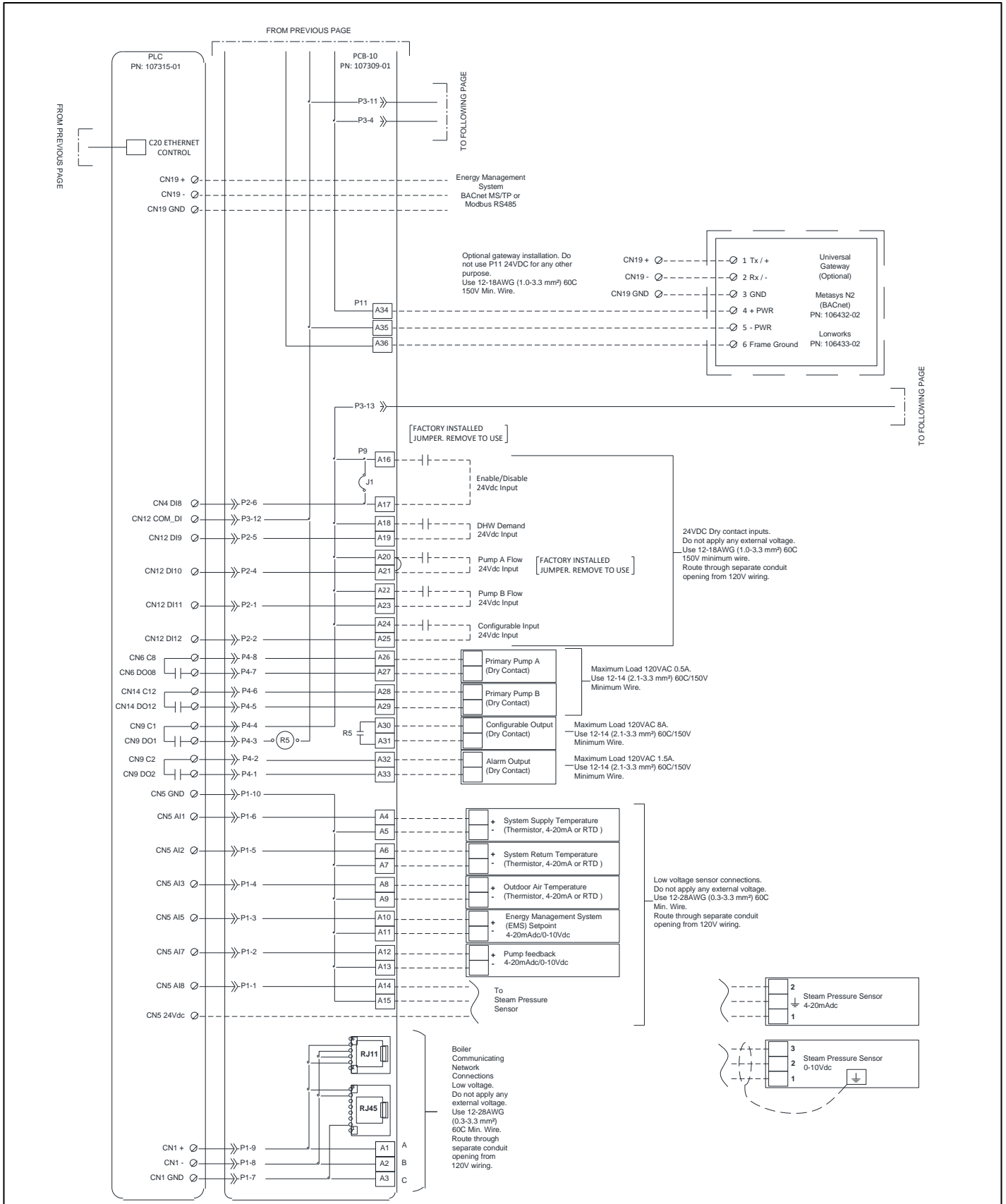


Figure 14: Ladder Diagram sheet 2 of 3

Installation Electrical

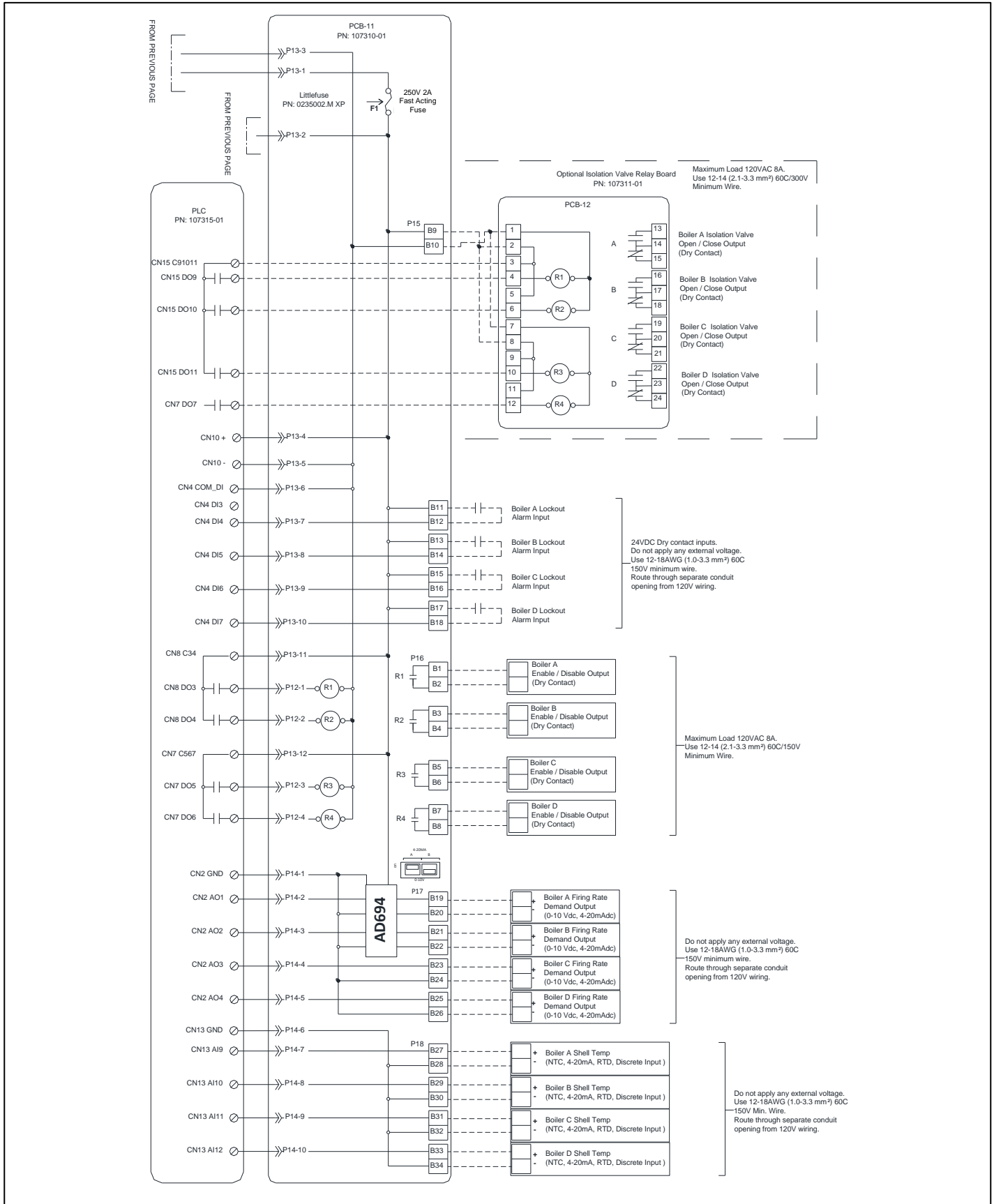
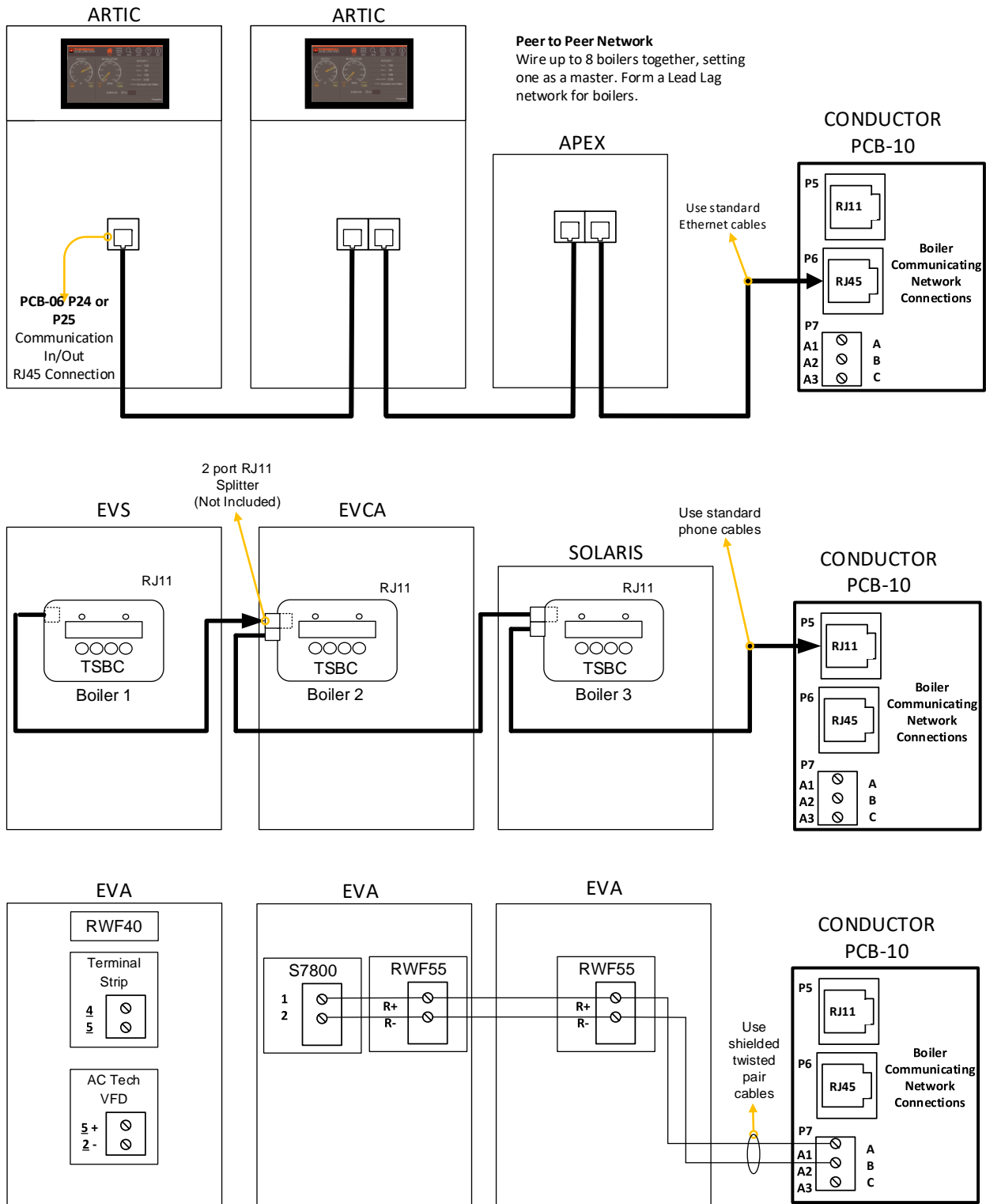


Figure 15: Ladder Diagram sheet 3 of 3

Installation

Boiler-To-Boiler Network Wiring

The Boiler-To-Boiler Network allows the Conductor to control and monitor connected boilers.



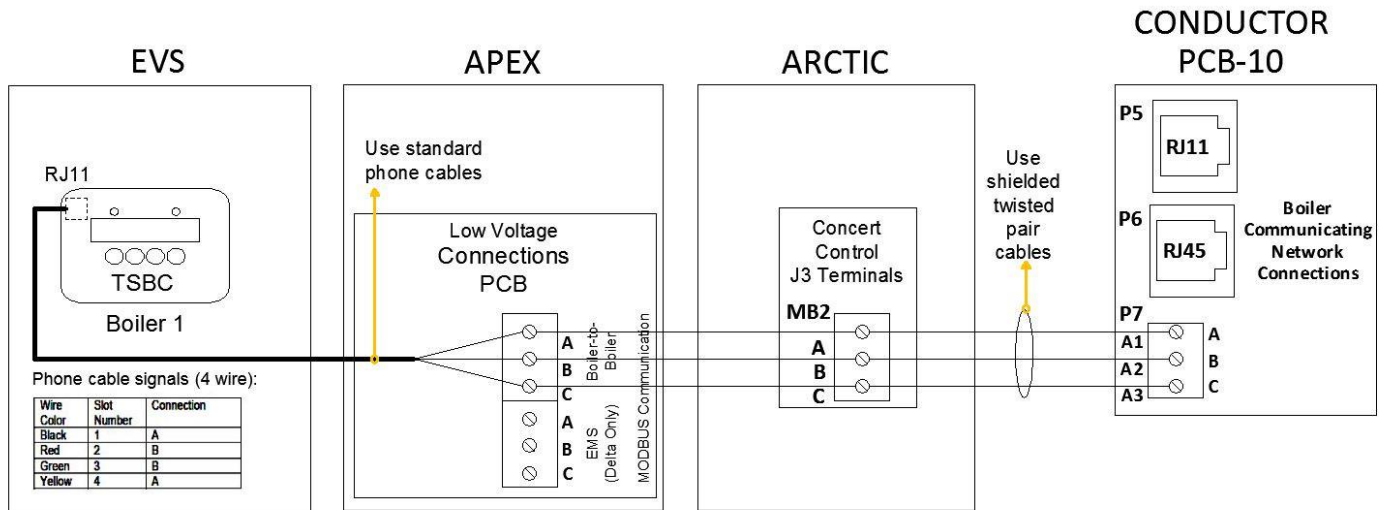
EVA with RWF40 Wiring Notes:

RWF40 Control does not communicate at 38400 baud rate, and must use "hardwired" connection terminals on Conductor. From Conductor PCB-11 wire Enable/Disable Output contact (P16) to 4 and 5 on EVA terminal strip (remove jumper), and Firing Rate Demand Output (P17) + to 5 and - to 2 on AC Tech VFD. If EVA has a VFD that is not AC Tech, contact factory for further instructions.

Figure 16: Communication Network Connections

Installation

Boiler-To-Boiler Network Wiring (continued)



TSBC RJ11 Wiring to Terminals Notes:

Connect one end of the RJ11 cable to the TSBC and cut off the other end of the cable to access the individual conductors. The TSBC is a 2 wire Modbus communication. Connect the "A" and "B" terminals to the corresponding terminals on the next controller.

Figure 17: Communication Network Connections When Installing Multiple Boiler Types

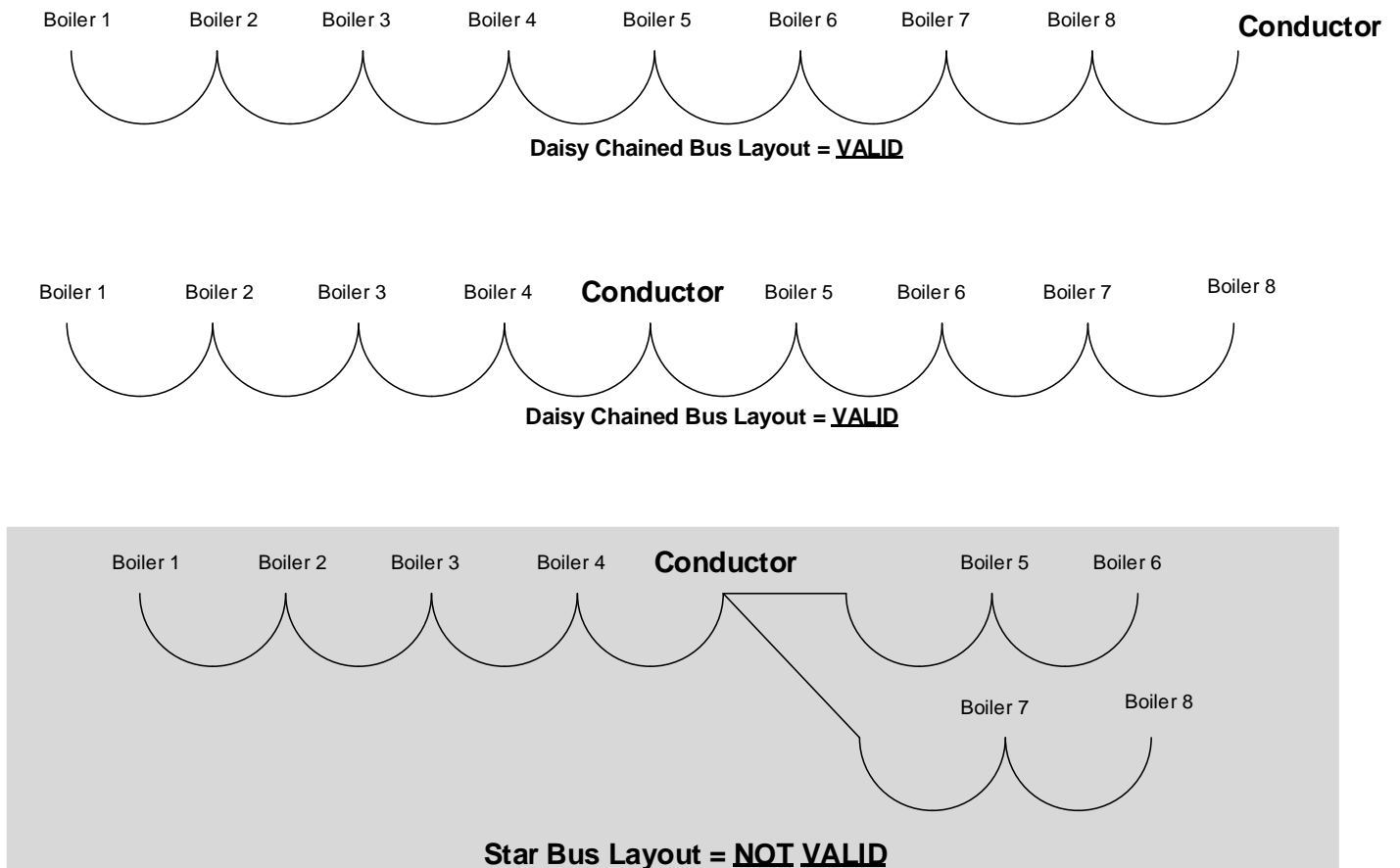


Figure 18: Valid and NOT Valid Bus Layouts

Installation

Energy Management Interface

The Control has a full featured ability to interface with an Energy Management System (EMS). The Control allows remote control and monitoring via RS485 Modbus, Modbus IP, BACnet MS/TP, BACnet IP, or through direct contacts and 4-20mA/0-10Vdc wiring.



Figure 19:
Modbus
Setup
Screens

(From Display “Press” Menu > EMS Interface to access)

Table 2: Energy Management System Parameters

Factory Setting	Range / Choices	Parameter and Description
Modbus	Modbus, BACnet MS/TP, BACnet IP	EMS Communication Selects the type of Energy Management System (EMS) communication interface. This includes both RS485 and IP. Modbus Input wired to CN19 terminals on Schneider controller. BACnet MS/TP Connection at Ethernet switch. BACnet IP
10.0.0.100	1 st #: 0 – 223 2-4 #: 0 – 255	Control IP Address This is the Control’s IP address for use with Modbus or BACnet IP. The first 3 numbers of the Display’s address must match.
255.255.255.0	0 – 255	Subnet Mask A Subnet mask is a 32-bit number that masks an IP address, and divides the IP address into network address and host address. This number must be set the same for Control and Display.
10.0.0.1	1 st #: 0 – 223 2-4 #: 0 – 255	Gateway IP A gateway is used as the destination of all traffic that is not on the same subnet. This number must be set the same for Control and Display.
1	1 – 255	Conductor RS485-1 Address This is the Conductor’s EMS Port address on the EMS network.
38400	9600, 19200, 38400, 76800	EMS Port Baud Rate Units are 1000 Bits Per Second (KBPS). Only significant when Protocol equals Modbus RS485 or BACnet MS/TP.
Even	None, Odd, Even	EMS Parity Only significant when Protocol equals Modbus RS485 or BACnet MS/TP.
1	1 – 4192303	BACnet Device Instance Only significant when Protocol equals BACnet MS/TP. This is the global ID of Conductor for the BAS.

Installation

Energy Management Interface

Factory Setting	Range / Choices	Parameter and Description
Local	Local, Wired, EMS	Setpoint Source The setpoint may be based on local or remote signals. Setpoint Source has the following selections: Local: User entered value, DHW setpoint, or outdoor reset Wired: Signal present at terminals A10 and A11 (4-20mA or 0-10Vdc) is used as the temperature setpoint. Min and Max Setpoint may be used to adjust the signal range. See Input/Output Configuration Menu for signal selection. EMS: EMS signal connected to the Control is used as the temperature setpoint. See EMS Communication parameter for selection.
130 F	60 – 230°F	Wired Range Minimum Setpoint Wired Setpoint (4-20mAdc or 0-10Vdc) Setup. Sets the 4 mA or 0 Vdc water temperature.
180 F	140 – 230°F	Wired Range Maximum Setpoint Wired Setpoint (4-20mAdc or 0-10Vdc) Setup. Sets the 20 mA or 10 Vdc water temperature.
Local	Local, Remote	Local/Remote Control Master switch for local or remote setpoint control NOTICE This parameter is located on the Home screen.

The following steps are required when connecting a EMS Modbus Interface:

Table 3: Energy Management System Interface Procedure

Step	Description	Comments
1	Install Wiring between EMS and Conductor	For Modbus RS485, or BACnet MS/TP connect 3 wires from the CN19 terminals on the PLC controller to the EMS. For Modbus or BACnet IP, connect the EMS to a spare port on the Conductor's Ethernet Switch using a standard RJ45 cable.
2	Enable EMS Communication	Communication must be enabled. On the Home Screen press the blue word "Local" next on the Setpoint line, and select remote on the pop-up window.
3	Adjust Communication Parameters	Communication Parameters are adjustable. Go to Modbus menu (Press Menu > EMS Interface > Modbus/BACnet Setup) and select EMS Modbus Parameters. Follow on screen instructions. NOTICE Baud Rate and Parity must match the EMS settings for communication to be established.
4	Adjust Setpoint Source	Setpoint source is adjustable. Go to Modbus menu (Press Menu > EMS Interface > Remote Demand) and select the setpoint source. Follow on screen instructions.
5	Confirm Communication	The display provides a list of all EMS signals. Go to Modbus menu (Press Menu > EMS Interface) and select Points List. Use the list to verify signals sent and received from the EMS.

Installation

Energy Management Interface

The Control and Display use an IP network to communicate with each other. Therefore, changing the IP address of the panel requires a change to both components. To properly change IP address follow these steps.

Table 4: IP Address Change Procedure

Step	Description	Comments
1	Set Control IP Address	<p>Go to Modbus menu (Press Menu > EMS Interface > Modbus/BACnet Setup). Select Control IP Address. Read the instructions provided on the pages that follow. Then press the Change Address button. Make necessary changes to all four values within IP address parameter, and then press the checkmark. A warning screen will appear. Press Display Settings to proceed.</p> <p style="text-align: center;">NOTICE</p> <p>Record the Control IP setting for your reference before pressing Display Settings. You will not be able to view it again until this process is complete.</p>
2	Navigate to the Display's Network Menu	The Display Settings button sets the Control's IP address and opens the System Menu. Select System Setting, then press the right arrow to get to the Network tab.
3	Adjust Display Address & Refresh	<p>On the Network menu, touch the numbers on the IP parameter. A keypad will appear with the display's address on top.</p> <p>Set the first three values of IP to the same values that were set for the Control. The fourth value of IP must be different from the Control's fourth value. Once the values have been adjusted, press the Enter button to save them. Then press the Refresh button to restart the Ethernet connection. After refreshing press the button in the top right corner twice (Home and close). This will reboot the display.</p> <p style="text-align: center;">NOTICE</p> <p>Setting the IP address incorrectly will result in a communication error (blue rectangle reading "TCP/IP error 22"). If this occurs, the system menu can be accessed again by pressing and holding the screen in a blank area until five icons appear in the top left. Press the gear-shaped icon on top.</p>

Table 5: EMS Signal List

The following is the list of available EMS (Modbus and BACnet) signals.

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read / Write (W)	Description
System Status					
9847	Plant_load	AI	0	R	Status of Load Monitoring. Units: kBTU/h
9848	EMS_Enable	BV	0	R/W	Use this register to enable the Master Sequencer. 0 = Disable 1 = Enable Jumper 1 on PCB-10 must be cut.
9849	EMS_Setpoint	AV	0	R/W	Use this register to change the Sequencer setpoint. Valid range 60°F to 230°F or [pressure range]PSI
9845	Firing_Rate	AI	1	R	Master Sequencer modulation rate. Units: %
9846	Active_Setpoint	AI	2	R	Setpoint currently in use by controller. Units: F
9850	Master_SP_Source	AI	4	R	Master Setpoint Source 0 = Normal, 1 = Remote, 2 = DHW, 3 = Reset, 4 = Reset/Setback, 5 = Setback

Installation

Energy Management Interface

Table 5: EMS Signal List (continued)

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read I/ Write (W)	Description
System Status					
9851	Status	AI	3	R	0 Standby 1 Start Lead 2 Start 1 st Lag 3 Start 2 nd Lag 4 Start 3 rd Lag 5 Start 4 th Lag 6 Start 5 th Lag 7 Start 6 th Lag 8 Start 7 th Lag
9844	Priority	AI	5	R	0 Disabled 1 Sequence Off 2 WWSD Both 3 WWSD Boiler 4 Non-Condensing 5 Condensing
9827	Lead	AI	6	R	Number of Lead Boiler
Analog Inputs					
9836	SYSTEM_SUPPLY	AI	7	R	Units: F
9837	SYSTEM_RETURN	AI	8	R	Units: F
9838	OUTDOOR_AIR	AI	9	R	Units: F
8976	UAI5_EMS_SETPOINT	AI	10	R	Units: F
8978	UAI7_PUMP_FEEDBACK	AI	11	R	Units: %
9843	STEAM_PRESSURE	AI	12	R	Units: psi
9839	BLR_A_SHELL	AI	13	R	Units: F
9840	BLR_B_SHELL	AI	14	R	Units: F
9841	BLR_C_SHELL	AI	15	R	Units: F
9842	BLR_D_SHELL	AI	16	R	Units: F
Discrete Outputs					
8990	UDO1_CONFIGURABLE	AI	17	R	0 = Off 1 = On
8991	UDO2_ALARM	AI	18	R	0 = Off 1 = On
8996	UDO7_BLR_D_ISOLATION_VALVE	AI	19	R	0 = Off 1 = On
8997	UDO8_PUMP_A	AI	20	R	0 = Off 1 = On
8998	UDO9_BLR_A_ISOLATION_VALVE	AI	21	R	0 = Off 1 = On
8999	UDO10_BLR_B_ISOLATION_VALVE	AI	22	R	0 = Off 1 = On
9000	UDO11_BLR_C_ISOLATION_VALVE	AI	23	R	0 = Off 1 = On
9001	UDO12_PUMP_B	AI	24	R	0 = Off 1 = On
System Alarms					
9684	ALR_Press_High	AI	25	R	High Steam Pressure 0 = Normal 1 = High

Installation

Energy Management Interface

Table 5: EMS Signal List (continued)

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read / Write (W)	Description
System Alarms					
9685	ALR_Press_Low	AI	26	R	Low Steam Pressure 0 = Normal 1 = Low
9686	ALR_Temp_High	AI	27	R	High Supply Water Temperature 0 = Normal 1 = High
9687	ALR_Temp_Low	AI	28	R	Low Supply Water Temperature 0 = Normal 1 = Low
9688	ALR_Return_Temp_Low	AI	29	R	Low Return Water Temperature 0 = Normal 1 = Low
9696	ALR_Pump_A_Fault	AI	30	R	System Pump A Fault 0 = Normal 1 = Fault
9697	ALR_Pump_B_Fault	AI	31	R	System Pump B Fault 0 = Normal 1 = Fault
9702	ALR_Shell_1_High	AI	32	R	Boiler 1 High Shell Temperature (Steam) 0 = Normal 1 = High
9703	ALR_Shell_2_High	AI	33	R	Boiler 2 High Shell Temperature (Steam) 0 = Normal 1 = High
9704	ALR_Shell_3_High	AI	34	R	Boiler 3 High Shell Temperature (Steam) 0 = Normal 1 = High
9705	ALR_Shell_4_High	AI	35	R	Boiler 4 High Shell Temperature (Steam) 0 = Normal 1 = High
Boiler 1 Points					
9426	BLR1_Supply	AI	36	R	Supply Temperature, Units: F
9427	BLR1_Return	AI	37	R	Return Temperature, Units: F
9428	BLR1_Stack	AI	38	R	Stack Temperature, Units: F
9429	BLR1_CH_Mod_Rate	AI	39	R	Boiler Firing Rate, Units: %
9430	BLR1_Rate_Commanded	AI	40	R	Boiler Firing Rate Feedback, Units: %
9433	BLR1_CH_Mod_Stat	AI	41	R	CH Modbus STAT 0 = No Demand 1 = Demand
9434	BLR1_General_Alarm	AI	42	R	0 = Normal 1 = Fault
9435	BLR1_Boiler_Pump	AI	43	R	0 = Off 1 = On
9436	BLR1_System_Pump	AI	44	R	0 = Off 1 = On
9920	BLR1_Pump_Status	AI	45	R	0 = Off 1 = On
9438	BLR1_Flame	AI	46	R	Flame Signal, Units: mA/V

Installation

Energy Management Interface

Table 5: EMS Signal List (continued)

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read I/ Write (W)	Description	
Boiler 1 Points						
9439	BLR1_State	AI	47	R	See state codes below:	
<u>Sola States</u> 0 Initiate 1 Standby Delay 2 Standby 3 Safe Startup 4 Drive Purge 5 Prepurge 6 Drive Lightoff 7 Preignition Test 8 Preignition 9 Pilot Flame Establishing Period 10 Main Flame Establishing Period 11 Direct Ignition 12 Running 13 Postpurge 14 Lockout		<u>TSBC States</u> 0 Undefined 1 Boiler Disabled 2 Weather Shutdown 3 Lockout 4 Pump Purge 5 Limit Hold 6 Purge/Pilot Ignition 7 Low Fire/Ignition 8 Main Ignition 9 Low Fire Hold 10 Boiler Running 11 Fan Post Purge 12 Pump Cool Down 13 Standby		<u>S7800 States</u> 0 Initiate 1 Standby 2 Purge 3 Pilot Ignition 4 Main Ignition 5 Run 6 Postpurge 7 Pre-Ignition 8 Valve Proving 13 Alarm 14 Hold 15 Lockout		<u>Hardwired States</u> 0 Unknown 1 Off Network 2 Disabled 3 Blocked 4 Available 5 Valve Opening 6 Limit Hold 7 Add stage 8 Drive to Low Fire 9 Low Fire Hold 10 Running
9440	BLR1_Ann_Lockout	AI	48	R	See Lockout codes below:	
<u>Sola Lockout</u> 0 No lockout, 4 Supply high limit 5 DHW high limit 6 Stack High limit 12 Flame detected out of sequence 18 Lightoff rate proving failed 19 Purge rate proving failed 20 Invalid Safety Parameters 21 Invalid Modulation Parameter 22 Safety data verification needed 23 24VAC voltage low/high 24 Fuel Valve Error 25 Hardware Fault 26 Internal Fault 27 Ignition Failure 27 Interrupted Air SW ON 27 Interrupted Air SW OFF 42 AC Phase Fault 47 Flame Lost 48 Static flame 49 Pre-ignition Interlock Off 50 Pilot test hold 51 Demand lost in run		<u>TSBC Lockout</u> 0 No Lockout 1 Low Water Level 2 Off Switch 3 Low Water Flow 4 Fuel Limit 5 High Temp Limit 6 Low Air Flow 7 FSG Lockout 8 Outlet Temp Fail 9 Inlet Temp Fail 10 OA Temp Fail 11 Remote Temp Fail 12 Remote In Fail 13 Comm Fail 14 Low Inlet Temp 15 Memory Failure		<u>S7800 Lockout</u> 0 No lockout, 1 No Purge Card 2 AC Frequency/Noise 3 AC Line Dropout 4 AC Frequency 5 Low Line Voltage 6 Purge Card Error 7 Flame Amplifier 8 Flame Amp/Shutter 9 Flame Detected 10 Preignition ILK 11 Running ILK On 12 Lockout ILK On 13 Airflow Switch On 14 High Fire Switch 15 Flame-Out Timer 16 Main Flame Fail 17 Main Flame Ign. 18 Low Fire SW Off 19 Running ILK 20 Lockout ILK 21 Air Flow Switch 22 Call Service 23 Man-Open Sw. Off 24 Start Switch On 25 Pilot Flame Fail 26 Control On 27 Main Valve On 28 Pilot Valve 1 On 29 Ignition On 30 Pilot Valve 2 On 31 Flame Amp Type 32 Jumpers Changed 33 Delayed MV On 34 Man-Open SW On 35 Jumpers Wrong 36 Flame Too Strong 37 Lockout Switch 38 Comb. Pressure 39 Purge Fan SW On 40 Block Intake 41 Purge Fan SW Off 42 AC Phase 43 Device Specific 44 Accessory 45 Poor Flame Sensor 46 Valve Closure 47 Aux Interlock 48 Low Gas Pressure 49 High Gas Pressure 50 Atomizing SW 51 Low Oil Temp 52 High Oil Temp 53 Low Oil Pressure 54 High Oil Pressure 55 Both Fuels Select 56 Fuel Select Off 57 Aux Limit 58 High Limit 59 LWCO		

Installation

Energy Management Interface

Table 5: EMS Signal List (continued)

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read / Write (W)	Description
Boiler 1 Points					
9441	BLR1_Ann_Hold	AI	49	R	<u>Hold Code (Sola Only)</u> 0 None 1 Anti short cycle 2 Boiler Safety Limit Open 3 Boiler Safety Limit Open, (ILK Off) 7 Return sensor fault 8 Supply sensor fault 9 DHW sensor fault 10 Stack sensor fault 11 Ignition failure 13 Flame rod shorted to ground 14 Delta T inlet/outlet high 15 Return temp higher than supply 16 Supply temp has risen too quickly 17 Fan speed not proved 23 24VAC voltage low/high 25 Hardware Fault 27 Ignition Failure
9706	ALR_BLR1SupplyHigh	AI	50	R	High Supply Water Temperature 0 = Normal 1 = Fault
9714	ALR_LeadBLR1Fault	AI	51	R	Lead Boiler Fault 0 = Normal 1 = Fault
9722	ALR_BLR1StartFault	AI	52	R	Boiler Start Fault 0 = Normal 1 = Fault
9730	ALR_BLR1Lockout	AI	53	R	Boiler Lockout 0 = Normal 1 = Fault
9738	ALR_BLR1lost	AI	54	R	Communication Lost 0 = Normal 1 = Fault
9891	ALR_BLR1Mod_Source	AI	55	R	Modulation Source Fault 0 = Normal 1 = Fault
9900	ALR_BLR1DMD_Source	AI	56	R	Demand Source Fault 0 = Normal 1 = Fault
10264	BLR1_Cycles	AI	212	R	Count of boiler starts
10280	BLR1_Run_Time	AI	220	R	Units: hours
Boiler 2 Points (see Boiler 1 Points for descriptions)					
9446	BLR2_Supply	AI	57	R	
9447	BLR2_Return	AI	58	R	
9448	BLR2_Stack	AI	59	R	
9449	BLR2_CH_Mod_Rate	AI	60	R	
9450	BLR2_Rate_Commanded	AI	61	R	

Installation

Energy Management Interface

Table 5: EMS Signal List (continued)

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read / Write (W)	Description
Boiler 2 Points (see Boiler 1 Points for descriptions)					
9453	BLR2_CH_Mod_Stat	AI	62	R	
9454	BLR2_General_Alarm	AI	63	R	
9455	BLR2_Boiler_Pump	AI	64	R	
9456	BLR2_System_Pump	AI	65	R	
9921	BLR2_Pump_Status	AI	66	R	
9458	BLR2_Flame	AI	67	R	
9459	BLR2_State	AI	68	R	
9460	BLR2_Ann_Lockout	AI	69	R	
9461	BLR2_Ann_Hold	AI	70	R	
9707	ALR_BLR2SupplyHigh	AI	71	R	
9715	ALR_LeadBLR2Fault	AI	72	R	
9723	ALR_BLR2StartFault	AI	73	R	
9731	ALR_BLR2Lockout	AI	74	R	
9739	ALR_BLR2lost	AI	75	R	
9893	ALR_BLR2Mod_Source	AI	76	R	
9901	ALR_BLR2DMD_Source	AI	77	R	
10266	BLR2_Cycles	AI	213	R	
10282	BLR2_Run_Time	AI	221	R	
Boiler 3 Points (see Boiler 1 Points for descriptions)					
9466	BLR3_Supply	AI	78	R	
9467	BLR3_Return	AI	79	R	
9468	BLR3_Stack	AI	80	R	
9469	BLR3_CH_Mod_Rate	AI	81	R	
9470	BLR3_Rate_Commanded	AI	82	R	
9473	BLR3_CH_Mod_Stat	AI	83	R	
9474	BLR3_General_Alarm	AI	84	R	
9475	BLR3_Boiler_Pump	AI	85	R	
9476	BLR3_System_Pump	AI	86	R	
9922	BLR3_Pump_Status	AI	87	R	
9478	BLR3_Flame	AI	88	R	
9479	BLR3_State	AI	89	R	
9480	BLR3_Ann_Lockout	AI	90	R	
9481	BLR3_Ann_Hold	AI	91	R	
9708	ALR_BLR3SupplyHigh	AI	92	R	
9716	ALR_LeadBLR3Fault	AI	93	R	
9724	ALR_BLR3StartFault	AI	94	R	
9732	ALR_BLR3Lockout	AI	95	R	
9740	ALR_BLR3lost	AI	96	R	
9894	ALR_BLR3Mod_Source	AI	97	R	
9902	ALR_BLR3DMD_Source	AI	98	R	
10268	BLR3_Cycles	AI	214	R	
10284	BLR3_Run_Time	AI	222	R	
Boiler 4 Points (see Boiler 1 Points for descriptions)					
9486	BLR4_Supply	AI	99	R	

Installation

Energy Management Interface

Table 5: EMS Signal List (continued)

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read / Write (W)	Description
Boiler 4 Points (see Boiler 1 Points for descriptions)					
9487	BLR4_Return	AI	100	R	
9488	BLR4_Stack	AI	101	R	
9489	BLR4_CH_Mod_Rate	AI	102	R	
9490	BLR4_Rate_Commanded	AI	103	R	
9493	BLR4_CH_Mod_Stat	AI	104	R	
9494	BLR4_General_Alarm	AI	105	R	
9495	BLR4_Boiler_Pump	AI	106	R	
9496	BLR4_System_Pump	AI	107	R	
9923	BLR4_Pump_Status	AI	108	R	
9498	BLR4_Flame	AI	109	R	
9499	BLR4_State	AI	110	R	
9500	BLR4_Ann_Lockout	AI	111	R	
9501	BLR4_Ann_Hold	AI	112	R	
9709	ALR_BLR4SupplyHigh	AI	113	R	
9717	ALR_LeadBLR4Fault	AI	114	R	
9725	ALR_BLR4StartFault	AI	115	R	
9733	ALR_BLR4Lockout	AI	116	R	
9741	ALR_BLR4lost	AI	117	R	
9895	ALR_BLR4Mod_Source	AI	118	R	
9903	ALR_BLR4DMD_Source	AI	119	R	
10270	BLR4_Cycles	AI	215	R	
10286	BLR4_Run_Time	AI	223	R	
Boiler 5 Points (see Boiler 1 Points for descriptions)					
9506	BLR5_Supply	AI	120	R	
9507	BLR5_Return	AI	121	R	
9508	BLR5_Stack	AI	122	R	
9509	BLR5_CH_Mod_Rate	AI	123	R	
9510	BLR5_Rate_Commanded	AI	124	R	
9513	BLR5_CH_Mod_Stat	AI	125	R	
9514	BLR5_General_Alarm	AI	126	R	
9515	BLR5_Boiler_Pump	AI	127	R	
9516	BLR5_System_Pump	AI	128	R	
9924	BLR5_Pump_Status	AI	129	R	
9518	BLR5_Flame	AI	130	R	
9519	BLR5_State	AI	131	R	
9520	BLR5_Ann_Lockout	AI	132	R	
9521	BLR5_Ann_Hold	AI	133	R	
9710	ALR_BLR5SupplyHigh	AI	134	R	
9718	ALR_LeadBLR5Fault	AI	135	R	
9726	ALR_BLR5StartFault	AI	136	R	
9734	ALR_BLR5Lockout	AI	137	R	
9742	ALR_BLR5lost	AI	138	R	
9896	ALR_BLR5Mod_Source	AI	139	R	
9904	ALR_BLR5DMD_Source	AI	140	R	

Installation

Energy Management Interface

Table 5: EMS Signal List (continued)

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read / Write (W)	Description
Boiler 5 Points (see Boiler 1 Points for descriptions)					
10272	BLR5_Cycles	AI	216	R	
10288	BLR5_Run_Time	AI	224	R	
Boiler 6 Points (see Boiler 1 Points for descriptions)					
9526	BLR6_Supply	AI	141	R	
9527	BLR6_Return	AI	142	R	
9528	BLR6_Stack	AI	143	R	
9529	BLR6_CH_Mod_Rate	AI	144	R	
9530	BLR6_Rate_Commanded	AI	145	R	
9533	BLR6_CH_Mod_Stat	AI	146	R	
9534	BLR6_General_Alarm	AI	147	R	
9535	BLR6_Boiler_Pump	AI	148	R	
9536	BLR6_System_Pump	AI	149	R	
9925	BLR6_Pump_Status	AI	150	R	
9538	BLR6_Flame	AI	151	R	
9539	BLR6_State	AI	152	R	
9540	BLR6_Ann_Lockout	AI	153	R	
9541	BLR6_Ann_Hold	AI	154	R	
9711	ALR_BLR6SupplyHigh	AI	155	R	
9719	ALR_LeadBLR6Fault	AI	156	R	
9727	ALR_BLR6StartFault	AI	157	R	
9735	ALR_BLR6Lockout	AI	158	R	
9743	ALR_BLR6lost	AI	159	R	
9897	ALR_BLR6Mod_Source	AI	160	R	
9905	ALR_BLR6DMD_Source	AI	161	R	
10274	BLR6_Cycles	AI	217	R	
10290	BLR6_Run_Time	AI	225	R	
Boiler 7 Points (see Boiler 1 Points for descriptions)					
9546	BLR7_Supply	AI	162	R	
9547	BLR7_Return	AI	163	R	
9548	BLR7_Stack	AI	164	R	
9549	BLR7_CH_Mod_Rate	AI	165	R	
9550	BLR7_Rate_Commanded	AI	166	R	
9553	BLR7_CH_Mod_Stat	AI	167	R	
9554	BLR7_General_Alarm	AI	168	R	
9555	BLR7_Boiler_Pump	AI	169	R	
9556	BLR7_System_Pump	AI	170	R	
9926	BLR7_Pump_Status	AI	171	R	
9558	BLR7_Flame	AI	172	R	
9559	BLR7_State	AI	173	R	
9560	BLR7_Ann_Lockout	AI	174	R	
9561	BLR7_Ann_Hold	AI	175	R	
9712	ALR_BLR7SupplyHigh	AI	176	R	
9720	ALR_LeadBLR7Fault	AI	177	R	

Installation

Energy Management Interface

Table 5: EMS Signal List (continued)

Modbus Register Address	Protocol Name	BACnet Data Type	BACnet Object ID	Read / Write (W)	Description
Boiler 7 Points (see Boiler 1 Points for descriptions)					
9728	ALR_BLR7StartFault	AI	178	R	
9736	ALR_BLR7Lockout	AI	179	R	
9744	ALR_BLR7lost	AI	180	R	
9898	ALR_BLR7Mod_Source	AI	181	R	
9906	ALR_BLR7DMD_Source	AI	182	R	
10276	BLR7_Cycles	AI	218	R	
10292	BLR7_Run_Time	AI	226	R	
Boiler 8 Points (see Boiler 1 Points for descriptions)					
9566	BLR8_Supply	AI	183	R	
9567	BLR8_Return	AI	184	R	
9568	BLR8_Stack	AI	185	R	
9569	BLR8_CH_Mod_Rate	AI	186	R	
9570	BLR8_Rate_Commanded	AI	187	R	
9573	BLR8_CH_Mod_Stat	AI	188	R	
9574	BLR8_General_Alarm	AI	189	R	
9575	BLR8_Boiler_Pump	AI	190	R	
9576	BLR8_System_Pump	AI	191	R	
9927	BLR8_Pump_Status	AI	192	R	
9578	BLR8_Flame	AI	193	R	
9579	BLR8_State	AI	194	R	
9580	BLR8_Ann_Lockout	AI	195	R	
9581	BLR8_Ann_Hold	AI	196	R	
9713	ALR_BLR8SupplyHigh	AI	197	R	
9721	ALR_LeadBLR8Fault	AI	198	R	
9729	ALR_BLR8StartFault	AI	199	R	
9737	ALR_BLR8Lockout	AI	200	R	
9745	ALR_BLR8lost	AI	201	R	
9899	ALR_BLR8Mod_Source	AI	202	R	
9907	ALR_BLR8DMD_Source	AI	203	R	
10278	BLR8_Cycles	AI	219	R	
10294	BLR8_Run_Time	AI	227	R	

Setup & Tuning

Initial Setup

Quick Setup

Quick Setup questions may be used to quickly and easily setup the Control. Quick Setup includes the following topics:

Table 6: Initial Conductor Setup Procedure

Step	Description	Comments
1	How Many Boilers will be Controlled?	The network can have between 2 and 8 boilers. This is how many boilers the Conductor is connected to regardless of the type of connection.
2	Steam or Hot Water System?	Choose steam or hot water boilers. Limitations are as follows: Steam: Boilers can only be hardwired. Limit of four (4) on network. Hot Water: Any combination of boiler models. Up to eight (8) boilers on network.
3	What Brand is Displayed?	Choose what brand you want to see on the Home screen banner, and the name of boiler models that are available for those that are shared between brands. Thermal Solutions: Arctic and Amp models Bryan Boilers: Free Flex and BFIT models
4	Is Load Monitoring Used?	System load is measured using system supply and return temperatures when constant speed primary pump is used or pump speed feedback (0-10vdc input) when variable speed system pump is provided. Load Monitoring is for "Use First" boiler capability. NOTICE Pump speeds will be entered on the next page if an option other than "None" is selected.
5	What is the Boiler Model?	Select boiler models in the order you want them to appear on the home screen. Each boiler may be assigned to direct wired terminals or any listed boiler model. NOTICE The Control enclosure hardware can support up to 4 direct wired boilers (enable/disable, lockout and firing rate demand wired to boiler). The control limits the number of boilers assigned to "Hardwired" to suit available hardware. "Hardwired" boilers can be assigned an isolation valve (hot water system) or a shell temperature sensor (steam system).
6	What is the Boiler Name?	If a boiler is selected as "Hardwired" you will be prompted to enter a name for the boiler. This name can be any combination of letters and numbers up to 9 characters long. The name will be displayed along with the boiler model on all relevant screens.
7	Isolation Valve Installed?	Select if a relay on (optional) PCB-12 is being used with this boiler. Up to 4 boilers can have a relay assigned. Relays are assigned (A to D) in order of selection.

Setup & Tuning

Initial Setup

Table 6: Initial Conductor Setup Procedure (continued)

Step	Description	Comments
8	Shell Temperature Input?	Select if a shell temperature sensor is being used with a steam boiler. Sensor: Sends a temperature to the Control (Thermistor or RTD) Contact: Input is a thermostat (open or closed)
9	Honeywell S7800 Modbus Module Installed?	Select if a Modbus module is installed on an EVA model boiler. This indicates the Conductor will use Modbus to communicate with both the RWF55 and S7800 on the boiler.

Once Initial Setup is complete the display is sent to the Sequence Status Help screen. This screen may also be accessed from the Help menu.

NOTICE

Alternately, Quick Setup may be skipped and set up may be performed by loading preset configurations from a USB drive. Additionally, Quick Setup can be re-run at any time from the Adjust menu.

If Initial Setup is skipped, the Control defaults to the most basic configuration: Hot Water System, No Load Monitoring, 2 Hardwired Boilers without isolation valves.

Concert Control (Arctic/Free Flex, Amp/BFIT, and Apex Boilers) must have their Sequence Master Disabled. If enabled erratic communication is possible. TSBC Control must have Modbus selected.

Setup & Tuning

Initial Setup

The following steps are required to complete setup.

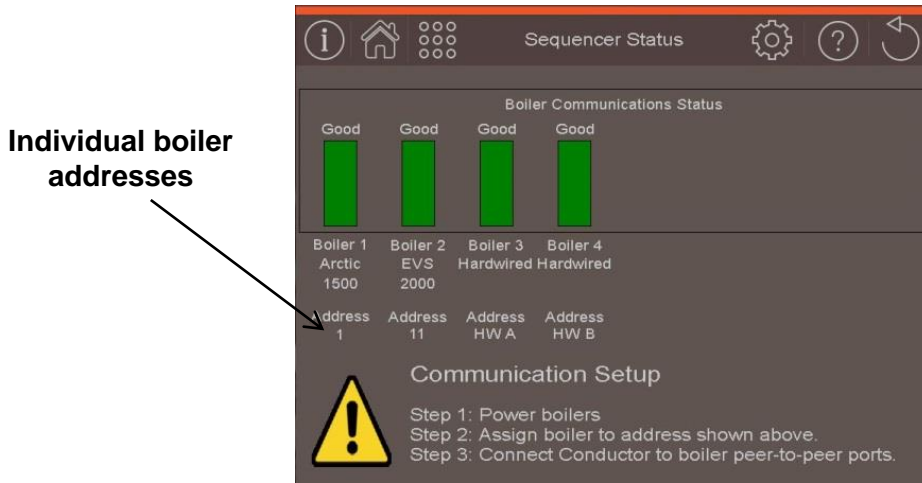


Figure 20: Sequencer Status Screen

Table 7: Setup Overview

Step	Description	Comments
1	Complete Initial Setup	Complete the "Initial Setup" as described above.
2	Set boiler communication parameters	<p>The Sequence Status screen provides the boiler address that <u>MUST BE ENTERED</u> into each boiler connected to the network. This screen is entered after the Quick Setup questions are completed or from the Help Menu.</p> <p>Concert Control Menu Selections:</p> <ul style="list-style-type: none"> i. Adjust >> Sequence Master = Disabled ii. Slave Sequencer>> Boiler Address = Address from Sequencer Status screen. iii. EMS >> Remote Demand >> Modulation Source = Modbus iv. EMS >> Remote Demand >> CH Demand Switch = Modbus <p>TSBC Control Menu Selections:</p> <ul style="list-style-type: none"> i. System Config >> Remote Control = Modbus Mod ii. Communications >> Address = Address from Sequencer Status screen. iii. Communications >> Protocol = Modbus iv. Communications >> Baud Rate = 38.4 v. Communications >> Parity = None vi. Put jumper wires between RO & C and LR & C <p>RWF55 Control Menu Selections:</p> <ul style="list-style-type: none"> i. ConF >> IntF >> bdr = 3 (for 38.4) ii. ConF >> IntF >> Adr = Address from Sequencer Status screen. iii. Ensure local Setpoint (SP1) and Off Point (HYS1) are set to desired values, then cycle power. <p>S7800 Module Menu Selections:</p> <ul style="list-style-type: none"> i. Display Setup >> MB Address = boiler's RWF55 address + 10 ii. Display Setup >> MB Baud = 38400

Setup & Tuning

Initial Setup

Table 7: Setup Overview (continued)

Step	Description	Comments
3	Connect Boilers	Refer to Network Boiler Wiring section for connection details.
4	Confirm Communication	Until boilers are connected with the correct address (as found on the Sequence Status Screen), the Sequence Status boiler status bars are shown red and the Help Icon will blink. As a boiler is detected its status bar turns from red to green and status text changes to "Good". NOTICE Initial communication may take up to 2 minutes.
5	Manual Start and Modulate Boilers	Each boiler, isolation valve and pump is equipped with a manual / automatic station to allow individual signal proving during commissioning.
6	Release System to Automatic	Set sequencer and individual Manual / Automatic switches to Automatic.

Setup & Tuning

Manual Operation

The Firing rate may be adjusted manually using the Operation screen. The user may adjust firing rate anywhere between low and high.



Figure 21: Operations Screen

Bar Graph & Trend

Supply Sensor, Active Setpoint & Modulation

Firing Rate

After selecting Manual Mode, the User may adjust modulation manually. The factory default is Automatic mode.

Master Sequencer

Select Auto to enable the Sequencer to Operate. Select Off to disable the sequencer.

Service Trend

Service Trend screen shows: system temps, firing rate & plant load (when selected and sensors installed).

Tune

Tune screen allows for adjustment of parameters related to the rate of Sequencer response. This includes PID settings, Delay Times and more. For more details on the Tune Screen see Master Sequencer in Adjustable Parameters Section.

NOTICE

Manual control mode locks firing rate to a fixed speed. The control stays in manual even through a power cycle. Select Automatic when commissioning is complete.

Setup & Tuning

Manual Operation

Individual boilers, isolation valves, and pumps can be controlled manually from the Operation screens accessible via the Operation Menu.

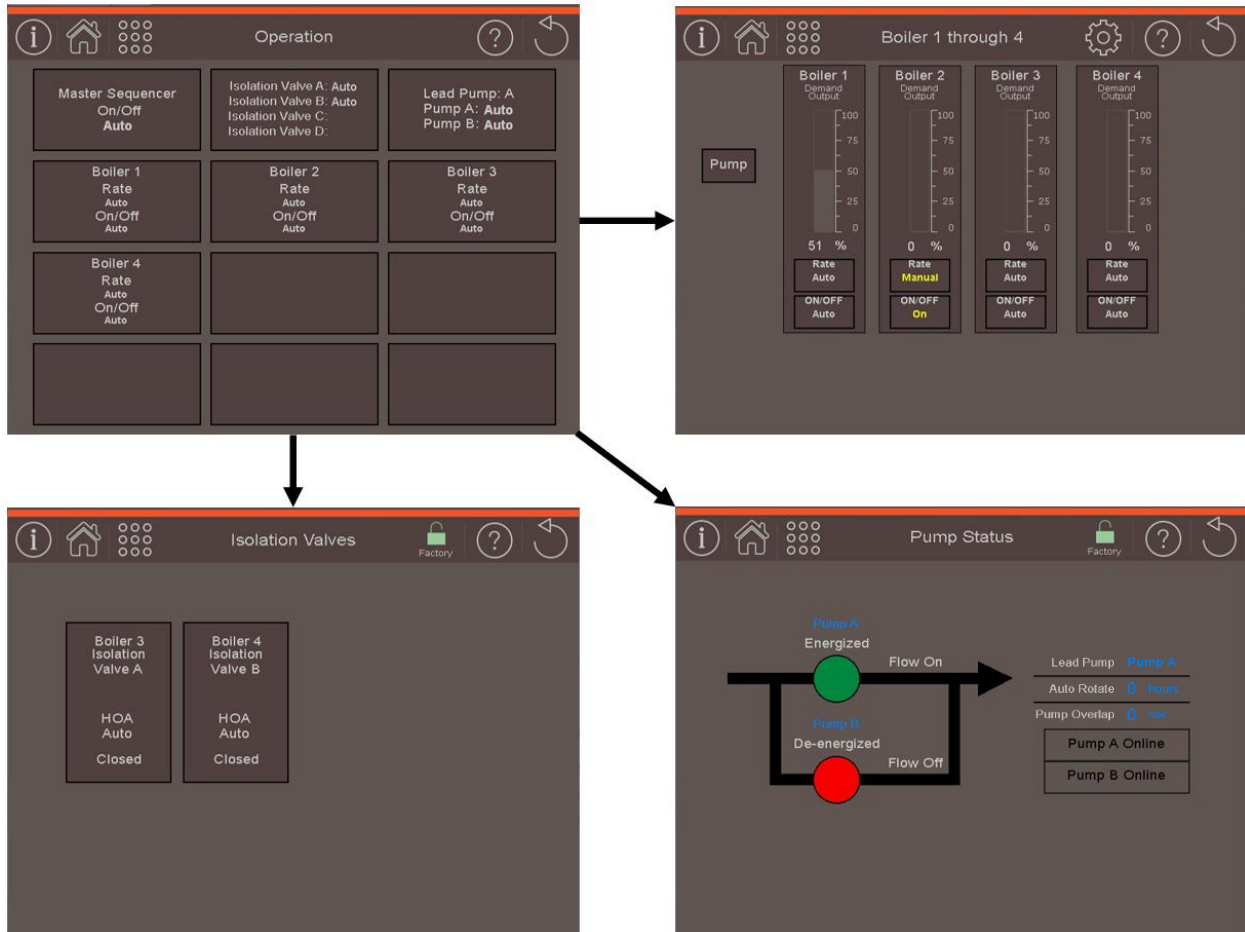


Figure 22: Additional Operations Screens

Boiler Manual Firing Rate

After selecting Manual Mode, the User may adjust boiler modulation manually. The factory default is Automatic mode. The numeric display shows the commanded rate, while the bar displays boiler feedback rate.

On / Off / Auto

On each of these screens an item may be set to On, Off, or Automatic. On and Off are forced states that will override any action by the Control. The Control will continue to function in the background regardless of these states. Once Auto is selected, the item will immediately return to its sequencer-demanded operating state.

Isolation Valves

Isolation valves will open while their assigned boiler is running. If the lead boiler has an assigned valve, it will remain open during Standby.

Lead Pump

The Control includes automatic alternating pump outputs. Either pump may be selected as lead and the second as backup. Additionally, the lead may be rotated automatically. The system is designed to have one pump running at a time with the second pump available as a backup pump. If the lead pump fails to produce flow (sensed by a flow switch located in the individual pump piping), an alarm is generated and the backup pump is started. The backup pump is run as long as the lead pump is called to run and does not produce required flow. Lead pump is rotated manually or based on run time hours. If auto rotation is selected, the backup pump is started and the lead pump is stopped after an overlap time delay (field adjustable). A pump runs when the Control is enabled and there is no Warm Weather Shutdown.

Setup & Tuning

Parameter Adjustment

Login to Adjust Parameters

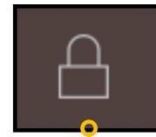
Control operation may be tailored to suit the application by adjusting parameters. To adjust parameters select the ADJUST icon located throughout the display.



Press ADJUST icon to review and adjust all parameters.

Parameters are password protected to discourage unauthorized or accidental changes to settings. User login is required to adjust these settings. Parameters are locked and login requirement is shown when the padlock icon is not green

- Press the Lock icon to access password screen.
- Use keypad to enter Password.
- Press Enter Key when complete.



Login is Required
Select Icon to enter password.



Select dark gray box and Enter Password
Factory = 86
Supervisor = 76

Login is Complete
Parameters may be adjusted

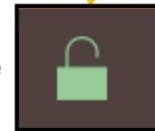


Figure 23: Security System

Adjusting Parameters

Editing parameters is accomplished as follows:

Use the key pad to edit the value of the parameter.

Press the enter key to confirm newly edited value. The value modified with the increase and decrease buttons is not accepted unless this button is also pressed.

Press the checkmark to confirm newly edited value. The value modified with the increase and decrease buttons is not accepted unless this button is also pressed.

Press the Up/Down arrows to edit a value. While editing a value it will blink until it has been accepted or cancelled. A value is also cancelled by leaving the screen without accepting the value

Press the X button to cancel newly edited value and go back to the original

Figure 24: Adjusting Parameters

Setup & Tuning

Parameter Adjustment

From the ADJUST menu select the following buttons to view and adjust parameters. If factory setting differs between Hot Water and Steam systems, steam is listed in brackets “()”.



Press  to adjust the following parameters.

Table 8: System Parameters

Factory Setting	Range / Choices	Parameter and Description
Fahrenheit	Fahrenheit Celsius	Temperature Units The Temperature Units parameter determines whether temperature is represented in units of Fahrenheit or Celsius degrees.
Xx/xx/xxxx	xx/xx/xxxx	System Date Date used by display Alarm History screen. A battery is provided to maintain the system date and time while the display is powered down.
Xx:xx:xx	xx:xx:xx	System Time Time used by display Alarm History screen. A battery is provided to maintain the system date and time while the display is powered down.
Enable	Enable Disable	<p>Auto Jump to Home Page</p> <p>Enable: After 45 minutes of no use, the display will automatically return to the Home Page and turn off the backlight (screen will turn black).</p> <p>Disable: After 45 minutes of no use, the display will NOT automatically return to the Home Page and will NOT turn off the backlight.</p> <div style="text-align: center;">  <p>CAUTION</p> <p>Screen life is reduced when Auto Jump to Home Page is Disabled.</p> </div>
76		<p>Supervisor Password</p> <p>Allows for custom password to be set. Must be 9 characters or less. Only allows adjustment of supervisor password (supervisor default: 76). Cannot change Factory password.</p> <ul style="list-style-type: none"> • Must enter current installer password. • Must enter new password and press enter. • Must re-enter new password and press enter. <p style="text-align: center;">NOTICE</p> <p>Can be reset to supervisor default 76 if accessed with the Factory level password (86).</p>
Thermal Solutions	Thermal Solutions / Bryan Boilers	<p>Brand</p> <p>Choose what brand you want to see on the Home screen banner, and the name of boiler models that are available for those that are shared between brands.</p> <p>Thermal Solutions: Arctic and Amp models Bryan Boilers: Free Flex and BFIT models</p>

Setup & Tuning

Parameter Adjustment

Press **Setpoints** to adjust the following parameters.

Table 9: Setpoint Parameters

Factory Setting	Range / Choices	Parameter and Description
180°F	60 – 230°F	Operation Setpoint, Hot Water (Visible when Hot Water selected) Target temperature for the central heat priority. Value also used by the outdoor air reset function.
8 PSI	0 – 15 PSI, 0 – 30 PSI, 0 – 100 PSI, 0 – 200 PSI, 0 – 300 PSI	Operation Setpoint , Pressure (Visible when Steam system selected) Target pressure for steam system.
Disable	Enable Disable	High Temperature System (Visible when Hot Water system selected) The High Temperature System Enable/Disable parameter determines the action the controller takes in response to a high water temperature setpoint request from an Energy Management System (EMS), or internal Outdoor Air Reset (OAR) logic. The parameter has the following selections: Disable: Water temperature maximum is limited to suit active or running boilers. Active maximum setpoint limit is set equal to the lowest boiler maximum setpoint requirement. Enable: When system water temperature setpoint is above a boiler’s maximum setpoint, the boiler lead is passed (if Lead), start command is removed or the boiler is not started, and Boiler Status changes to “Blocked”. Boilers remain blocked until the setpoint is lower than their maximum setpoint for 5 minutes. This feature is typically used to prevent stainless steel, condensing boilers from running when high (220 F) system water temperature is required. The user only selects this feature when there are adequate High Temperature Boilers installed to satisfy the load without the condensing boilers.
5°F (2 PSI)	3 – 29°F (1 – 10 PSI)	Off Point (degrees above setpoint) Boilers will stop after the short “Off delay” when the water temperature (or steam pressure) rises “Off Point” degrees above the setpoint.
10°F (2 PSI)	3 – 29°F (1 – 10 PSI)	On Point (degrees below setpoint) Boilers will start when the water temperature (or steam pressure) drops ‘On Point’ degrees below the setpoint.
140°F	80 – 180°F	Sequence Use Last On Point (Visible when Hot Water system selected) When a boiler is selected as “Use Last” by the “Boiler Sequence” parameter and the Active Setpoint is below the “Use Last On Point” the boiler is sent to the end of the start order. When the Active Setpoint is above the “Use Last On Point” the boiler will rejoin the sequence order corresponding to its boiler number.
195°F	140 – 230°F	High Temperature Stop Setpoint (Visible when Hot Water system selected) When the High Temperature Stop Setpoint is reached all Networked boilers are stopped at once without any stop boiler time delays. This setpoint allows the Sequencer to respond to rapid load increases.

Setup & Tuning

Parameter Adjustment

Table 9: Setpoint Parameters (continued)

Factory Setting	Range / Choices	Parameter and Description
180°F	140 – 230°F	Domestic Hot Water Setpoint (Visible when Hot Water system selected) The Domestic Hot Water (DHW) Setpoint parameter is used to create a boiler water temperature setpoint that is used when DHW heat demand is “on”. When the DHW heat demand is not “on” (the contact is open or not wired) this setpoint is ignored.
Disabled	Enable Disable	Warm Standby Enable / Disable (Visible when Steam system selected) When warm standby is enabled the next boiler to start, (the standby boiler) is periodically started and held at low fire until it returns to the warm standby temperature (sensed by shell temperature sensor or Aquastat). This helps to minimize thermal shock and decrease the time it takes to produce steam when called on line. Warm Standby is disable during Warm Weather Shutdown.
180°F	60 F to 350 F	Warm Standby Setpoint (Visible when Steam system selected) When enabled, the Warm Standby Setpoint is the boiler target temperature.
5°F	3 to 29 (°F)	Warm Standby Off Point (Visible when Steam system selected) When Warm Standby is active the boiler stops when the water temperature rises ‘Off_Point’ degrees above the setpoint.
10°F	3 to 29 (°F)	Warm Standby On Point (Visible when Steam system selected) When Warm Standby is active the boiler starts when the water temperature drops ‘On_Point’ degrees below the setpoint.
180°F	80 – 220°F	Low Fire Hold Temperature (Visible when Steam system selected) On Point setpoint for steam boilers with shell temperature sensors. Boiler starts if shell temperature drops below this temperature.
Timer	Timer, Sensor	Low Fire Hold Type (Visible when Steam system selected) Determines the type of low fire hold for steam boilers. Timer: Boilers operate in Low Fire Hold for a set time (see individual boiler “Boiler Low Hold Time” parameter) before release to modulation. Sensor: Boilers are held in Low Fire Hold until their shell temperature is greater than the “Low Fire Hold Temperature” setpoint.
70°F	40 – 90°F	Warm Weather Shutdown Setpoint The Warm Weather Shutdown (WWSD) Setpoint used to shut down the boiler when enabled by the “WWSD Enable” parameter.

Setup & Tuning

Parameter Adjustment

Table 9: Setpoint Parameters (continued)

Factory Setting	Range / Choices	Parameter and Description
Off	Off, Boiler, Both	<p>Warm Weather Shutdown Enable</p> <p>Off: Warm Weather Shutdown (WWSD) is not used.</p> <p>Boiler or Both: A central heat boiler start is prevented if the outside temperature is greater than the WWSD setpoint. WWSD is initiated as soon as outside air temperature is above WWSD Setpoint. The control requires call for heat to be satisfied before entering WWSD. Boilers will still start in response to a Domestic Hot Water call for heat.</p> <p>Specifies WWSD control of boiler or system pump and boiler:</p> <p>Off: Ignores Warm Weather setpoint</p> <p>Boiler: When Outside Air Temperature (OAT) is higher than the WWSD setpoint, inhibits boiler start</p> <p>Both: When OAT is higher than the WWSD setpoint, inhibit Call for Heat and de-energized system pump output (SO) after boilers are off.</p>
200°F (15 PSI)	60 – 230°F (0-300 PSI)	<p>High Temperature (Pressure) Alarm Setpoint</p> <p>Setting is used to establish a high header temperature (or pressure) alarm.</p>
50°F (0 PSI)	40 – 230°F (0-300 PSI)	<p>Low Temperature (Pressure) Alarm Setpoint</p> <p>Setting is used to establish a low header temperature (or pressure) alarm.</p>
50°F	40 – 230°F	<p>Return Temperature Low Alarm Setpoint (Visible when Hot Water system selected)</p> <p>Alarm used to alert operator to excessively low return temperature on Non-Condensing boilers. When a Non-Condensing boiler is called to run, the water temperature is below Return Low Alarm setting, and the Return Low time delay has expired an alarm is generated.</p>
300s	0 – 900s	<p>Return Temp. Low Alarm Time Delay (Visible when Hot Water system selected)</p> <p>The time delay may be used to prevent nuisance alarms. The Return Temperature Low Alarm Time Delay allows the alarm to be present only during a sustained low water temperature condition.</p>
250°F	60 – 500°F	<p>Shell Temperature High Alarm Setpoint (Steam Systems) (Visible when Steam system selected)</p> <p>Setting is used to establish a high shell temperature alarm.</p>

Setup & Tuning Parameter Adjustment

Press **Outdoor Reset** to adjust the following parameters.

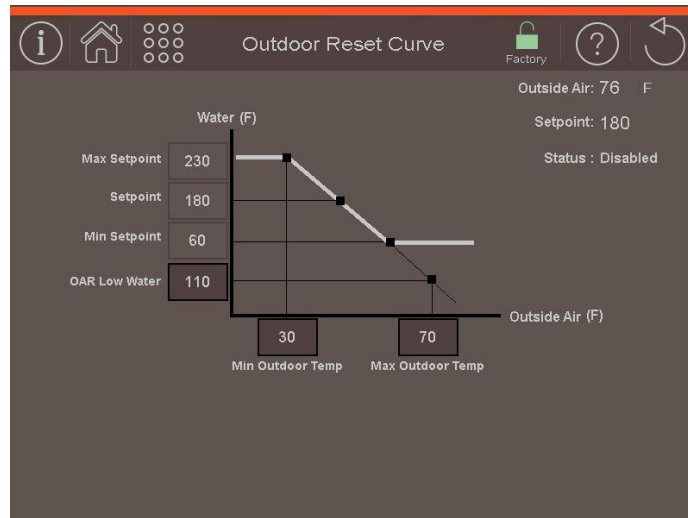


Figure 25: Reset Curve

Table 10: Outdoor Reset Parameters (Visible when Hot Water system selected)

Factory Setting	Range / Choices	Parameter and Description
Disable	Enable Disable	<p>Outdoor Reset Enable</p> <p>If an outdoor sensor is installed, and Outdoor Reset is Enabled, the boiler will automatically adjust the heating setpoint temperature based on the outdoor reset curve in (see Figure 25). As the outdoor temperature falls the supply water target temperature increases and as outdoor temperature increases supply water target decreases. The “Max Setpoint” is set equal to the lowest active boiler maximum setpoint and the “Min Setpoint” is set equal to the highest active boiler minimum setpoint. Minimum setpoint prevents the water temperature setpoint from being reduced below what active boilers can accept.</p> <p>Disable: Do Not Calculate setpoint based on outdoor temperature. Enable: Calculate the temperature setpoint based on outdoor temperature using a reset curve defined by Low Outdoor Temp, High Outdoor Temp, Low Boiler Water Temp, individual active minimum boiler temperature, and Central Heat Setpoint.</p>
70°F	35 – 100°F	<p>Maximum Outdoor Temperature</p> <p>The High Outdoor Temperature parameter is the outdoor temperature at which the Low Boiler Water Temperature is supplied. This parameter is typically set to the desired building temperature.</p>
30°F	-50 – 32°F	<p>Minimum Outdoor Temperature</p> <p>The Low Outdoor Temperature parameter is also called “Outdoor Design Temperature”. This parameter is the outdoor temperature used in the heat loss calculation. It is typically set to the coldest outdoor temperature.</p>
110°F	70 – 180°F	<p>Low Water Temperature</p> <p>The Low Boiler Water Temperature parameter is the operating setpoint when the High Outdoor Temperature is measured. If the occupied space feels cool during warm outdoor conditions, the Low Boiler Water Temperature parameter should be increased.</p>

Setup & Tuning

Parameter Adjustment

Press **Load Monitoring** to adjust the following parameters.

Table 11: Load Monitoring Parameters (Visible when Hot Water system selected)

Factory Setting	Range / Choices	Parameter and Description
None	None, Pump Feedback, Pump Running	<p>Load Monitoring System load is calculated using system supply temperature, system return temperature, and system pump speed. For load monitoring to function all sensors (supply, return, and pump feedback if selected) must be configured and have good data quality.</p> <p>None: Do not measure system load Pump feedback: Measure system load using a variable-speed pump input via a 0-10Vdc or 4-20mAdc feedback input. Pump Running: Measure system load with a constant-speed pump.</p>
50 GPM	0 – 1000 GPM	<p>Minimum System Pump Flow Parameter used to scale System Pump Feedback in gallons per minute. For constant-speed pump the minimum speed is 0 GPM.</p>
400 GPM	0 – 1000 GPM	<p>Maximum System Pump Flow Parameter used to scale System Pump Feedback in gallons per minute. This is the operating speed for a constant-speed pump.</p>

Press **Master Sequencer** to adjust the following parameters.

Table 12: Master Sequencer Parameters

Factory Setting	Range / Choices	Parameter and Description
13	0 – 100	<p>Proportional Rate Proportional Gain value used on hot water or steam applications. A larger gain value results in tighter, more active, PID control. Gain is the primary PID modulation rate tuning adjustment, and provides the immediate modulation rate response. Pick a gain based on the desired initial response. The burner modulation rate can oscillate if the Proportional Gain is too large.</p>
600	0 – 1200	<p>Integral Rate Integral gain value used on hot water or steam applications. A smaller value makes the Integral ramp in less time (i.e., faster). Integral is a secondary PID modulation rate tuning adjustment that ramps the output over time (typically minutes). Based on the selected Local PID P. The burner modulation rate can oscillate if the Integral time is too small.</p>
120s	16 – 420s	<p>Net Start Dwell The Net Start Dwell Time Delay specifies the length of time the peer-to-peer network will wait for the Boiler Running input after a boiler Call for Heat. If the Net Start Dwell time is exceeded before the main fuel valve is open, the next boiler Call for Heat is initiated without further delay. This parameter should be longer than the sum of the pump purge and boiler purge times.</p>

Setup & Tuning

Parameter Adjustment

Table 12: Master Sequencer Parameters (continued)

Factory Setting	Range / Choices	Parameter and Description
30s	3 – 120s	Limit Fault Time The Limit Fault Time Delay specifies the length of time the peer-to-peer network will wait for the boiler limits input after a boiler's Call for Heat. If the Limit Fault time is exceeded before the limits are energized the next boiler Call for Heat is immediately initiated.
180s	60 – 900s	Boiler On Delay Time Delay after On Point setpoint has been reached before starting the next boiler. Short time delay to prevent nuisance starts due to momentary temperature and modulation rate swings.
60s	10 – 900s	Boiler Off Delay Time Delay after the Off Point setpoint has been reached before stopping the next boiler. Short time delay to prevent nuisance stops due to momentary temperature, and modulation rate swings.
100%	25 – 100%	High Fire Limit This is the Base Load Common Rate used when Modulation Type parameter is set to Unison modulation and condensing boilers are active. To maximize condensing boiler efficiency, the firing rate is limited to an adjustable value. Boilers are kept at or below this firing rate as long as the boilers can handle the load. After last available boiler has started, the modulation rate limit is released up to 100%. Additionally, if a non-condensing boiler is started the High Fire Limit is ignored.
1°/min	1 – 10°/min	Degrees/Minute Hold Off Specifies a temperature rate of change that inhibits the next boiler being started or stopped. If the temperature is increasing faster than this rate of change, the next boiler is not started. Also, if the temperature is decreasing faster than this rate of change, the next boiler is not stopped.
Auto Rotate	Auto Rotate, Manual	Rotation (Enable / Disable) Enables the lead boiler role to be rotated through the boilers on the network. When in Manual the selected boiler is Lead and does not rotate lead.
24h	8 – 720h	Lead Rotation Time Time boilers will act as the lead before switching the lead to another boiler in the network.
2 min	0 – 20 min	Lead Overlap Time Time 1st Lag boiler will be run before Lead is forced to rotate to it. If a lead boiler stays running 12 hours past the set Rotation Time, Conductor will force the lead to rotate to the next boiler. If the lead is the only boiler running, in order to maintain system temperature/pressure, Conductor will start the first lag for this amount of time before rotating and stopping the previous lead.
80%	25 – 100%	Boiler Base Rate Lag boiler base rate for maximum efficiency when Modulation Type parameter is set to <i>Sequential Modulation</i> .
90%	50 – 100%	High Helper Firing Rate % This parameter only applies to <i>Sequential Modulation</i> . High Helper Firing Rate % sets the modulation rate the lead boiler must reach before lag boilers enter Helper Mode to increase firing rate and "help" lead boiler meet load.

Setup & Tuning

Parameter Adjustment

Table 12: Master Sequencer Parameters (continued)

Factory Setting	Range / Choices	Parameter and Description
25%	0 – 50%	<p>Low Helper Firing Rate % This parameter only applies to <i>Sequential Modulation</i>. Low Helper Firing Rate % specifies the modulation rate that the lead boiler must be below before lag boilers enter Helper Mode to reduce firing rate, and “help” lead boiler meet load.</p>
Unison	Unison, Sequential	<p>Modulation Type Boiler firing rate may be modulated in Unison or Sequential modes.</p> <p>Unison: All boilers are modulated at the same rate. Sequential: The lead boiler is modulated, and lag boilers are base loaded at an efficient rate (see “Boiler Base Rate” parameter).</p>
90%	50 – 100%	<p>Start Trigger Firing Rate % Specifies the percent of maximum modulation rate the running boiler(s) must reach before calling upon additional boilers for help.</p> <p>This parameter is for load balancing only and should not be used to affect boiler sequencing operation.</p>
25%	0 – 50%	<p>Stop Trigger Firing Rate % Specifies the modulation rate that the running boiler(s) must be below before shutting down a lag boiler.</p> <p>This parameter is for load balancing only and should not be used to affect boiler sequencing operation.</p>
20 min	2 – 30 min	<p>% Firing Rate On Delay This parameter sets the amount of time to determine if the load is large enough to start another boiler to carry the load at a lower firing rate. This setting should always be at least two times greater than the Boiler On Delay.</p> <p>This parameter is for load balancing only and should not be used to affect boiler sequencing operation.</p>
20 min	2 – 30 min	<p>% Firing Rate Off Delay This parameter sets the amount of time to determine if the load is small enough to stop a boiler to carry the load at a higher firing rate. This setting should always be at least two times greater than the Boiler On Delay.</p> <p>This parameter is for load balancing only and should not be used to affect boiler sequencing operation.</p>

Setup & Tuning

Parameter Adjustment


Press  to adjust the following parameters.


Table 13: Input / Output Parameters

Factory Setting	Range / Choices	Parameter and Description
Thermistor (Unconfigured)	Unconfigured, Thermistor, 4-20mA, RTD	System Supply Temperature Sensor Type (Visible when Hot Water system selected) Unconfigured: No sensor installed. Thermistor: Sensor is an 10k NTC temperature sensor 4-20mA: Sensor is a temperature transmitter, range min and max set below. RTD: Sensor is an PT1000 RTD
Unconfigured	Unconfigured, Thermistor, 4-20mA, RTD	System Return Temperature Sensor Type (Visible when Hot Water system selected) Unconfigured: No sensor installed. Thermistor: Sensor is an 10k NTC temperature sensor 4-20mA: Sensor is a temperature transmitter, range min and max set below. RTD: Sensor is an PT1000 RTD <p style="text-align: center;">NOTICE</p> If Supply & Return are both configured, they MUST have the same configuration.
0 F	0 – 230°F	System Supply/Return Temperature 4-20mA Range Minimum (Visible when 4-20mA Supply selected) Sets the 4 mA supply and return water temperature.
230 F	0 – 230°F	System Supply/Return Temperature 4-20mA Range Maximum (Visible when 4-20mA Supply selected) Sets the 20 mA supply and return water temperature.
Unconfigured	Unconfigured, Thermistor, RTD	Outdoor Temperature Sensor Type Outdoor sensor must be configured for Outdoor Reset. Unconfigured: No sensor installed. Thermistor: Sensor is an 10k NTC temperature sensor RTD: Sensor is an PT1000 RTD
Unconfigured	Unconfigured, 4-20mAdc, 0-10Vdc	EMS Setpoint Sensor Type EMS Setpoint sensor must be configured for “Wired” Setpoint Source. Unconfigured: No sensor installed. 4-20mAdc: EMS sends an analog current signal. 0-10Vdc: EMS sends an analog voltage signal. Refer to EMS Communication Menu to set range.
Unconfigured	Unconfigured, 4-20mAdc, 0-10Vdc	System Pump Feedback Sensor Type (Visible when HW system selected) Load Monitoring parameter must be set to “Pump Feedback” Unconfigured: No sensor installed. 4-20mAdc: Pump speed sensor sends an analog current signal. 0-10Vdc: Pump speed sensor sends an analog voltage signal. Refer to Load Monitoring Menu to set range.

Setup & Tuning

Parameter Adjustment

Table 13: Input / Output Parameters (continued)

Factory Setting	Range / Choices	Parameter and Description
Unconfigured (4-20mA dc)	Unconfigured, 4-20mA dc, 0-10V dc	<p>Steam Pressure Sensor Type (Visible when Steam system selected) Steam pressure sensor must be configured for steam system.</p> <p>Unconfigured: No sensor installed. 4-20mA dc: Pressure sensor sends an analog current signal. 0-10V dc: Pressure sensor sends an analog voltage signal.</p> <p>Refer to System Menu << Display Units to set range.</p>
0-15 PSI	0-15 PSI, 0-30 PSI, 0-100 PSI, 0-200 PSI, 0-300 PSI	<p>Pressure Units (Visible when Steam system selected) The Pressure Units parameter determines what range of pressures is displayed for system pressure.</p>
Unconfigured	Unconfigured, Thermistor, RTD, Discrete Input	<p>Boiler Shell Temperature Sensor Type (Typical for Boilers A through D) (Visible when Steam system selected) Shell temp sensor must be configured for Low Fire Hold Type-Sensor.</p> <p>Unconfigured: No sensor installed. Thermistor: Sensor is an 10k NTC temperature sensor RTD: Sensor is an PT1000 RTD Discrete Input: Temperature switch input.</p> <p style="text-align: center;">NOTE</p> <p>Use Temperature Switch that breaks circuit on Temperature rise.</p>
4-20mA dc	1 to 9 V dc, 0-10V dc, 2-10V dc, 4-20mA dc	<p>Boiler Firing Rate Output Type (Typical for Boilers A through D)</p> <p>1 to 9V dc: Special voltage demand, allows boiler control to detect high and low voltage signal. This is the type signal used by the TSBC. 0-10V dc: Standard voltage demand. 2-10V dc: Voltage demand with Rate and Enable / Disable from signal output. When voltage below 2 Volts boiler is disabled. 4-20mA dc: Standard Analog Signal.</p> <p style="text-align: center;">NOTICE</p> <p>To select 4-20mA dc for boilers A and B, PCB 11 4-20mA / 0-10V the corresponding DIP switch must be selected to 4-20mA dc.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Figure 26: PCB 11 4-20mA/0-10V Dip Switch</p> </div> </div>
Alarm	Verify, Alarm, Alarm Reset	<p>Configurable Input The configurable Input may be set to perform the following functions:</p> <p>Verify Input: Input monitors component status before activating any stage. This input may be used to check the Fresh Air Damper, or flow switch status. Alarm Input: Input monitors the alarm input and generates an alarm when the input is energized. Alarm Reset Pushbutton: Input monitors a momentary alarm reset pushbutton input. When the input is energized the alarm output is de-energized.</p>

Setup & Tuning

Parameter Adjustment

Table 13: Input / Output Parameters (continued)

Factory Setting	Range / Choices	Parameter and Description
Fresh Air Damper	Fresh Air Damper, Boiler Running, DHW Pump	Configurable Output The Configurable Output may be set to perform the following functions: Fresh Air Damper: When a lead start is initiated, the fresh air damper is energized. Boiler Running Status: The output is energized when any boiler is running. DHW Pump Control: The output is energized in response to a DHW demand input.
Lockout	Lockout, General Alarm	Alarm Output Alarm parameter determines the Alarm Output, terminal A32 & A33, function. Lockout: Relay closes when an individual boiler's lockout alarm is present. General Alarm: Relay closes when any alarm is present.

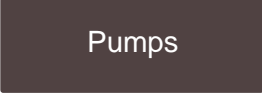
Press  to adjust the following parameters.

Table 14: Pump Parameters

Factory Setting	Range / Choices	Parameter and Description
Auto	Start, Stop, Auto	Pump A Start – Stop – Auto Station Each pump may be selected to Start, Stop or respond to the control system in Auto mode. The user has the ability to manually operate the pump or allow the Conductor to operate the pump. Start: Pump is started. Stop: Pump is stopped. Auto: Pump is started or stopped based on control requirements.
Auto	Start, Stop, Auto	Pump B Start – Stop – Auto Station Each pump may be selected to Start, Stop or respond to the control system in Auto mode. The user has the ability to manually operate the pump or allow the Conductor to operate the pump. Start: Pump is started. Stop: Pump is stopped. Auto: Pump is started or stopped based on control requirements.
Pump A	Pump A, Pump B, Auto	Pump Lead Selection Pump Lead Selection enables the user to select pump A or Pump B as lead or allow the boilers to rotate base on run time hours.
24h	8 – 720h	Pump Lead Rotation Time Time pump will act as the lead before switching the lead to alternate pump.
15s	5 – 600s	Pump Alternate Overlap Time When “Pump Auto Lead Selection” is selected and the “Pump Rotation time” is complete the pump lead changes and a backup pump is enabled to start. A previous lead remains running for “Pump Alternate Overlap Time” to allow time for the backup pump to start and prove operation. After the time retention the previous lead stops. If the backup pump fails to produce flow the previous lead pump will remain running and a pump failure alarm is generated.

Setup & Tuning

Parameter Adjustment

Press **Isolation Valves** to adjust the following parameters.

Table 15 Isolation Valve Parameters

Factory Setting	Range / Choices	Parameter and Description
Auto	Open, Close, Auto	<p>Valve Open – Close – Auto Station Each valve may be selected to Open, Close or respond to the control system in Auto mode. The user has the ability to manually operate the valve or allow the Conductor to operate it.</p> <p>Open: Valve is started. Stop: Valve is stopped. Auto: Valve is started or stopped based on control requirements.</p>
30s	0 – 180s	<p>Valve Open Delay When a boiler start demand is generated the valve will be called to open, but the boiler start command will not be sent until after this delay.</p>
60s	0 – 300s	<p>Valve Overrun Time Valve will remain open for the “Valve Overrun Time” after the boiler start command is removed from the assigned boiler.</p>

Press **Service Contacts** to adjust the following parameters.

This information may be entered from a USB thumb drive, or from the Service Contacts screen. Refer to Using Archives section for thumb drive instructions.

Table 16: Service Contacts

Factory Setting	Parameter and Description
Enter name Enter address line 1 Enter address line 2 Enter phone number Enter email	<p>Contractor Select the line of information to edit. Use key pad to input data and press ENT to enter data into Contractor Info.</p>
Enter name Enter address line 1 Enter address line 2 Enter phone number Enter email	<p>Service Company Select the line of information to edit. Use key pad to input data and press ENT to enter data into Service Company Info.</p>
Enter name Enter address line 1 Enter address line 2 Enter phone number Enter email	<p>Sales Representative Select the line of information to edit. Use key pad to input data and press ENT to enter data into Sales Representative Info.</p>

Setup & Tuning

Parameter Adjustment

Press **Boiler Setup** to adjust the following parameters.

Table 17: Boiler 1 Setup Parameters (Boiler 1 shown, typical for boiler 1 through 8)

Factory Setting	Range / Choices	Parameter and Description
Hardwired	Hardwired, Thermal Solutions Boilers	<p>Boiler 1 Model Number This stores the boiler model. The following is a list of selectable boilers:</p> <ul style="list-style-type: none"> - Hardwired - Apex: 425, 525, 625, 725, 825 - Arctic/Free Flex: 1000, 1500, 2000, 2500, 3000 - EVA: 500, 750, 1000, 1500, 2000, 2000S, 2500, 3000 - EVS: 500, 750, 1000, 1500, 2000, 2000S, 2500, 3000 - EVCA: 750, 1000, 2000, 3000 - Solaris: 500, 750, 1000, 1250, 1500 - Amp/BFIT: 1000, 1250, 1500, 2000, 2500, 3000, 3500, 4000
Hardwired	Hardwired, TSBC, Sage (4716), RWF55	<p>Boiler 1 Control Type The type of temperature controller installed on the boiler.</p> <p>Hardwired: Any boiler controlled by the Conductor through the direct wired PCB terminals.</p> <p>TSBC: Thermal Solutions Boiler Control installed on all EVS, EVCA, and Solaris boilers.</p> <p>Sage (4716): Honeywell control installed on all Arctic, Amp, and Apex. Also called "Sola".</p> <p>RWF55: Siemens control installed on all EVA boilers.</p>
500	0 – 30,000 MBH	<p>Boiler 1 Size This parameter allows the Control to manage boilers according to their heat output.</p>
100	0 – 30,000 MBH	<p>Boiler 1 Minimum modulation rate This parameter along with load monitoring allows the Control to arrange boiler firing order minimum firing, and help avoid excessive cycling.</p>
Non-Condensing	Condensing, Non-Condensing	<p>Boiler 1 Type The boiler type parameter is used to setup modulation for condensing or non-condensing operation.</p> <p>Condensing: Condensing boiler attributes are assigned to the boiler.</p> <p>Non-Condensing: Non-Condensing boiler attributes are assigned to the boiler.</p>
Enable	Enable, Disable	<p>Shell Temperature Enable (Visible when Steam system selected) Enables the use of a Shell Temperature input for Low Fire Hold and Warm Standby functions.</p>
Use Last	Normal Order, Use First, Use Last	<p>Boiler 1 Sequence Order Used to determine lead selection order.</p> <p>Normal Order: Boiler follows normal numeric lead selection order. Typical for a large condensing boiler.</p> <p>Use First: Used in conjunction with Load Monitoring, boiler is selected as lead when plant load is less than minimum firing rate of current lead. Typical for a small boiler.</p> <p>Use Last: Used in conjunction with Non-condensing boilers, boiler is moved to the last lag boiler position when the active setpoint is less than the "Use Last On Point" (see Setpoints parameters).</p>

Setup & Tuning

Parameter Adjustment

Table 17: Boiler Setup Parameters (continued)

Factory Setting	Range / Choices	Parameter and Description
100	0 – 10,000 MBH	Boiler 1 Low Hold Rate Firing Rate the Control will hold boiler at for set Low Fire Hold Time after start.
0 min	0 – 20 min	Boiler 1 Low Hold Time Period the Control will hold boiler at Low Fire Hold Rate.
200°F (PSI)	60 – 230°F (PSI)	Boiler 1 High Alarm Setpoint (Visible when Hot Water system selected) Alarm used to alert operator to excessive temperature / pressure.
210°F	60 – 230°F	Boiler 1 Maximum Setpoint (Visible when Hot Water system selected) Boiler 1 Maximum Setpoint parameter allows each boiler to have a unique water temperature maximum setpoint. It is possible to set stainless steel boilers for a maximum setpoint of 190°F and copper boilers for a maximum setpoint of 230°F. The low selection of these parameters is used as the upper limit for the Active Setpoint when this boiler is in operation. This parameter limits outdoor air reset and Energy Management System (EMS) setpoint maximum value. When the “High Temperature System” parameter is enabled and water temperature setpoint is higher than this parameter, the boiler is shutdown, passes the lead, and shows boiler status as “Blocked”.
140°F	60 – 230°F	Boiler 1 Minimum Setpoint (Visible when Hot Water system selected) Boiler 1 Minimum Setpoint parameter allows each boiler to have a unique water temperature minimum setpoint. It is possible to set stainless steel boilers for a minimum setpoint of 60°F and copper boilers for a minimum setpoint of 140°F. The high selection of these parameters is used to limit the outdoor air reset and Energy Management System (EMS) setpoint minimum value. This parameter is used as the lower limit for the Active Setpoint when this boiler is in operation.
None	None, Installed	Isolation Valve Enable (Visible when Hot Water system selected) Enables the use of an Isolation Valve output. For use with PCB-12 kit (see Table 24: Replacement Parts). There can be a total of 4 valves “installed” in the boiler network.
N/A	N/A	Boiler 1 Name (Visible when Hardwired boiler model selected) A nine character name that will appear below “Hardwired” everywhere the Boiler Model parameter is displayed.
Disabled	Enable Disable	S7800 Modbus Module Enable (Visible when RWF55 control selected) Enables the use of a Honeywell S7800 Modbus Module installed on a Flame Safeguard. Every RWF55 connected can have a S7800 enabled. The module will send boiler state and lockout codes to Conductor.

Troubleshooting

General Issues



WARNING

Electrical Shock Hazard. Turn off power to panel before working on wiring. This panel must only be serviced by skilled and experienced service technician.

Troubleshooting when “Help” icon



NOT flashing;

Table 18: General Issue Troubleshooting

Indication	Condition	Possible Cause
Boiler is not responding to call for heat, Sequencer Status shows “Start...”, but Boiler Status shows “Standby”.	Demand Not Detected	<p>Boiler is not seeing Enable/Disable From the Conductor.</p> <ul style="list-style-type: none"> • If boiler is hardwired check for loose wiring connection, or miswiring. • Check boiler remote demand settings (see Table 7 on page 37) • Firmware version on controller may be incorrect. Update to latest version.
All 4 LEDs on PLC are on. All boilers show “Off Network” on display. Erratic display behavior.	Controller Crash	A boiler on the network may be enabled as a Master. Set all boilers to Slave, and power cycle the Control.
Display completely dark, no green power light on Display, Control, 24Vdc power supply, or Ethernet Switch	No 120Vac Power at the Control	<ul style="list-style-type: none"> • Check breaker and wiring between breaker and Conductor. • Blown high voltage fuse or breaker tripped.
No green power light on Control, but Display has power	No 24Vdc Power at Control	<ul style="list-style-type: none"> • Check 24Vdc power supply and wiring to and from it • Blown fuse on PCB-11

Troubleshooting

General Issues

Faults are investigated by selecting the “Help” button from the “Home” screen. When a fault is active the “Help” button flashes red. Continue selecting the flashing buttons to be directed to the Fault cause.

The figure consists of two screenshots from the Thermal Solutions control interface. The top screenshot shows the 'Home' screen with a 'Sensor Fault' indicated by a flashing red 'HELP' icon in the top navigation bar. A yellow arrow points from the 'HELP' icon to a text box explaining its function. Another yellow arrow points from the 'HELP' icon to a 'Sensor Fault' label. A third yellow arrow points from the 'Alarm Reset' button to a text box explaining its function. A fourth yellow arrow points from the 'Protocol 0 Link 1 Station 255' message to a 'Communication Fault' label. The bottom screenshot shows the 'Help' menu with a grid of options. A yellow arrow points from the 'Sensor Status' option in the grid to the 'Sensor Fault' label.

HELP icon available on all screens. Active Fault shown by flashing outline.

Select flashing **HELP** icon to follow cause of fault. Select flashing menu item to continue fault investigation.

Sensor Fault

Communication Fault

Select **ALARM RESET** push button to silence active alarms; stopes **HELP** icon flashing outline and opens **ALARM CONTACT OUTPUTS**. Alarm menu window outline remains flashing and Alarm History list captures events.

System Temperature High/Low	Return Temperature Low	Pump Faults
Boiler Fault	Sensor Status	Firing Rate I/O Status
Sequencer Status	ALARM RESET	Discrete I/O Status
Service Contacts	EMS Status	Isolation Valve I/O Status

Figure 27: General Alarms

Troubleshooting

General Issues

Table 19: Display Issues

Indication	Condition	Possible Cause
Blank Screen with "Reading" shown	Display lost communication with control	Failure to establish Communication upon display boot-up. Once you establish communication, reboot display to read controller and setup display properly.
Communication Error 2	Communication Fault	The display write attempt has failed. Possible causes are that the password level is too low for the parameter being changed, the controller is un-configured, or has a memory failure. Consult Factory
Communication Error 3	Communication Fault	Display has lost communication with controller. <ul style="list-style-type: none"> - Loose or defective display harness - Defective Display - Defective Control - Incorrect Communication Parameters
Communication Error 6 or 7	Communication Fault	Display and control have mismatching tags. Possible causes are that either the display or controller software revision is out of date. Update the display and controller with the most recent revision, and reboot the Control.
Protocol 0 Link 1 Station 255	Communication Fault	Display has lost communication with the controller. <ul style="list-style-type: none"> - Loose or defective display harness - Defective Display - Defective Control - Incorrect Display IP address. - Factory default is 10.0.0.101, Subnet 255.255.255.0, Gateway 10.0.0.1

Table 20: General Issues

Indication	Condition	Possible Cause
No boiler running	Temperature of water higher than the OFF POINT.	Boilers will come on automatically when system water temperature drops below ON POINT.
	Boilers in local mode and boiler water temperature is above OFF POINT.	Switch to remote or wait for temperature to drop below ON POINT.
Touch Screen is not lit	Breaker in Conductor Panel in OFF or tripped.	Turn on breaker in Conductor Panel.
	Power feeding Conductor Panel is OFF or tripped.	Turn on breaker feeding Conductor Panel.
	Improper power supply to panel.	Check voltage and correct as needed. Panel requires 120VAC wired to 4 amp circuit breaker inside panel.
	Power to screen is not connected.	Check wiring and correct as needed, 24VDC
	Improper power supply to screen.	Screen uses 24VDC from PLC. Check voltage and correct if needed.
	Bad touch screen.	Replace screen.
No data being displayed on screen and no communication error or data on screen is not updating	Modbus communication wires shorted together on any temperature controller or flame safeguard.	Check Modbus wires A & B on all controllers for location where wires are touching each other and separate.

Troubleshooting

Sensor Status

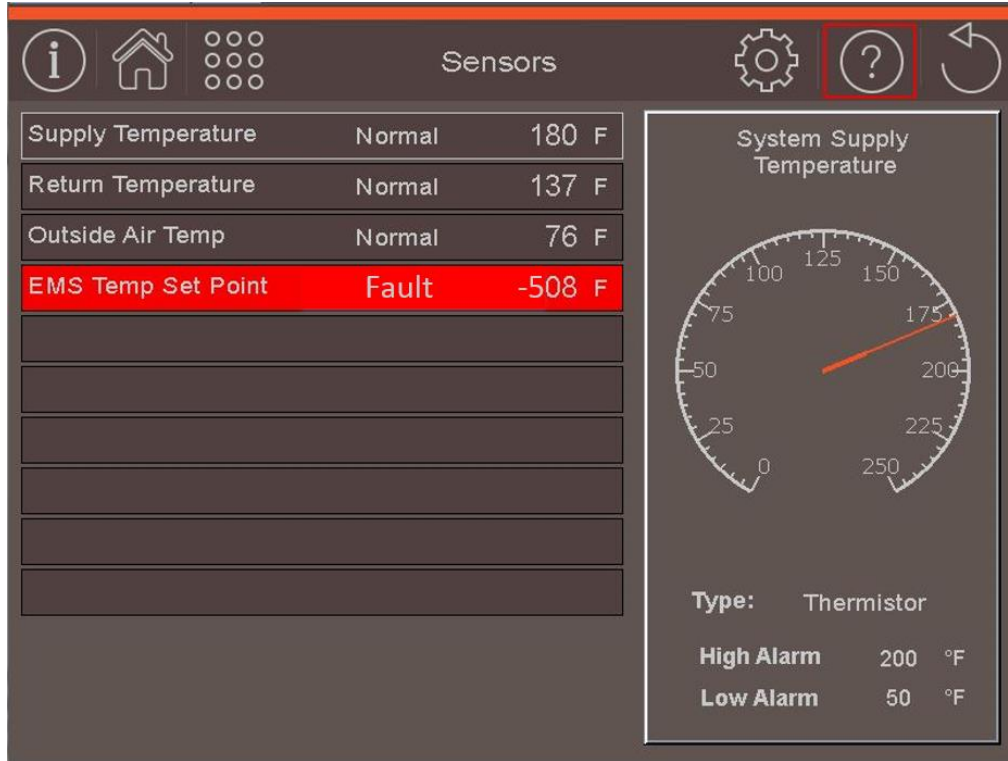


Figure 28: Sensor Screen with Shorted EMS Wired Setpoint Sensor

The sensor status screen is selected from the **MAIN** or **HELP** menus. A failed sensor is shown with a red background. By selecting on the individual sensors a larger display “gauge” with applicable limits is provided. When a sensor fails by being open or shorted, the value shows “-768” or “-508” to indicate that there is a fault with the sensor.

Each Sensor is provided with the following diagnostic information:

Table 21: Sensor Status

Indication	Possible Cause
Blank Rectangle (Not Installed)	The sensor has not been configured. As shown in Figure 28 above, the Pump Feedback, and Steam system sensors have not been configured. Refer to the Parameter Adjustment section for additional information.
Fault	<p>Check sensor wiring. Sensor open will show if the sensor has not yet been wired to the boiler or if a wire is loose.</p> <p>NOTE The below list of sensor pairs MUST be set to the identical sensor type. If different sensor types are selected both sensors are set to SENSOR FAULT. The sensor type must be identical on the following sensor pairs:</p> <p>System Supply and Return Temperature Sensors, Boiler Shell Temperature A and B, Boiler Shell Temperature C and D.</p>

Troubleshooting

Alarms

The Control generates alarms for system performance faults as well as individual boiler faults. All faults can be found through the Help screen. Below is an in-depth guide to all possible lockouts.

Table 22: Control Alarms

Flashing Red Outline	Condition	Possible Cause
System Alarms		
System Temperature High/Low	Supply Water Temperature <u>above</u> alarm setpoint	<p>High Temperature</p> <ul style="list-style-type: none"> • Heating load less than minimum firing rate of the boilers • Defective system pump or no flow in primary loop. • Inadequate boiler water flow. Verify that circulator is operating and that circulator and piping are sized per Installation Instructions manual of boilers.
	Supply Water Temperature <u>below</u> alarm setpoint	<p>Low Temperature</p> <ul style="list-style-type: none"> • Heating load greater than maximum firing rate of the active boilers and/or sequence did not start additional boilers quickly enough. • System pump running at too high a speed. • Boiler fault or miswired so that the boilers did not start when called.
Return Temperature Low	Return Water Temperature below alarm setpoint	Consider system or operational changes to avoid low temperature events. This parameter is used for Non-condensing boilers. Note that a low temperature alarm time delay parameter may be used to avoid nuisance alarms.
System Pressure High/Low	Steam Pressure <u>above</u> alarm setpoint	<p>High Pressure</p> <ul style="list-style-type: none"> • Heating load less than minimum firing rate of the boilers
	Steam Pressure <u>below</u> alarm setpoint	<p>Low Pressure</p> <ul style="list-style-type: none"> • Heating load greater than maximum firing rate of the active boilers and/or sequence did not start additional boilers quickly enough. • Boiler fault or miswired so that the boilers did not start when called.
Pump Faults	Flow Switch for a system pump is <u>NOT</u> made when pump is energized	<ul style="list-style-type: none"> • Pump not wired, pump operation does not occur when commanded. • Flow switch not installed. • Defective system pump
Sequencer Status	Boiler is Configured and not detected on the network	<ul style="list-style-type: none"> • Boiler Modbus wiring is disconnected or miss wired. • Boiler Modbus address incorrect. Ensure boiler address matches address shown on the Conductor “Sequencer Status” screen. • Bad Ethernet connection. Check cables and connection points. • Baud rate setting on boiler control is wrong. (see Table 7: Setup Overview on page 37)
EMS Status	An EMS Write parameter has a fault	<ul style="list-style-type: none"> • EMS Wired Setpoint has bad signal quality, or is open or shorted. • EMS Modbus/BACnet Setpoint has received a value out of the acceptable range.

Troubleshooting Alarms

Table 22: Control Alarms (continued)

Flashing Red Outline	Condition	Possible Cause
Boiler Alarms		
Boiler Supply Temperature High	Boiler Supply Sensor detected temperatures exceeding High Limit.	<ul style="list-style-type: none"> • Heating load less than minimum firing rate of the boilers. • Defective system pump or no flow in primary loop. • Inadequate boiler water flow. Verify that circulator is operating and that circulator and piping are sized per Installation Instructions manual of boilers. • Control system miswired so that the boiler operation is permitted when no zones are calling.
Boiler Shell Temperature High	Boiler Shell Sensor detected temperatures exceeding High Limit.	<ul style="list-style-type: none"> • Rate of load change too high • Alarm setpoint too low.
Lead Boiler Fault	Boiler experienced fault while selected as Lead	<ul style="list-style-type: none"> • Boiler experienced a Start Fault (see item below). • Boiler was “Blocked” when selected as lead (see High Temperature System parameter in Table 9: Setpoint Parameters) • Communication was lost between boiler and the Control (see Sequencer Status Alarm). • Boiler failed to start. Consult boiler manual for possible causes.
Start Fault	Boiler was called to start and failed to do so	<ul style="list-style-type: none"> • Power off to boiler. • Modbus wiring disconnected on boiler showing alarm. • Boiler limits were not made within the set Limit Fault Time (see Table 12: Master Sequencer Parameters). • Boiler failed to reach “Run” state within the set Net Start Dwell time (see Table 12: Master Sequencer Parameters). • Boiler failed to start. Consult boiler manual for possible causes.
S7800 Module Lost	Module is enabled on boiler, and communication is lost.	<ul style="list-style-type: none"> • Power off to boiler • Modbus wiring incorrect or disconnected • Communication settings on module incorrect
Lockout	Boiler Lockout signal was received	<ul style="list-style-type: none"> • If boiler is Hardwired, check for miswiring or short on lockout contact, PCB-11: B11–B18. • Consult boiler manual for cause of lockout.

Troubleshooting Using Archives

The archives are a fundamental resource for the users interested in commissioning, optimizing and troubleshooting an issue with the Control. Using the archives, a user may review up to 4 months of sensor values, up to 3000 alarms, lockout history or cycle and run history. Data may be simply viewed on screen or exported to a thumb drive for detailed analysis.

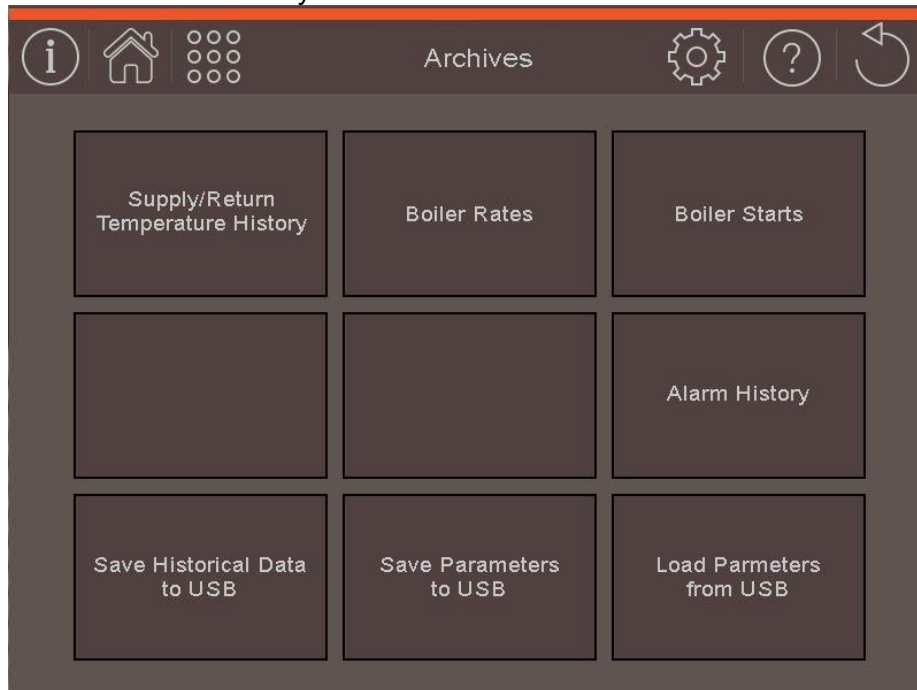
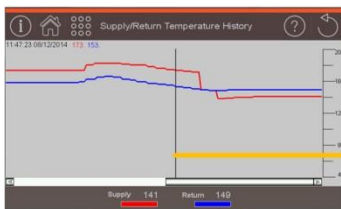


Figure 29: Archives Menu

Supply/Return Temperature History / Boiler Rates / Boiler Starts

Supply, Return, rate and start data provides an opportunity to investigate issues, learn about system operation or fine tune the boiler. Values are stored on the display for up to 4 months. Data may be easily backed up to a thumb drive. Historical data values are viewed by scrolling left and right, the further left, the older the data. By touching the trend at any location, the exact data points will display as well as the Date and Time at which they were recorded.



Touch at any point in the graph to show the exact data, and Time and Date it was taken at.

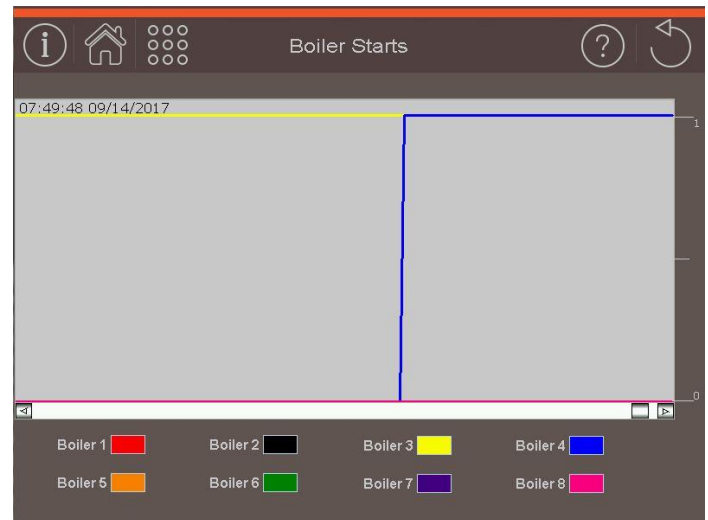


Figure 30: Boiler Start Trend

Troubleshooting

Using Archives

Alarm History

The alarm history is a powerful tool that will record up to 3000 alarms. These alarms include **Lockouts, Holds, Sensor Faults, Lead Faults, Start Faults, EMS Communication Error or Loss, and Boiler-to-Boiler Network Communication Loss.**

The alarms are recorded in a list with the most recent appearing at the bottom. The alarm list can be scrolled through to investigate past alarms, and most current alarms. The alarms are given a date, and time stamp which allows for better troubleshooting capability. The alarm list may be downloaded to a USB in the form of a spreadsheet by using the **Save to Historical Data** function in the **Archives Menu.**



Figure 31: Alarm History

Troubleshooting

Using Archives

USB Thumb Drive Requirements

The Thumb Drive **must** be formatted as a FAT32 for use with the display. In order to check the format of a USB Thumb Drive, follow these instructions:

- Plug the USB Drive into a computer
- Ensure that the USB Drive does not have anything currently saved on it.
- Go to My Computer (Select Start > Computer)
- Right click on the “Removable Disk” and select Properties
- Under the “General” tab confirm “File system: FAT32”
- If it does not say FAT32, close window, return to My Computer
- Right Click on the “Removable Disk” and select Format
- Select File system = FAT32
- Select Start and then select OK to format the USB Thumb Drive.
- The USB Thumb Drive is now FAT32 format

Save Historical Data

“Save Historical Data” will save historical parameter data, and the current alarm list as spreadsheets to the USB Drive that is plugged into the Boiler Display. The files will have a date code in the file name, year/month/date, of when they were saved from the boiler. That CSV files will be saved to the USB thumb drive under the following path:

My Computer > Removable Disk (USB Drive) > HMI > HMI000 > @HMI0001 > CSV

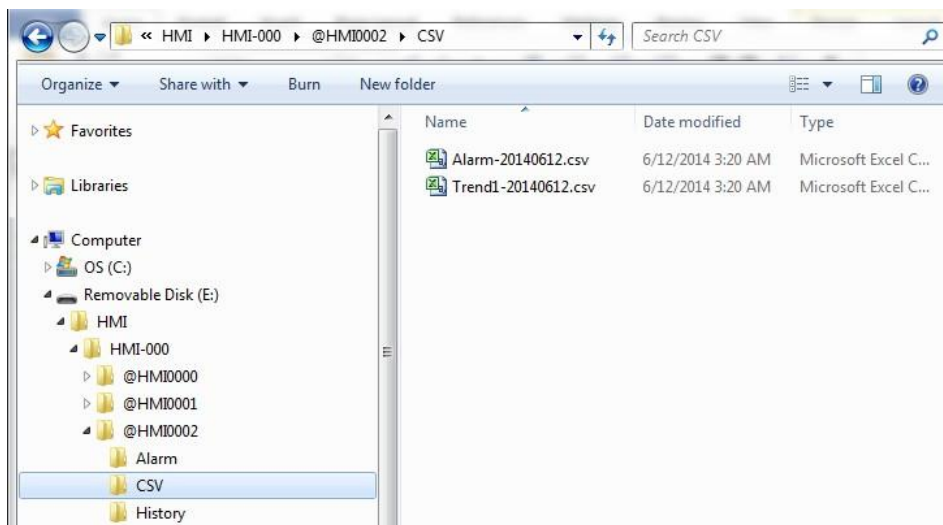


Figure 32: USB History Files

NOTICE

“@HMI0001” is newer than “@HMI0000”. If another set of historical data is saved from the display, the new file will be saved as @HMI0002. The highest number is the newest data.

“Trend1-20140612.csv” & “Alarm20140612” are the names of the files that saved from the boiler in the example above. The 20140612 is the date code of whenever the data was retrieved from the boiler. In the example shown it was the year 2014, the 6th month of the year, 12th day of that month.

Troubleshooting Using Archives

An example of the **Trend1-20141022.csv** file follows:

Firing Rate of Boilers									Boiler Starts							
	FR BLR1	FR BLR2	FR BLR3	FR BLR4	FR BLR5	FR BLR6	FR BLR7	FR BLR8	Stat BLR1	Stat BLR2	Stat BLR3	Stat BLR4	Stat BLR5	Stat BLR6	Stat BLR7	Stat BLR8
15:22:24	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:22:25	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:22:26	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:22:26	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:22:27	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:22:27	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:22:28	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:22:28	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:22:29	#####	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 33: Historical Trend File

Table 23: Boiler State

#	Sola Boiler State	TSBC Boiler State	RWF40/55 Boiler State	Hardwired Boiler State
0	Initiate	Undefined	Initiate	Unknown
1	Standby delay	Boiler Disabled	Standby	Off Network
2	Standby	Weather Shutdown	Purge	Disabled
3	Safe Startup	Lockout	Pilot Ignition	Blocked
4	Drive Purge	Pump Purge	Main Ignition	Available
5	Prepurge	Limit Hold	Run	Valve Opening
6	Drive Light-off	Purge/Pilot Ignition	Postpurge	Limit Hold
7	Preignition Test	Low Fire/Ignition	Pre-Ignition	Add stage
8	Preignition	Main Ignition	Valve Proving	Drive to Low Fire
9	PFEP	Low Fire Hold	-	Low Fire Hold
10	MFEP	Boiler Running	-	Running
11	Direct Ignition	Fan Post Purge	-	
12	Running	Pump Cool Down	-	
13	Postpurge	Standby	Alarm	
14	Lockout		Hold	
15			Lockout	

Troubleshooting Using Archives

An example of the **Alarm-20141022.csv** file follows:

Date and Time of alarm occurrence

10/16/2014	23:48:49	O	(LCI) ON/OFF Switch
10/16/2014	23:48:52	X	(LCI) ON/OFF Switch
10/21/2014	21:18:59	O	Hold 14, Delta T Inlet/Outlet High
10/21/2014	21:19:08	O	(LCI) ON/OFF Switch
10/21/2014	21:19:11	X	(LCI) ON/OFF Switch
10/21/2014	21:19:25	X	Hold 14, Delta T Inlet/Outlet High
10/21/2014	21:19:45	O	Lockout 4, Outlet/Supply High Limit
10/21/2014	21:20:18	X	Lockout 4, Outlet/Supply High Limit
10/21/2014	21:23:49	O	Lockout 4, Outlet/Supply High Limit
10/21/2014	21:24:13	X	Lockout 4, Outlet/Supply High Limit
10/21/2014	21:24:29	O	Lockout 4, Outlet/Supply High Limit
10/21/2014	21:24:33	X	Lockout 4, Outlet/Supply High Limit
10/21/2014	21:24:45	O	Lockout 4, Outlet/Supply High Limit

O means the alarm was tripped.
X means the alarm was cleared.

The alarm list is organized so that the newest alarms are at the bottom.

Figure 34: Alarm History File

Save Parameters to USB

“Save Parameters” saves the current parameter settings of the boiler, including the contact information of the contractor, Service Company, and sales representative, to a USB Drive. This allows for easy transfer of boiler parameters from one boiler to another. Refer to parameter summary for list of parameters.

Instructions for Save Parameters:

1. Plug USB thumb drive into USB Port on Boiler
2. Select Main Menu > Archives > Save Parameters to USB
3. Confirm or Cancel Save Parameters.

Once procedure is complete, the display saves two files in a directory as follows:

My Computer > Removable Disk (USB Drive) > HMI > HMI000 >
 - Parameter File: Recipe.csv
 - Contact Information Recipe32.csv:

Load Parameters from USB

“Load Parameters” loads the current saved parameter settings off a USB Drive. This allows for easy transfer of boiler parameters, and contact information from one boiler to another. Refer to parameter summary for list of parameters. Parameter files must be stored and named as follows:

My Computer > Removable Disk (USB Drive) > HMI > HMI000 >
 - Parameter File: Recipe.csv
 - Contact Information Recipe32.csv:

Instructions for Load Parameters:

1. Plug USB thumb drive into USB Port on Boiler
2. Select Main Menu > Archives > Load Parameters to USB
3. Confirm or Cancel Load of Parameters.
4. Confirm or Cancel Load of Contact Information.

Specifications

General

Part Number:

107327-01

Electrical Ratings:

Input Rating:

120Vac, 50VA

Interrupting Current Rating:

10KVA

Output Ratings:

Boiler Enable / Disable Outputs:

Max. Load 120Vac 8A

Boiler Isolation Valve Outputs:

Max. Load 120Vac 8A

Primary Pump Outputs:

Max. Load 120Vac 0.5A

Configurable Output:

Max. Load 120Vac 8A

Alarm Output:

Max. Load 120Vac 1.5A

Enclosure:

Enclosure: Type 1

Weight: 33 lbs.

Certifications:



UL File Number E490108

Operating Temperature:

32°F ~ 122°F (0°C ~ 50°C)

Storage/Shipping Temperature:

-4°F ~ 140°F (-20°C ~ 60°C)

Humidity:

90% RH, 32°F ~ 104°F (0 ~ 40°C),

55% RH, 105°F ~ 122°F (41 ~ 50°C)

Sensors:

RTD temperature sensors are PT 1000

Thermistor temperature sensors are 10k NTC

**Table 24: Temperature Sensors
(temperature versus resistance)**

Temp °C (°F)	10K NTC (kOhm) Beta of 3950	PT 1000 Alpha =0.00385
-30 (-22)	176.08	880
-20 (-4)	96.81	920
-10 (14)	55.25	960
0 (32)	32.64	1000
10 (50)	19.9	1040
20 (68)	12.49	1080
25 (77)	10	1100
30 (86)	8.06	1120
40 (104)	5.32	1150
50 (122)	3.6	1190
60 (140)	2.49	1230
70 (158)	1.75	1270
80 (176)	1.26	1310
90 (194)	0.92	1350
100 (212)	0.68	1390
110 (230)	0.51	1420
120 (248)	0.39	1460

Display (Delta)

Electrical Ratings:

Operating voltage:

24Vdc (21.6 to 27.6 Vdc)

Backup Battery:

3V Lithium Battery CR2032, about 3 years operating life with power removed. Battery used to maintain time and date clock, not display memory.

Controller

Electrical Ratings:

Operating voltage:

24Vdc (20 to 38 Vdc)

Specifications

General

Table 25: Replacement Parts

Part Number	Name	Description
107315-01	Control	Programmed Control Modicon PLC TM172PBG42R
107317-02	Display	Programmed Display, Delta 7 inch touch screen, DOP-107EG
CR2032	Display Battery	3V Lithium Battery. Used to maintain time and date clock.
107329-01	Ethernet Switch	Ethernet Switch, 5 ports Delta DVS-005
107226-01	Power Supply	Power Supply, Delta 24Vdc, 60W, Commercial boilers Model: EOE11010006
107309-01	PCB-10	PCB-10 Sequencer Master Connections Commercial Boiler
107310-01	PCB-11	PCB-11 Sequencer Slave Connections Commercial Boilers
107311-02	PCB-12 kit	PCB-12 Relay Board with snap track mounting bracket.
101935-01	<u>Direct Immersion Type</u> Temperature Sensor	10K ohm, single element, two wire thermistor type, Direct Immersion temperature sensor. Insertion is ½" NPT.
801SOL0012	Outdoor Sensor	10k ohm, single element, two wire thermistor type, temperature sensor, outdoor air temperature sensor with weather proof box and protective sleeve.
105685-01	<u>Thermowell Type</u> Temperature Sensor	10K ohm, single element, two wire thermistor type, temperature sensor, suitable for insertion into thermowells. Thermowell not included.
105684-01	Thermowell	½"NPT Brass Immersion Well.
106416-02	BACnet (Metasys N2 Open) Universal Gateway Kit (includes gateway & manual)	Energy Management Systems (EMS) Universal Gateway translates Modbus 485 to BACnet MS/TP, BACnet/IP, Metasys N2 Open, or Modbus TCP. Compatible with Concert Boiler Control, Apex Boiler Control (ABC), Thermal Solutions Boiler Control (TSBC), Sage2.1 Control and Conductor .
106418-02	LonWorks Universal Gateway Kit (includes gateway & manual)	Energy Management Systems (EMS) Universal Gateway translates Modbus 485 to LonWorks. Compatible with Concert Boiler Control, Apex Boiler Control (ABC), Thermal Solutions Boiler Control (TSBC), Sage2.1 Control and Conductor

Specifications

Parameter Summary

Table 26

USB	Parameter	Range	Security	Page
EMS Communication Menu				
X	EMS Communication	Modbus / BACnet MS/TP / BACnet IP	Supervisor	24
	Conductor IP Address	10.0.0.100 (default)	Supervisor	24
	Subnet Mask	255.255.255.0 (default)	Supervisor	24
	Gateway IP	10.0.0.1 (default)	Supervisor	24
X	Conductor RS485-1 Address	1 - 255	Supervisor	24
X	EMS Port Baud Rate	9600, 19200, 38400, 76800	Supervisor	24
X	EMS Parity	None, Odd, Even	Supervisor	24
X	BACnet Device Instance	1 - 4192303	Supervisor	24
X	Setpoint Source	Local / Wired / EMS	Supervisor	25
X	Local / Remote Control	Local / Remote	Basic	25
X	Wired Range Minimum Setpoint	60 – 230°F	Supervisor	25
X	Wired Range Maximum Setpoint	140 – 230°F	Supervisor	25
System Menu				
X	Temperature Units	Fahrenheit / Celsius	Basic	42
	System Date	xx/xx/xxxx	Basic	42
	System Time	xx:xx:xx	Basic	42
X	Auto Jump to Home Page	Enable / Disable	Basic	42
	Supervisor Password	XXXXXX	Basic	42
X	Brand	Thermal Solutions / Bryan Boilers	Basic	42
Setpoints Menu				
X	Setpoint	60 - 230°F / 0-15 PSI / 0-30 PSI / 0-100 PSI / 0-200 PSI / 0-300 PSI	Supervisor	43
X	High Temp System	Enable / Disable	Supervisor	43
X	Off Point	3 - 29°F / 1 - 10 PSI	Supervisor	43
X	On Point	3 - 29°F / 1 - 10 PSI	Supervisor	43
X	Use Last On Point	80 - 180°F	Supervisor	43
X	High Temp Stop	140 - 230°F	Supervisor	43
X	DHW Setpoint	140 - 230°F	Supervisor	44
X	Warm Standby Enable / Disable	Enable Disable	Supervisor	44
X	Warm Standby Setpoint	60 F to 350 F	Supervisor	44
X	Warm Standby Off Point	3 to 29 (°F)	Supervisor	44
X	Warm Standby On Point	3 to 29 (°F)	Supervisor	44
X	Low Fire Hold Temp	80 – 220°F	Supervisor	44
X	Low Fire Hold Type	Timer / Sensor	Supervisor	44
X	WWSD Setpoint	40 - 90°F	Supervisor	44
X	WWSD Enable	Off / Boiler / Both	Supervisor	45
X	High Alarm Setpoint	60 - 230°F / 0-300 PSI	Supervisor	45
X	Low Alarm Setpoint	40 - 230°F / 0-300 PSI	Supervisor	45
X	Return Low Alarm	40 - 230°F	Supervisor	45
X	Return Low Time Delay	0 - 900s	Supervisor	45
X	Shell High Alarm	60 - 500°F	Supervisor	45

Specifications

Parameter Summary

Table 26

USB	Parameter	Range	Security	Page
Reset Menu				
X	Reset Enable	Enable / Disable	Supervisor	46
X	OAR Max Outdoor Temp	35 - 100°F	Supervisor	46
X	OAR Min Outdoor Temp	-50 - 32°F	Supervisor	46
X	OAR Low Water Temp	70 - 180°F	Supervisor	46
Operational Menu				
	Master Off / Auto Control Switch	Off / Auto	Supervisor	39
	Manual Firing Rate	0 - 100%	Supervisor	39
	Manual / Auto Control Switch	Manual / Auto	Supervisor	39
	Manual Lead	Boiler 1 - 8	Basic	12
X	Pump A HOA	On / Off / Auto	Supervisor	52
X	Pump B HOA	On / Off / Auto	Supervisor	52
X	Pump Lead Selection	Pump A / Pump B / Auto Rotate	Supervisor	52
X	Pump Rotation	8 - 720 hours	Supervisor	52
X	Pump Overlap Time	5 – 600 seconds	Supervisor	52
X	Isolation Valve A HOA	Open / Closed / Auto	Supervisor	53
X	Isolation Valve B HOA	Open / Closed / Auto	Supervisor	53
X	Isolation Valve C HOA	Open / Closed / Auto	Supervisor	53
X	Isolation Valve D HOA	Open / Closed / Auto	Supervisor	53
X	Valve Open Delay	0 – 180 seconds	Supervisor	53
X	Valve Overrun Time	0 – 300 seconds	Supervisor	53
Load Monitoring Menu				
X	Load Monitoring	None / Pump Feedback / Pump Running	Supervisor	47
X	Minimum System Pump Flow	0 – 1000 GPM	Supervisor	47
X	Maximum System Pump Flow	0 – 1000 GPM	Supervisor	47
Master Sequencer Menu				
X	P Gain	0 – 100	Supervisor	47
X	I Gain	0 – 1200	Supervisor	47
X	Net Start Dwell	16 – 420s	Supervisor	47
X	Limit Fault	3 – 120s	Supervisor	48
X	High Fire Limit	25 – 100%	Supervisor	48
X	Base Rate	25 – 100%	Supervisor	48
X	DPM Hold Off	1 - 10°/min	Supervisor	48
X	Start Trigger	50 – 100%	Supervisor	48
X	Stop Trigger	0 – 50%	Supervisor	48
X	High Helper Firing Rate	50 – 100%	Supervisor	48
X	Low Helper Firing Rate	0 – 50%	Supervisor	48
X	Boiler On Delay	60 – 900s	Supervisor	48
X	Boiler Off Delay	0 – 900s	Supervisor	48
X	% Firing Rate On Delay	1 – 30 min	Supervisor	49
X	% Firing Rate Off Delay	1 – 30 min	Supervisor	49
X	Rotation	Auto Rotate / Manual	Basic	49

Specifications

Parameter Summary

Table 26

USB	Parameter	Range	Security	Page
Master Sequencer Menu				
X	Rotation Time	8 – 720 hours	Supervisor	49
X	Modulation Type	Unison / Sequential	Supervisor	49
	Lead Overlap Time	0 – 20 minutes	Supervisor	49
Input/Output Configuration Menu				
X	System Supply Temperature Sensor Type	Unconfigured / Thermistor / 4-20mA / RTD	Supervisor	50
X	System Return Temperature Sensor Type	Unconfigured / Thermistor / 4-20mA / RTD	Supervisor	50
X	System Supply/Return Temperature 4-20mA Range Minimum	0 - 230°F	Supervisor	50
X	System Supply/Return Temperature 4-20mA Range Maximum	0 - 230°F	Supervisor	50
X	Outdoor Temperature Sensor Type	Unconfigured / Thermistor / RTD	Supervisor	50
X	EMS Setpoint Sensor Type	Unconfigured / 4-20mAdc / 0-10Vdc	Supervisor	50
X	System Pump Feedback Sensor Type	Unconfigured / 4-20mAdc / 0-10Vdc	Supervisor	50
X	Steam Pressure Sensor Type	Unconfigured / 4-20mAdc / 0-10Vdc	Supervisor	51
X	Pressure Units	0-15 PSI / 0-30 PSI / 0-100 PSI / 0-200 PSI / 0-300 PSI	Supervisor	51
X	Boiler A Shell Temperature Sensor Type	Unconfigured / Thermistor / RTD / Discrete Input	Supervisor	51
X	Boiler B Shell Temperature Sensor Type	Unconfigured / Thermistor / RTD / Discrete Input	Supervisor	51
X	Boiler C Shell Temperature Sensor Type	Unconfigured / Thermistor / RTD / Discrete Input	Supervisor	51
X	Boiler D Shell Temperature Sensor Type	Unconfigured / Thermistor / RTD / Discrete Input	Supervisor	51
X	Boiler A Firing Rate Output Type	1-9Vdc / 0-10Vdc / 2-10Vdc / 4-20mAdc	Supervisor	51
X	Boiler B Firing Rate Output Type	1-9Vdc / 0-10Vdc / 2-10Vdc / 4-20mAdc	Supervisor	51
X	Boiler C Firing Rate Output Type	1-9Vdc / 0-10Vdc / 2-10Vdc / 4-20mAdc	Supervisor	51
X	Boiler D Firing Rate Output Type	1-9Vdc / 0-10Vdc / 2-10Vdc / 4-20mAdc	Supervisor	51
X	Configurable Input	Verify / Alarm / Alarm Reset	Supervisor	51
X	Configurable Output	Fresh Air Damper / Boiler Running / DHW Pump	Supervisor	52
X	Alarm Output	Lockout / General Alarm	Supervisor	52
Boiler Menu (Typical for Boiler 1 through 8)				
X	Boiler Model	Hardwired / Any T.S. Boiler	Supervisor	54
X	Boiler Control	Hardwired / TSBC / Sage (4716) / RWF40 or RWF55	Supervisor	54
X	Boiler Size	0 - 30,000 MBH	Supervisor	54
X	Boiler Minimum Modulation Rate	0 - 30,000 MBH	Supervisor	54
X	Boiler Type	Condensing / Non-Condensing	Supervisor	54
X	Boiler Sequence Order	Normal Order / Use First / Use Last	Supervisor	54
X	Boiler Low Fire Hold Rate	0 - 10,000 MBH	Supervisor	55
X	Boiler Low Fire Hold Time	0 – 20 min	Supervisor	55

Specifications Parameter Summary

Table 26

USB	Parameter	Range	Security	Page
Boiler Menu (Typical for Boiler 1 through 8)				
	Boiler HOA	On / Off / Auto	Basic	40
	Boiler Manual / Auto Control Switch	Manual / Auto	Basic	40
	Boiler Manual Rate	0 - 100%	Basic	40
X	Boiler High Alarm Setpoint	60 – 230 (°F)	Supervisor	55
X	Boiler Maximum Setpoint	60 – 230°F	Supervisor	55
X	Boiler Minimum Setpoint	60 – 230°F	Supervisor	55
X	Shell Temperature Enable	Enable / Disable	Supervisor	55
X	Boiler Isolation Valve	Installed / None	Supervisor	55
X	Boiler Name	XXXXXXXXXX	Supervisor	55

NOTES: “Load Parameters” loads the current saved parameter settings off a USB Drive. This allows for easy transfer of boiler parameters and contact information from one boiler to another.

Thermal Solutions *("seller")*

LIMITED WARRANTY

LIMITED WARRANTY

Subject to the terms and conditions herein and except as provided below with respect to products or parts not manufactured by Thermal Solutions, Seller warrants to the original owner at the original installation site that products manufactured by Seller ("Products") comply, at the time of manufacture, with recognized hydronics industry regulatory agency standards and requirements then in effect and will be free from defects in materials and workmanship for a period of 3 years from date of shipment (the "Warranty Period"). For products or parts not manufactured by Thermal Solutions, the warranty obligations of Thermal Solutions shall, in all respects, be limited to one year.

REMEDY

A. The sole remedy for breach of this warranty is expressly limited to the repair or replacement of any part found to be defective under conditions of normal use within the Warranty Period. Labor for removal and/or installation is not included.
B. Warranty - The owner must notify the original installer of the Product and Seller (Attention: Thermal Solutions, P.O. Box 3244, Lancaster, PA 17604-3244), in writing, within the Warranty Period, providing a detailed description of all claimed defects. Transportation to a factory or other designated facility for repairs of any products or items alleged defective shall, in all events, be the responsibility and at the cost of the owner.

EXCLUSIONS

Seller shall have no liability for and this warranty does not cover:

A. Incidental, special or consequential damages, such as loss of the use of products, facilities or production, inconvenience, loss of time or labor expense involved in repairing or replacing the alleged defective Product.
B. The performance of any Product under conditions varying materially from those under which such Product is usually tested under industry standards as of the time of shipment.
C. Any damage to the Product due to abrasion, erosion, corrosion, deterioration, abnormal temperatures or the influence of foreign matter or energy.

D. The design or operation of owner's plant or equipment or of any facility or system of which any Product may be made a part.

E. The suitability of any Product for any particular application.

F. Any failure resulting from misuse, modification not authorized by Seller in writing, improper installation or lack of or improper maintenance.

G. Equipment furnished by the owner, either mounted or unmounted, or when contracted for by the owner to be installed or handled.

H. Leakage or other malfunction caused by:

1. Defective installations in general and specifically, any installation which is made:

a. in violation of applicable state or local plumbing housing or building codes,

b. without a certified ASME, pressure relief valve, or
c. contrary to the written instructions furnished with the unit.

2. Adverse local conditions in general and, specifically, sediment or lime precipitation in the tubes and/or headers or corrosive elements in the atmosphere.

3. Misuse in general and, specifically, operation and maintenance contrary to the written instructions furnished with the unit, disconnection, alteration or addition of components or apparatus, not approved by seller, operation with fuels or settings other than those set forth on the rating plate or accidental or exterior damage.

I. Production of noise, odors, discoloration or rusty water.

J. Damage to surrounding area or property caused by leakage or malfunction.

K. Costs associated with the replacement and/or repair of the unit including: any freight, shipping or delivery charges, any removal, installation or reinstallation charges, any material and/or permits required for installation reinstallation or repair, charges to return the boiler and or components.

Seller's liability under this warranty shall not in any case exceed the amount paid for the Product found to be defective.

THIRD-PARTY WARRANTIES

For goods or components not manufactured by Seller, the warranty obligations of Seller shall, in all respects, conform and be limited to one year from the date of shipment

SEVERABILITY

To the extent that any provision of this warranty would be void or prohibited under applicable law, such provisions shall be limited in effect to the minimum extent necessary to render the remaining provisions hereof enforceable.



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