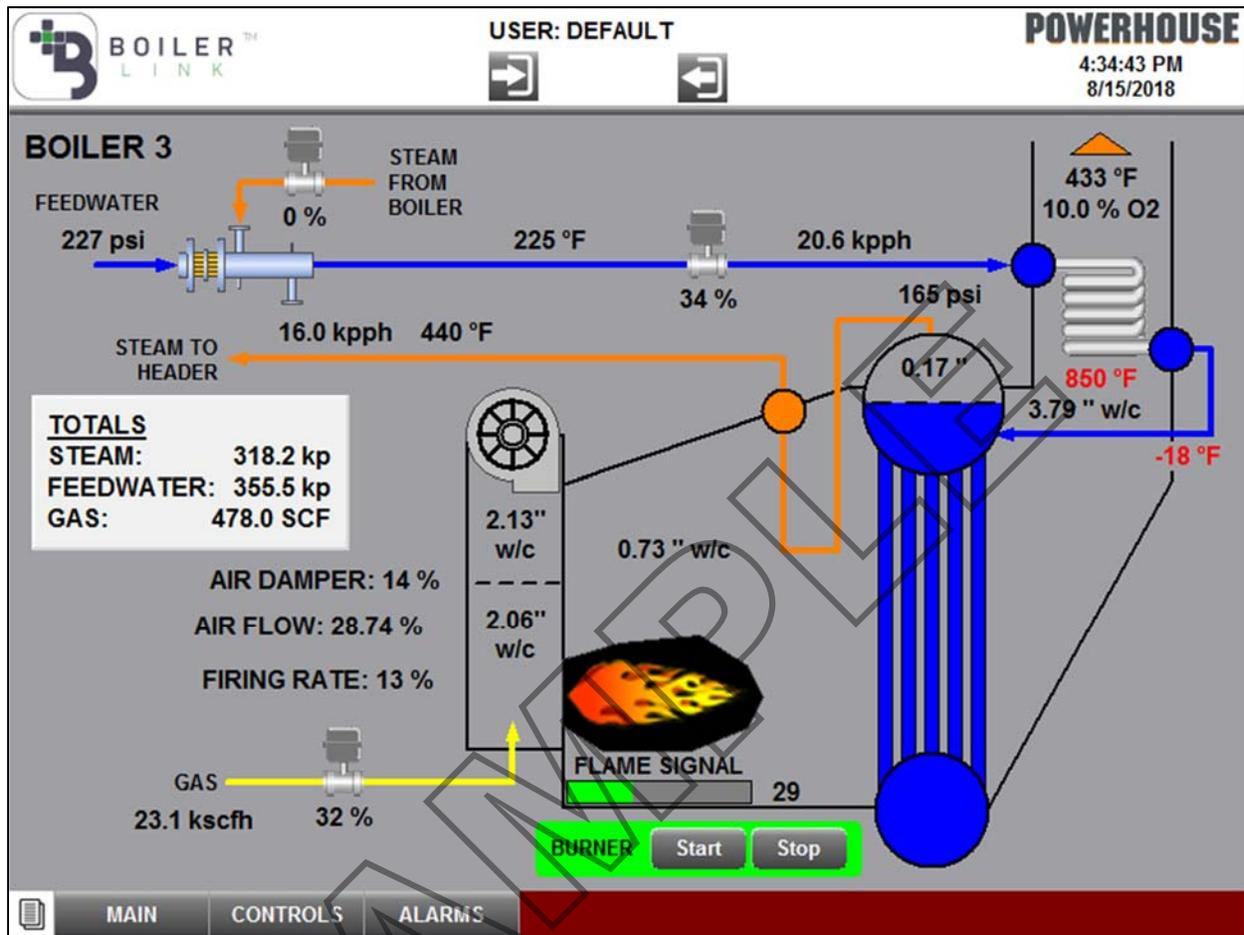


Chapter 1 PLC Operation



Main Screen
Figure 1

The boiler is operated via the BoilerLink™ controls system comprised of an Allen-Bradley CompactLogix Programmable Logic Controller (PLC) and PanelView Operator Interface Terminal (OIT). The primary operator interaction is via the PanelView OIT.

Main Screen: Boiler

The Main screen (Fig. 1) of the OIT displays information on the boiler and is also the means to operate the boiler. Access to the control interfaces and other screens are via the OIT.

When the boiler is not running the background of the Burner Start/Stop pushbutton faceplate will be gray. To start the burner, press the Start button. The faceplate background will turn green indicating the burner start command is being transmitted to the Fireye YB100 burner management relay (BMR). To stop the burner, press the Stop button.

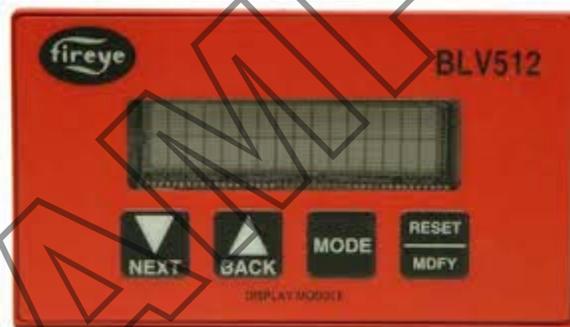
POWERHOUSE

The burner ignition sequence is initiated when the burner start command is received by the BMR. The BMR monitors the various interlocks required to ensure the safe and proper ignition and operation of the burner. During the burner ignition sequence the BMR transmits signals back to the PLC to start the forced draft (FD) fan and to adjust the air damper to the purge position and low fire position prior to ignition. Once the low fire position is obtained the BMR completes the ignition sequence by igniting the pilot flame and, ultimately, the main flame.

During the burner ignition sequence the status of the sequence is displayed on the boiler. Before the burner is started the displayed status will be Idle. When the sequence is started the displayed status will transition from Blower On, to High Fire Purge, to Low Fire Purge, followed by the small flame when the pilot is ignited. A larger flame will appear when the main flame is ignited and firing. Other status indicators (Postpurge, Alarm, Lockout, Alarm & Lockout) will also display under certain conditions. Below the burner status the Flame Signal is displayed both graphically and numerically.

The low fire hold symbol **LFH** will appear on the boiler if the boiler steam pressure is below the low fire hold setpoint (see *Alarms*). In this condition the boiler steam pressure control loop is set to an override state and the output to the air damper and fuel control valve is forced to the low fire position.

Once the main flame is ignited the BMR continues to monitor the safety interlocks and alarms and will shut down the burner if any of the interlocks are not satisfied. Should an interlock be triggered the specific cause is indicted on the Fireeye display (Fig. 2) mounted above the OIT.



Fireeye Display
Figure 2

Any unsatisfied BMR interlock will generate a BMR Control Alarm. See *Alarms* for more details.

The FD fan will continue to run until the Burner Start/Stop pushbutton is pressed.

The steam, feedwater and gas flows are totaled by the PLC and displayed on the Main OIT screen. The totaled flows automatically reset and restart at 1,000,000 lbs or scf depending on the measured units.

POWERHOUSE

Main Screen: Other

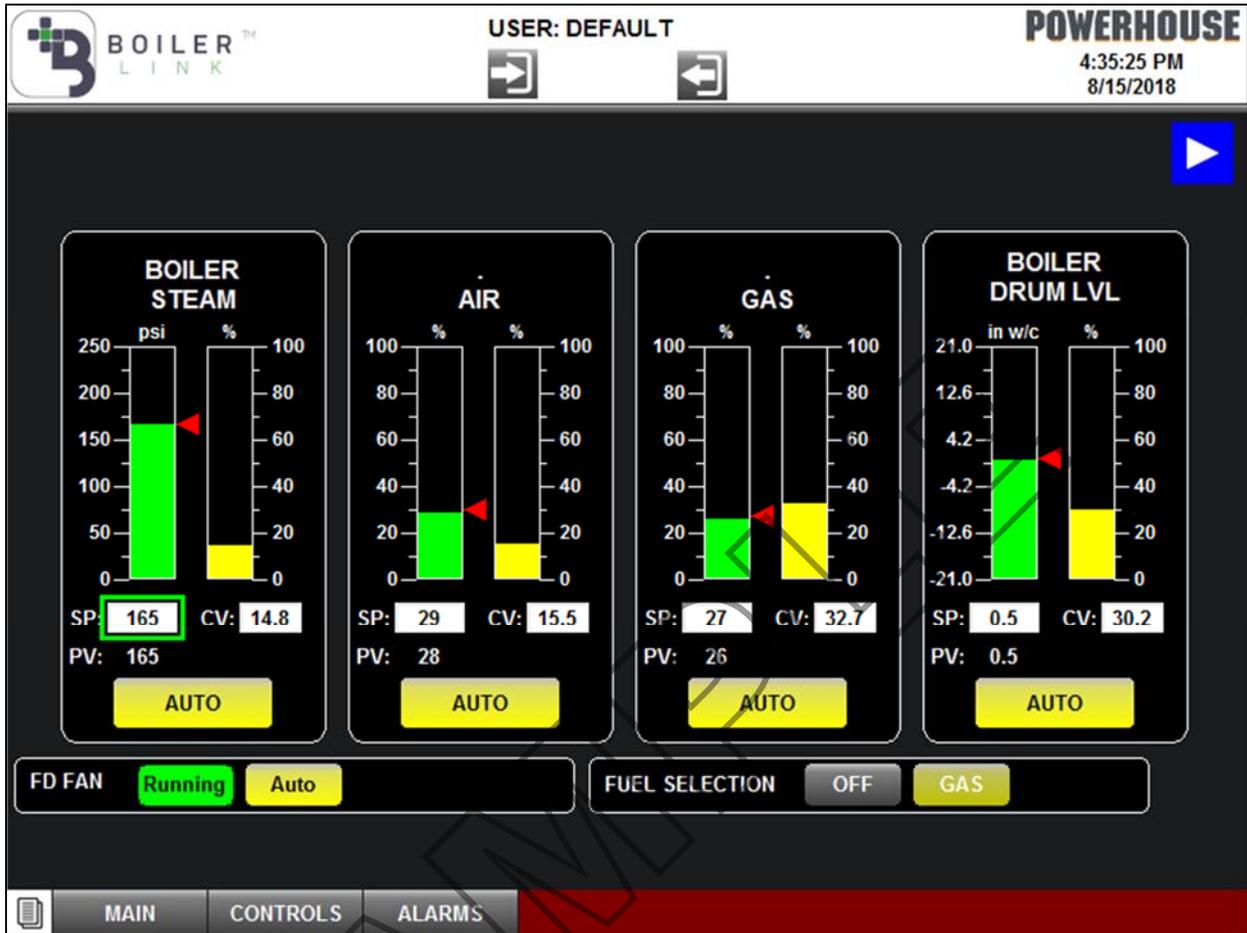
To access the process control loops and other controls, press the Controls button on the bottom banner (Fig. 3). To access a full list of alarms, press the Alarms button.

Active alarms will also display on the bottom banner and the flash the Alarms button.



Main Screen: Bottom Banner
Figure 3

SAMPLE



Controls Screen
Figure 4

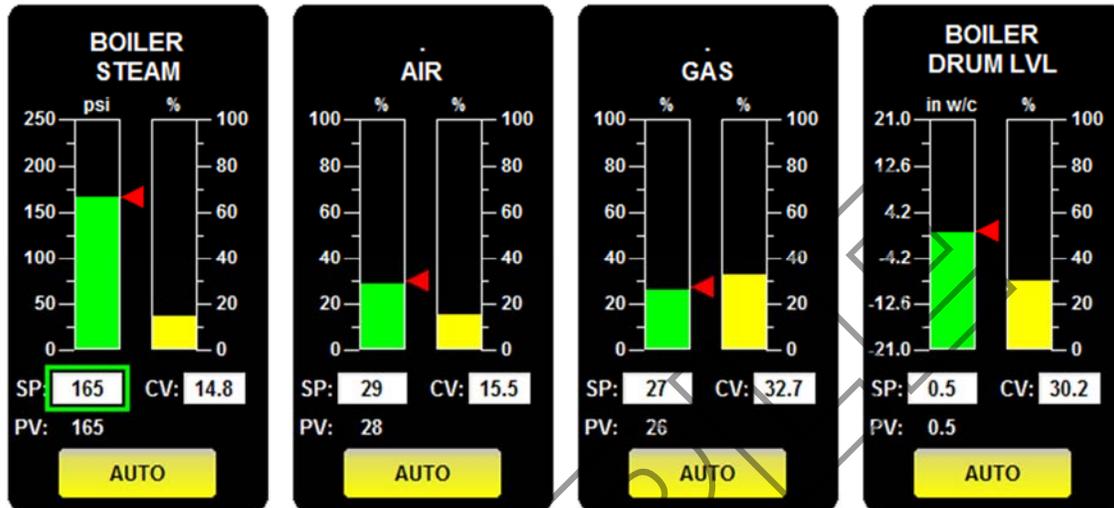
Controls

The Controls screen (Fig. 4) is accessed by pressing the Controls button on the bottom banner and provides access to the process control loops, the FD fan control, and fuel selection.

When the burner ignition sequence has been initiated the FD fan will start automatically at the corresponding step in the sequence. When the BMR status is Idle an auto/manual button will appear above the FD fan start/stop pushbutton allowing the fan to be manually operated. Pressing the auto/manual button switches the control between the automatic and manual modes. When the control is in the automatic mode the displayed text will be "Auto" and the button will be yellow. When the control is in the manual mode the displayed text will be "Manual", the button will be gray. To manually run the fan, use the auto/manual button to switch to the manual mode, and then press the start pushbutton. To stop the fan, press the stop pushbutton.

POWERHOUSE

The burner fuel selection pushbuttons display the current fuel selection. To prevent inadvertent switching of burner fuel these buttons are inactive once the burner start pushbutton has been pressed to initiate the burner ignition sequence. Fuel selection may only be performed when the burner is in Idle.



Control Faceplates
Figure 5

The process control loops are accessible via the control faceplates (Fig. 5). Each faceplate displays an auto/manual button allowing the loop to be switched¹ between the automatic and manual modes. Pressing the button switches between the two modes. When the loop is in the automatic mode the displayed text will be “AUTO” and the button will be yellow. When the loop is in the manual mode the displayed text will be “MANUAL” and the button will be gray.

The measured process variable is indicated in a green bar graph with the actual value displayed under the graph. Pressing the actual value will display a keypad from which the control loop setpoint can be entered. Pressing the enter key on the keypad accepts the new value and closes the keypad. Pressing the ESC key closes the keypad without accepting any changes.

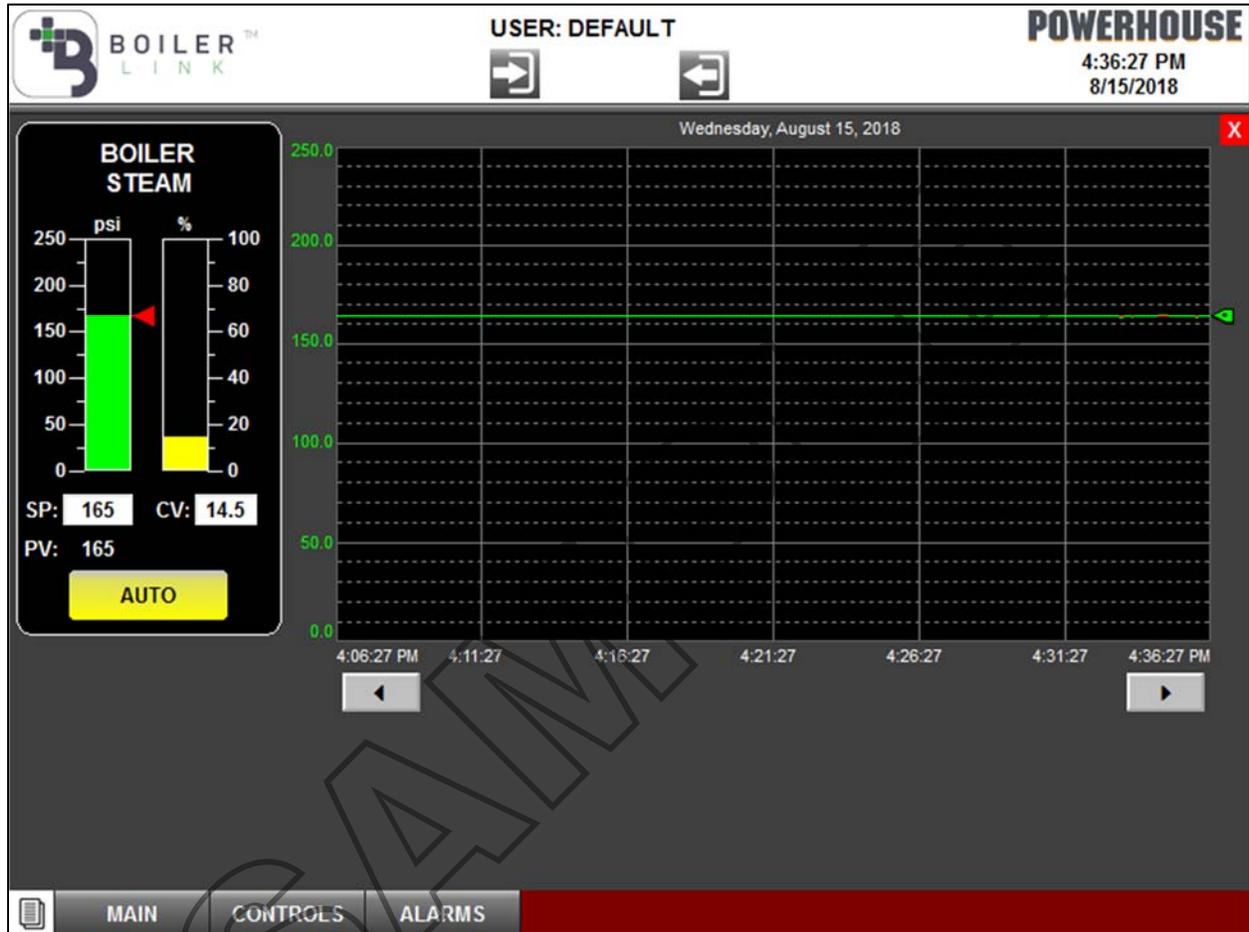
The position of the red arrow adjacent to the process variable bar graph will adjust based on the current setpoint.

The output to the control valve or damper (depending on the loop) is indicated by a yellow bar graph with the actual output value (in percent) displayed under the graph. Pressing the actual value will display a keypad from which the manual output to boiler feedwater valve can be entered. This value can be adjusted only with the loop in the manual mode. Pressing the enter key on the keypad accepts the new value and closes the keypad. Pressing the ESC key closes the keypad without accepting any changes.

¹ The Boiler Steam, Air and Gas auto/manual buttons function differently than described in this paragraph. See *Air/Fuel Parallel Positioning* for details.

POWERHOUSE

The boiler steam pressure control loop faceplate also displays the low fire hold symbol **LFH** if the boiler steam pressure is below the low fire hold setpoint (see *Alarms*). In this condition the boiler steam pressure control loop is set to an override state and the output to the fuel-air actuator damper is forced to the low fire position.



Control Loop Trending
Figure 6

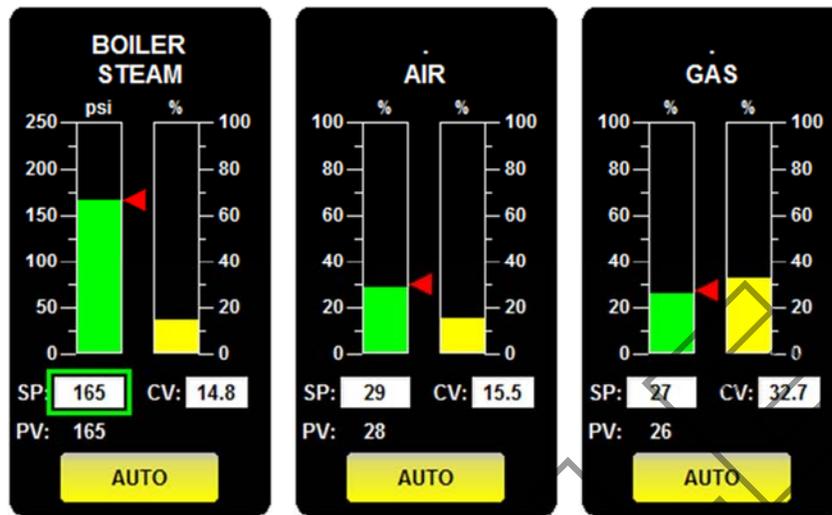
Pressing the loop description on the top of any faceplate will open the loop trending graphic. Above is an example of the boiler steam pressure trending graphic (Fig. 6).

The control loop faceplate on the left side functions in the same manner as it does on the Controls screen.

The line graph to the right of the faceplate displays the trends of the actual measured process variable (green) and the setpoint (red). The arrow buttons below the trends allow scrolling back and forth to different time periods.

Press the red "X" in the upper right to close the graphic.

Air/Fuel Parallel Positioning



Control Faceplates – Parallel Positioning
Figure 7

The control loops for the steam, air and fuel (Fig. 7) are interlocked to operate in a parallel positioning method. The steam loop may be switched between auto and manual however, the air and fuel loops are forced to auto. Switching the air or fuel loop to manual may only be done by authorized personnel.

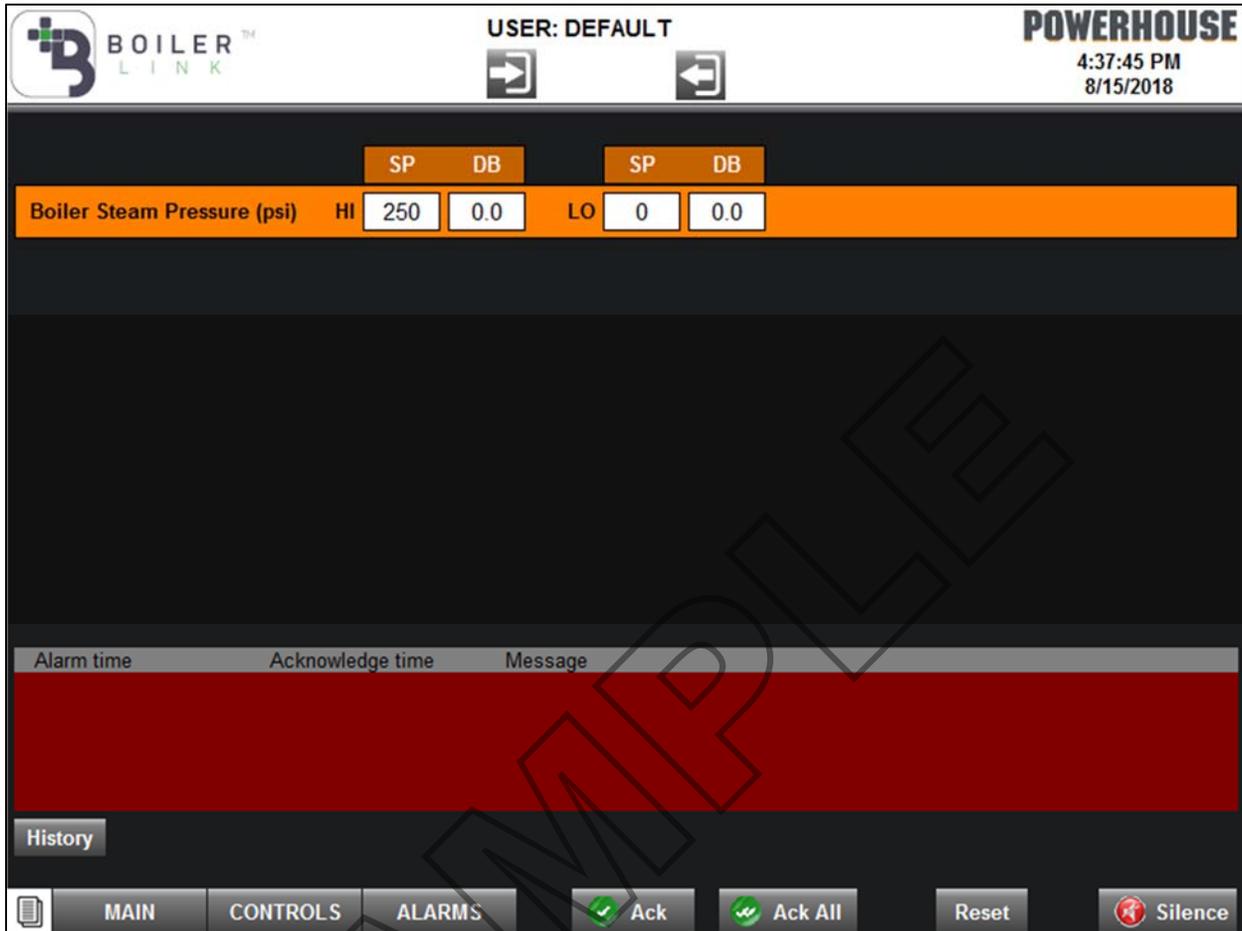
When burner is Idle the steam, air and fuel loops are automatically forced to a manual low fire setting. After starting the burner the BMR signals the PLC to open the air damper to the High Purge position (100%) for a set time and, subsequently, to the Low Fire position (0%) for a set time. Once the main flame has been ignited the BMR sends an 'Auto' status to the PLC and the PLC sets the air and fuel loops to auto, however the steam loop remains in manual at the low fire setting (0%).

From this point the air and fuel loops receive their respective setpoints from curves based on the output, or firing rate, from the steam loop. The air and fuel setpoint curves are specific to each loop and are based on combustion analysis of the boiler flue gas to optimize the air-to-fuel ratio during operation. The curves may only be adjusted by authorized personnel following a proper combustion analysis.

When in manual the steam loop output may be manually adjusted by setting the CV value. The setpoints to the air and fuel loops will adjust accordingly based on their curves.

Similarly, when in auto the output of the steam loop, or firing rate, when modulate to maintain the steam drum pressure setpoint (SP), and the setpoints to the air and fuel loops will adjust accordingly based on their curves.

Alarms



Alarms Screen
Figure 8

Alarms Screen

The Alarms screen (Fig. 8) is accessed by pressing the Alarm button on the bottom banner.

The boiler steam pressure high alarm is generated when the pressure goes above the high alarm setpoint. The BMR monitors this alarm as one of the safety interlocks. When the alarm is generated the BMR will immediately shut down the burner. The interlock will be satisfied when the pressure lowers to a level below the alarm setpoint less the deadband.

The boiler steam pressure low alarm is generated when the pressure goes below the low alarm setpoint. This is also known as the low fire hold condition. When this occurs the boiler steam pressure control loop will be forced to the manual mode and the last output will be held. The loop will remain forced in the manual mode until the pressure rises to a value higher than the setpoint plus the deadband.

POWERHOUSE

To change any value, press the box displaying the value. A keypad interface will display allowing entry of a new value. Pressing the enter key on the keypad accepts the new value and closes the keypad. Pressing the ESC key closes the keypad without accepting any changes.

NOTE: Changes to any of these values should be done only after consulting with Powerhouse Equipment engineers or technicians. Changes must be done by qualified authorized personnel only.

The boiler level high and low alarms are generated from level probes (hence, no alarm setpoints are required) and, respectively, high and low level relays. When either condition is realized, an alarm bell annunciates indicating an active boiler water level alarm. Both alarms are informational only and are not interlocked with the BMR nor does either alarm produce a boiler shutdown.

The lower portion of the Alarms screen displays a list of active (current) and inactive (historical) alarms. An alarm may be reset using the Reset button, provided the alarm condition is no longer present.

Pressing an alarm will highlight that alarm.

Press the Ack Alarm button  to acknowledge the highlighted alarm. Press the Ack All button  to acknowledge all the alarms.

Press the Silence Alarms button to silence an active alarm bell.

Press the directional keys to scroll through the alarm history. Press the History button to display a full alarm history.