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PF2000 CONTROLLER

for the

AQUARIUS® DEIONIZED WATER HEATING SYSTEM

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Rev. 02.0 08/21/17, (PF2000)

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1. INTRODUCTION

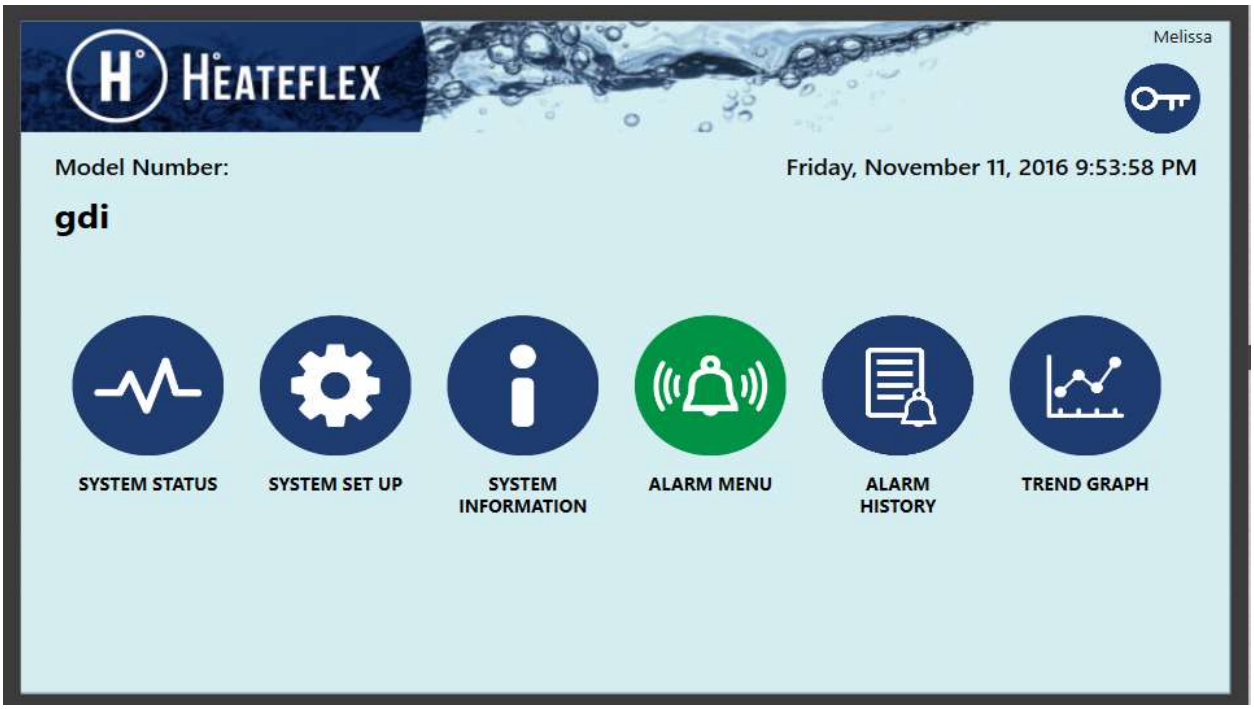
The Model **PF2000** is a Programmable Logic Controller (Safety PLC) for the Heateflex Corporation® Aquarius® **De**l**I**onized (**D.I.**) Water Heating Systems. It monitors and controls all functions of the Aquarius® D.I. Water Heating Systems. Although its primary function is to accurately control the temperature of the discharged D.I. water, it also provides monitoring for incoming or input fluid temperature, output fluid temperature, fluid flow rate, input voltage, input pressure, system alarms, and (optional) water resistivity.

The **PF2000** receives data from various sensors in the Aquarius® Systems. Temperature inputs are direct thermocouple connections. Separate individual thermocouples are used for the input temperature of the ambient D.I. water, output temperature of the heated D.I. water, and a thermocouple for each heating module in the Aquarius® D.I. Water Heating Systems, serving as independent over-temperature safety interlock (**HIGH LIMIT**). A liquid level sensor checks for the proper liquid level at the top of the final heating module. A flow sensor checks the flow rate at the input of the first heating module (all heater modules are configured in series). Pressure sensing is done with a pressure transducer at the ambient D.I. water input. Incoming line voltage monitoring is done with a voltage transducer at the step-down transformer at the power line. If the resistivity option is present a resistivity sensor after the output module is also connected to the **PF2000.**

The **PF2000** also includes a Safety PLC which monitors the high limit thermocouples values and status (all of which are Type J thermocouples), status of thermal cut-off sensors and status of ground fault circuit interrupter (GFCI). The Safety PLC logic determines if there is an output on the **Heater Master Relay** and/or the **Heater Safety Relay** which sets the system into **STANDBY** mode if there is an unsafe condition.

A Human Machine Interface (HMI) Touch Screen is utilized to operate the system, display the status of the unit and display various alarm conditions. Once the Aquarius® System is powered ON the **Main Menu** screen will appear, which is illustrated by Figure 1-1. The touch screen allows the user to set up and adjust the system parameters and set points. The screen also allows the user to monitor the flow rate, system pressure, voltage, incoming and process temperatures through the **System Status** screen (See Section 5.1) and displays the various system alarms on the **Alarm Menu** screen (See Section 7).

Figure 1-1: Main Menu Screen



The **System Set Up Menu** (See Section 6.1) is used to access system settings and troubleshooting. These settings include **Control Settings**, **Alarm Set Points**, **System Calibration**, **Factory Setup**, **Ethernet Interface**, and **Option Settings**. Note: A factory password is required to access the **Trouble Shoot Menu** and **Factory Set Up Menu**.

2. BASIC TOUCH SCREEN FUNCTIONS

2.1. UTILIZING THE TEN KEY

The **Ten Key** is a keypad used to enter numeric data such as temperature set points and parameters throughout the **PF2000** screens. Once the **Ten Key** window is accessed, type in the desired value ensuring that the value is within the maximum and minimum values that are indicated at the top of the **Ten Key** keypad. If a wrong entry is made, use either the **Back Arrow** key to backspace or the **Clear** key to clear the entire entry. Once the desired value is entered correctly, select the **Enter** key to submit the value into the controller as shown in Figure 2-1. If a change is not desired select the **Cancel** key to cancel the operation.

Figure 2-1: Ten Key Window

2.2. UTILIZING THE KEYBOARD

The **Keyboard** is a keypad (shown in Figure 2-2 and 2-3) used to enter alphanumeric data such as passwords or text. Once this **Keyboard** window is accessed, type in the value or characters desired. The **Shift** key is used to enter capital letters and special characters, as shown in Figure 2-3. If a wrong

entry is made, use either the **Back-Arrow** key to backspace or the **Clear** key to clear the entire entry. Once the desired value or characters are entered correctly, select the **Return** key to submit the value into the controller as shown in Figure 2-2. If a change is not desired select the **Cancel** key to cancel the operation.

Figure 2-2: Full Keyboard

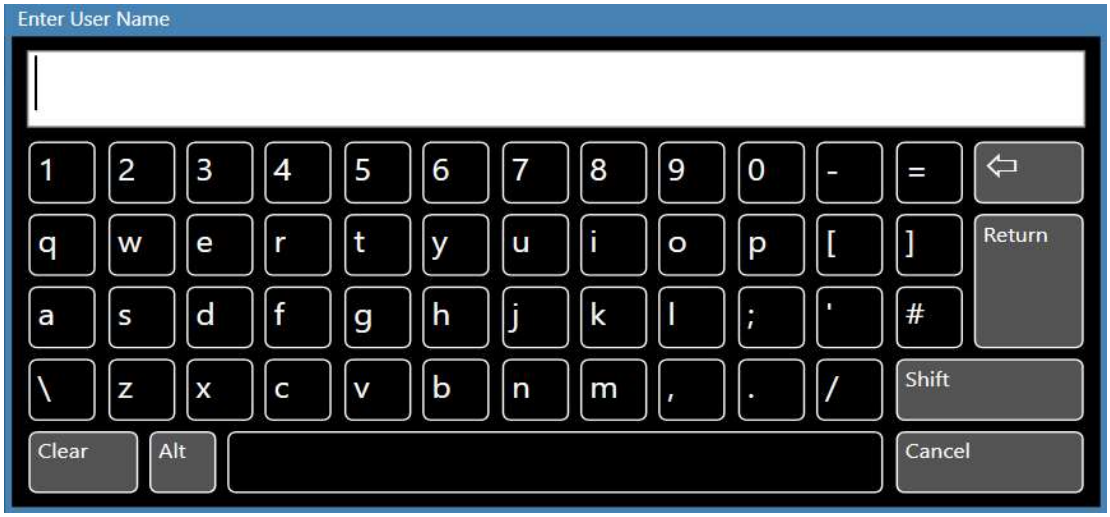
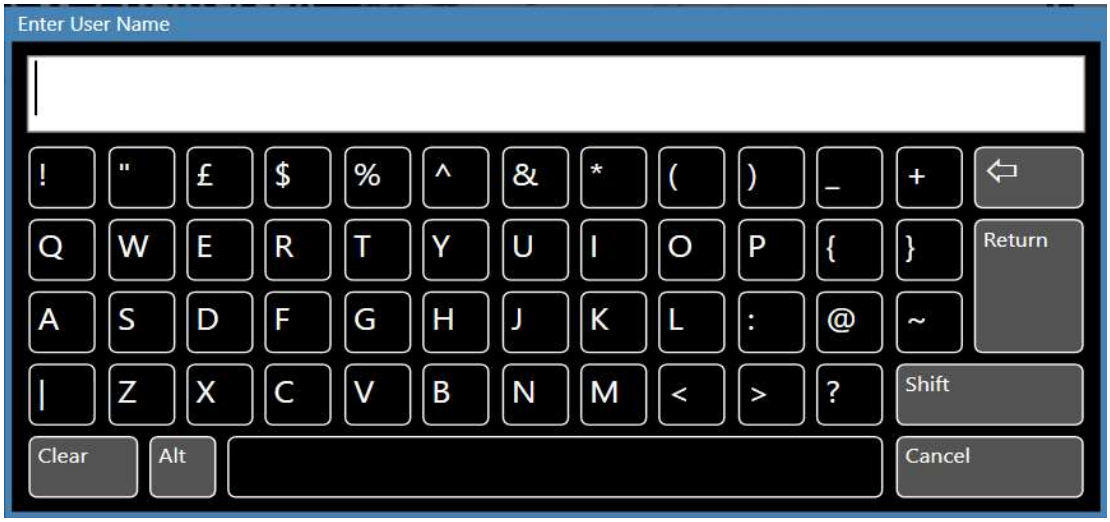


Figure 2-3: Full Keyboard (Shift)



2.3. UTILIZING THE SYSTEM SCREEN KEYS

The system screen keys are used to allow the user to easily navigate the touch screen. These keys are shown on the upper right hand corner, lower right hand corner and lower left hand corner. The keys that are shown are dependent on the current screen and may vary from screen to screen.

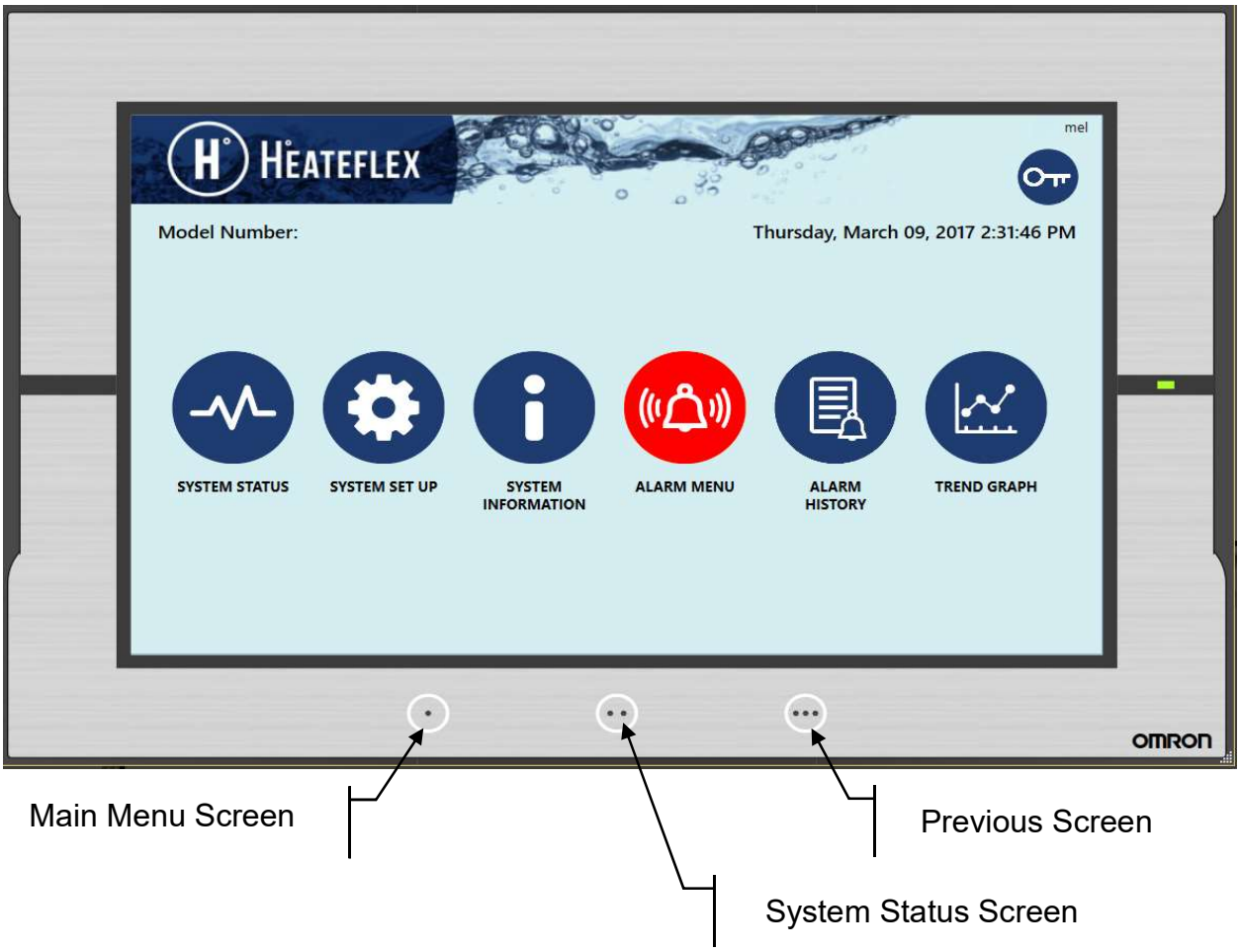
Table 2-1: System Screen Keys

KEY	DESCRIPTION	COMMENTS
	Login Window	This key is always visible and located on the upper right hand corner of the screen. See Section 3 for more details.
	Main Menu	The first screen that appears when the unit is powered on.
	System Setup Menu	Navigates to System Setup Menu screen
	Alarm Menu No Alarm	Indicates a No Alarm condition when green and navigates to the Alarm Menu screen when selected.
	Alarm Menu Critical Alarm	Indicates a Critical Alarm condition when red and navigates to the Alarm Menu screen when selected.
	Alarm Menu Non-Critical Alarm	Indicates a Non-Critical Alarm condition when yellow and navigates to the Alarm Menu screen when selected.
	System Status	Navigates to the System Status screen.
	Alarm History	Navigates to the Alarm History screen.
	Trend Graph	Navigates to the Trend Graph screen.
	Previous Screen	Navigates to the screen that was previous to the current screen. Can be pressed multiple times to navigate through multiple previous screens.
	Next Screen	Navigates to the “Next” screen of a series.
	Silence Alarm	The Silence Alarm key is used to silence the buzzer only. It does not clear the alarm.
	Alarm Reset	The Reset Alarm key is used to clear an alarm condition when the alarm condition has been resolved. If the alarm condition is not resolved, the alarm does not clear.

2.4. UTILIZING THE FUNCTION KEYS

The Function keys allow the user to easily navigate the touch screen. They are the three circular keys located on the bottom bezel of the touch screen. The leftmost function key with one dot will navigate to the Main Menu screen. The middle function key with two dots will navigate to the System Status screen. The rightmost function key with the three dots will navigate to the screen previous to the current screen. These keys will always be available and will not change function.

Figure 2-4: Function Keys



3. LOGIN

In some cases, it may be desirable to restrict access to the Aquarius® settings, parameters and set points. With that in mind a Password System is incorporated into the Aquarius® D.I. Water Heating Systems to limit access, prevent unauthorized access or prevent unintentional changes to the system.

A username and password is required to access some of the parameters and set points of the **System Set Up** submenus (**Control Settings, Alarm Set Points, Options** (if available), and **System Calibration**). When a user level access is required, the user must select the Login key at the upper right hand corner of the screen (see table 2-1 for icon) to bring up the **Login** window. The user must enter the correct **User Name** and **Password** with the proper credentials. Touch the input boxes within the **Login** window, shown in Figure 3-1 below, to access the **Keyboard** window so that the **User Name** and **Password** can be entered. (For instructions on how to use the **Keyboard** see Section 2.2) Once the correct **User Name** and **Password** are entered, select the **Return** key on the **Keyboard** window and then select the **OK** key on the **Login** window. When the **User Name** and **Password** is entered, the operator will gain access to the different settings, parameters, and set points associated with the password level entered. The active User Name will be shown at the upper right hand corner of the screen (See Figure 1-1). If the controller is left idle for over one minute, the “password lock” will be activated which will require the operator to re-enter the **User Name** and **Password** for access.

Figure 3-1: Login Window

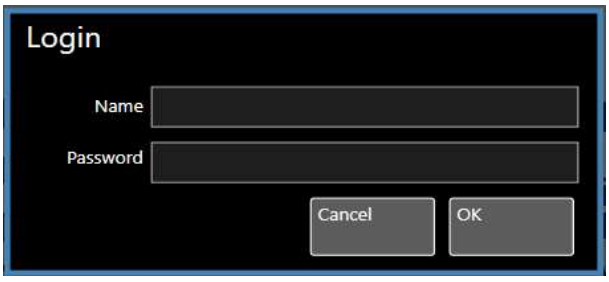
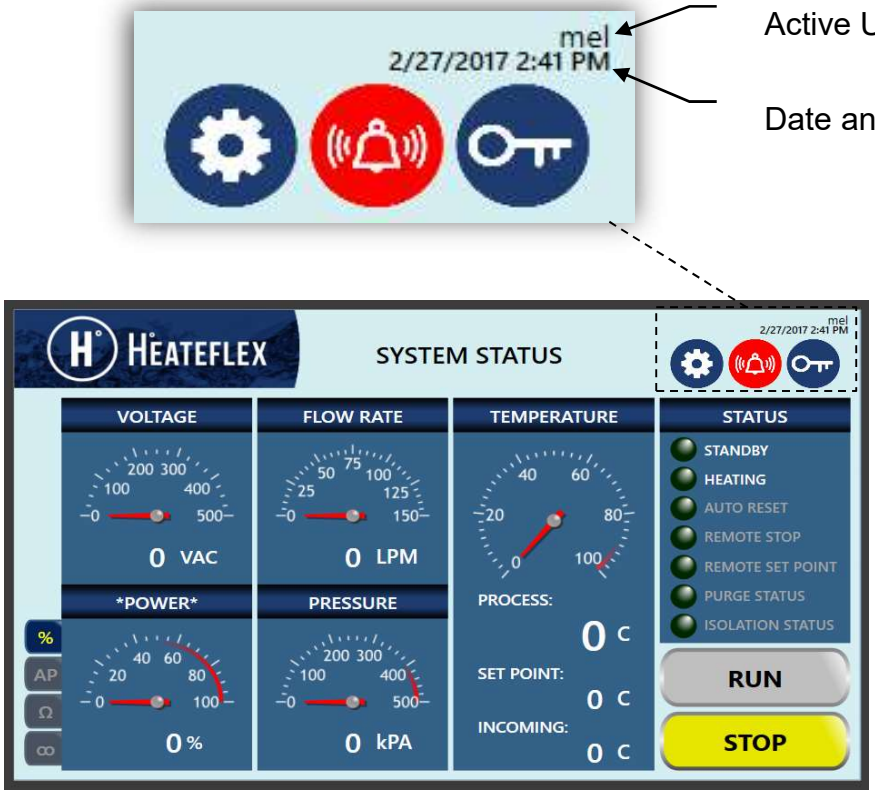


Figure 3-2 – Close Up of Active User Name, Date and Time



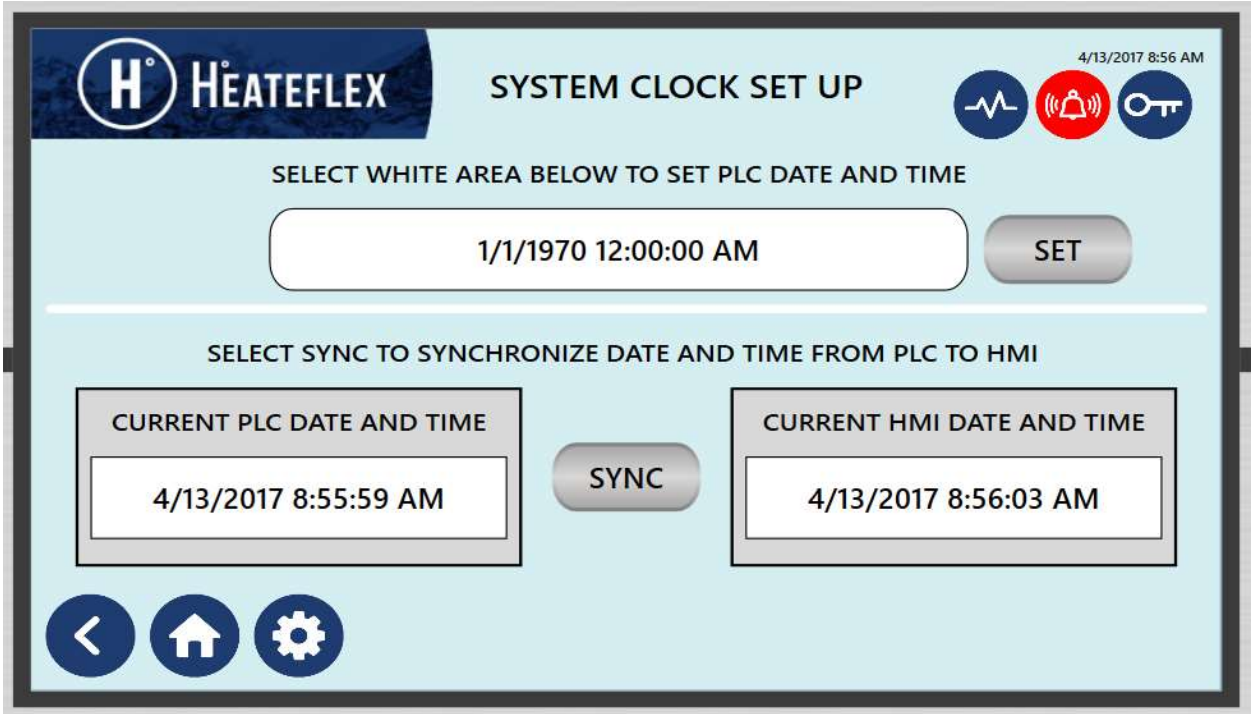
The password is eight digits alpha-numeric. This password will allow the user to modify the parameters and set points within the **Control Settings**, **Alarm Set Points**, **System Calibration,** and **Options** (if options are available). In addition, the **User Password** is required in order to clear the information on the **Alarm History** screen and in order to activate the **GFCI TEST** key for the **GFCI Alarm.**

Note: The **User Password** will not grant access to the **Factory System Menu** screen. This menu is for Factory Use Only and a Factory Password is required to access these screens.

4. DATE/TIME SET UP

To change the date or the time, select the System Information Key from the Main Menu Screen. Next select System Clock Set Up. This is shown in Figure 4-1 below.

Figure 4-1: System Clock Set Up Screen



The system will prompt you to enter the **User Password**. Once the correct password is entered, the date and time can be modified.

To change the date and time, select the white area next to the **SET** key. The **Set NA Calendar/Clock** window will display. The date and time can be entered using the drop-down menus labeled Day, Month, Year, Hour, Minute, and Second.

To change the date, enter the date in the following format **"mm/dd/yyyy"**.
Press the **Enter** key to accept the changes.

To change the time, enter the time in the following "24 hour" format **"hh:mm:ss"**.
Press the **Enter** key to accept the changes.

5. OPERATION

The basic function of the **PF2000** Controller is to provide hot D.I. water on demand. The unit continually monitors the flow sensor and once flow is detected by the flow sensor the heaters are turned on to a proportional power level that is calculated by the following formula:

$$KW = \frac{GPM \times \Delta T°C}{3.79}$$

This formula utilizes the input thermocouple temperature and process set point temperature to calculate $\Delta T°C$. The flow value in GPM is taken from the flow meter reading and the power or KW is adjusted by time proportioning the "on time" of the heaters in ratio to the time base set in the **"Cycle Rate" (CR)** parameter.

This value becomes the maximum KW that the system may utilize. Additionally, the actual percentage of power that is utilized is determined by the temperature control section utilizing the output thermocouple.

The temperature control section operates as an adjusting mechanism to the power requirement. It monitors the discharge temperature and compares it against the required set point. Based on the **"Power Reset" (PR)** parameter, it will adjust the power that is applied to the unit to bring the discharge temperature into complete compliance with the requirements. The **"Dead Band" (DB)** setting is utilized to establish a range above and below the set point in which the temperature control section will take no further action. This means that the **PR** parameter will adjust the power on a periodic basis and examine the temperature output to determine whether the temperature is within the customer specified control band. If the temperature is within this **DB**, it will leave the power alone. If the temperature is outside this **DB**, it will continue to adjust the power until the temperature is within the **DB**.

The **PF2000** has a large number of inputs and outputs. The main output is the silicon controlled relay drive to the heaters. This is a 12 VDC output signal that is active high. It has sufficient capacity to drive 10 solid-state relays. The alarm output is an open collector transistor that may be interfaced with an external alarm. The purge valve output is a form C relay. It will close either on automatic or manual purge.

When the system is powered ON, the **Main Menu** screen will appear and the unit will be in **STANDBY** mode. In this mode, all the keyboard operational features are active, the **Heater Master Relay** is inactive (normally open), and the **Heater Safety Relay** is active (normally closed). The Aquarius® D.I. Water Heating System is ready to process provided that all the installation requirements have been fulfilled, including water flow through the unit system, the desired process temperature has been entered, and there are no "critical alarms" present. The "critical" alarms in the system are designated as manual reset alarms. When any of these "critical" alarms are triggered, the unit will go into **STANDBY** mode and the heaters will be disabled. The unit will not return to normal operation until the system has been manually reset by pressing the **ALARM RESET** key (located on the **Alarm Menu** screen or Alarm submenu screens) and/or the alarm condition resolved. "Non-critical" alarms do not affect the system and serve only as a warning to the user.

Under normal operating conditions a minimum flow rate is required based on the size of the Aquarius® D.I. Water Heating System plumbing in order to process fluid (0.5 GPM for standard plumbing sizes). The Aquarius® D.I. Water Heating System has a special feature called **"Automatic Reset" (Auto Reset)** which allows the user to disable this minimum flow rate requirement. When the **Auto Reset** parameter is set to **ON,** the **Low Flow Alarm** will be disabled and the "**Low Flow Alarm Set Point"** will temporarily be set to 0 GPM. The system will automatically go from **STANDBY** mode to **ACTIVE** mode and start **HEATING** (indicated by the flickering light) when the system detects a flow rate provided there are no critical alarms present. The unit will remain in **STANDBY** mode when a flow rate of 0.5 GPM or lower exists. In addition, when the **AR** parameter is set to **ON**, the previous "**Low Flow Alarm Set Point"** will be stored and re-entered once the **AR** parameter is set to **OFF**. In order to process fluid in the **"Automatic Reset"** mode the **AR** setting must be set to **ON** and the **RUN** key must be pressed.

The **PF2000** has two redundant relays dedicated to the **Master System Contactor** coil. This **Heater Master Relay** which is linked to the Safety PLC and is interlocked with a number of intelligent alarms. Depending on the type of "critical alarm", the **Heater Master Relay** will open (if the system is processing) thus opening the **Master System Contactor** and disabling power to the heaters. In addition, if the unit is turned off, the power to the **Master System Contactor** will be disrupted, opening the **Heater Master Relay** and disabling power to the heaters. The Safety PLC is wired to two independent contact relays with relays wired in series to the **Master System Contactor.** This redundancy is to prevent a false contact condition.

The **Heater Safety Relay** is also interlocked with a number of intelligent alarms. Each of the "critical alarms" has the capability of disabling the **Heater Safety Relay**. As a result, when any of the "critical" alarms are triggered, they not only shut down the intelligent drive to the Silicon Controlled Rectifier (SCR), disable the **Heater Safety Relay** to provide an additional element of protection by mechanically eliminating the signal which controls power to the heaters.

The **PF2000** has an additional safety interlock feature that is transparent to its normal operation. If for some reason, the discharge temperature reaches 5°C higher than the process temperature set point, the heaters will be disabled. This is not announced as an alarm unless this temperature exceeds "**High Temperature Alarm"** setting. However, it is provided to ensure that the set point has overriding control over all of the automatic calculations. This provides additional first line protection against erroneous heater output due to conditions such as bad voltage or current sensors.

The Aquarius® D.I. Water Heating System has an optional **Auto Purge** feature that flushes or purges the unit after a programmable period of time where there is no demand for D.I. water. **Auto Purge** monitors the amount of time elapsed since leaving **ACTIVE** mode (i.e.: "No Flow Time"). If this amount of time exceeds the programmed "**Auto Purge Period" (AP)** parameter, the system is purged for the amount of time programmed in the "**Auto Purge Duration" (AD)** parameter. This cycle will continue until the Auto Purge feature is disabled or turned off. The system will continue to purge even if flow is detected while the unit is in **AUTO RESET** mode or **MANUAL** mode. Once the "**Auto Purge Period"** has elapsed, the unit will return to **AUTO RESET** mode. The purge cycle may be terminated prematurely by pressing the **PURGE** key located on the **System Status** screen. Note, to access the Purge Key, select the AP option key to display the Auto Purge User Selected Display. (The **PF2000** also supports a remote **Auto Purge** switch, which is available in the standard Ethernet Communications and Discrete Interface Package Option of the Auto Purge Option.) Please note that the heaters will be disabled during "**Auto Purge Duration"** time.

A **Resistivity** option is offered for the Aquarius® D.I. Water Heating Systems. The Resistivity option utilizes a standard Resistivity sensor with a cell constant of 0.01. It excites the sensor with an AC signal to prevent any interference due to electrolysis or secondary reactions with the electrode material. The standard cell has an extremely non-linear characteristic with respect to temperature. The transmitter has an extensive compensation algorithm to handle the standard 3D curve. It should be noted, that while the cell has an internal temperature sensor, this sensor is not utilized in the system. The Low Resistivity Alarm is considered a non-critical alarm and will not affect the heaters.

The Aquarius® D.I. Water Heating Systems incorporate a large red emergency power off switch (EMO) and an optional remote emergency power off switch is also supported (See Discrete Interface Package Option). Each of these switches will produce the same effect. When the switch is pressed, the normally closed contacts will open which causes the Safety Relay to POWER OFF the entire system therefore interrupting power to the Master Contactor holding coil, and disabling the heaters.

5.1. SYSTEM STATUS SCREEN

The **System Status** screen shown below is used to monitor and operate the system. The **Mode Indicating Lamps** are used to distinguish the different system modes. In addition, the operator will also be notified of any alarm conditions that are present on this screen. When an alarm condition is present the alarm icon will be illuminated red. When the alarm is reset the alarm icon will be illuminated green. The **System Status Displays** provide values for the Voltage, Power, Purge (optional), Resistivity (optional), Recirculation (optional), Flow Rate, Pressure, Process Temperature, Set Point Temperature, and Incoming Temperature. The **Unit Change Keys** are used to easily switch from English units to metric or SI units or vice versa. The units **GPM**, **PSI**, and **F** can be changed to **LPM**, **kPA**, and **C** by clicking on the unit label. The **System Operation Keys** are used to "**RUN"** the system or alternatively to "**STOP"** the system from heating, manually initiate Auto Purge (if available), and enable Recirculation (if available). See Table 5-3 for more information. Note, Auto Purge, Resistivity, and Recirculation are optional features. These sub-menus can only be accessed if the option is available. Furthermore, the sub-menus for Power, Purge, Resistivity, and Recirculation cannot be displayed concurrently. The **System Screen Keys** are used to easily navigate to various system screens. See Figure 5-1 below for more detail.

Figure 5-1: System Status Screen

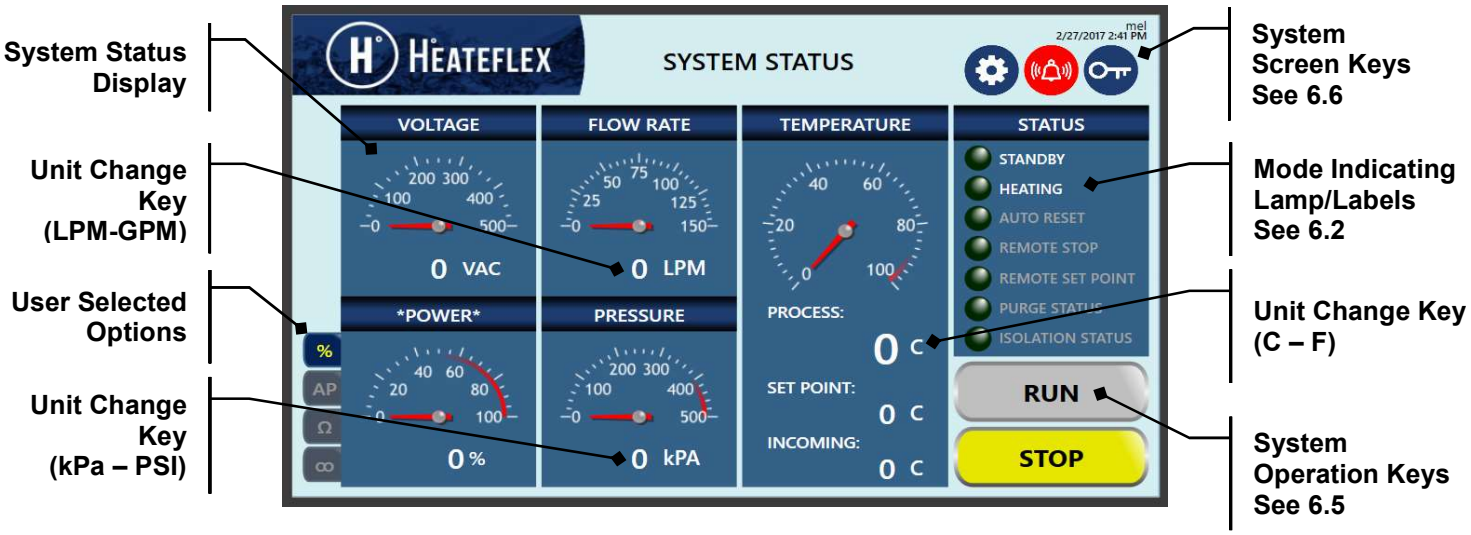


Figure 5-2: System Status Screen User Selection Keys

Power Display

Purge Display

Resistivity Display

Recirculation Display

Please note that the appearance of the **System Status** screen may vary depending on the Aquarius® D.I. Water Heating System options such as the **Resistivity**, **Auto Purge**, **Discrete Interface**, **Analog Interface Package** (**Remote Temperature Set Point**), **Secondary Process Temperature Set Point** and **Recirculation** that are present. Figure 5-3 through 5-5 illustrate a typical Aquarius® **System Status** screen with Auto Purge, Resistivity, and Recirculation options.

Figure 5-3: System Status Menu Screen w/ Auto Purge Selected

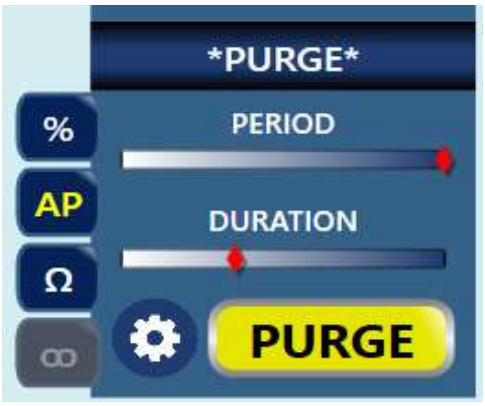


Figure 5-4: System Status Menu Screen w/ Resistivity Selected

Figure 5-5: System Status Menu Screen w/ Recirculation Selected

5.2. MODE INDICATING LAMPS/LABELS

There are two primary modes which are indicated by lamps and labels on the **System Status** screen which are **STANDBY/ACTIVE** and **HEATING**. Additional mode indicating lamps/labels will appear based on the Aquarius® D.I. Water Heating System options. See Table 5-1 for a complete list of system status mode descriptions.

Table 5-1: System Status Modes

MODE LAMP	DESCRIPTION
STANDBY	When the system is first powered ON the unit will load into the **STANDBY** mode. In this mode, all of the keyboard operational features are active, but the **Heater Master Relay** is inactive (disabling all power to the heaters), and the **Heater Safety Relay** is active provided that there are no critical alarms present. The system is "standing by" and is ready to go into **ACTIVE** mode.
ACTIVE	This is the normal operating mode for the system. In this mode, if there are no critical alarms present and the required minimum flow rate is detected, the control system will meter power to the heaters to raise the output D.I. water temperature to the "**Process Temperature Set Point"** parameter. This mode is initiated by pressing the **RUN** key while in **STANDBY** mode. The **STANDBY** label will automatically switch to the **ACTIVE** label and a green indicating lamp will illuminate.
HEATING	This mode lamp indicates the status of the heaters. When the heaters are ON the lamp will flicker amber. This lamp will cycle as required by the system parameters.
AUTO RESET	This mode lamp is active if the **AUTO RESET** mode is enabled. This mode allows the user to disable the minimum flow requirement. The **Low Flow Alarm** is disabled, and the **Low Flow Alarm Set Point** is temporarily set to zero. The system will automatically reset when there is flow and no critical alarms are present.

MODE LAMP	DESCRIPTION
REMOTE STOP (Optional)	This mode lamp is active only if the **Discrete Interface Package** option is available. This mode lamp notifies the user when the unit is remotely stopped or placed into **STANDBY**. When the Remote Stop function is active this mode lamp will illuminate green.
REMOTE SET POINT (Optional)	This mode lamp is active only if the Ethernet Remote Set Point (available standard), **Analog Remote Set Point** (option) **or Secondary Set Point** (option) is active. This mode lamp notifies the operator whether the **"Process Temperature Set Point"** is being controlled locally or remotely. When the **"Process Temperature Set Point"** is being controlled locally the **REMOTE SET POINT** mode lamp will not be illuminated. When the system is being controlled remotely the **REMOTE SET POINT** mode lamp will illuminate green.
PURGE STATUS (Located in User Selected Option Area when AP is selected)	This mode lamp is active only if the **Auto Purge** option is available. This mode lamp notifies the user as to the current status of the purging feature of the unit. When the system is automatically (Auto Purge) or manually purging this mode lamp will illuminate green.
ISOLATION STATUS (Optional)	This mode lamp is active only if the **Water Leaks** option is available. This mode lamp notifies the user when the isolation valves are active as a result of the detection of leaks.
DEMAND, **VENTING**, **RECIRCULATION** (Located in User Selected Option Area when ∞ is selected)	The following mode lamps are only accessible if the Recirculation option is available. • **DEMAND**: This mode lamp/label notifies the operator that the unit is in **DEMAND** mode and will illuminate green when active. • **VENTING**: This mode lamp/label notifies the operator that the unit is in **VENTING** mode and will illuminate green when active. • **RECIRCULATION**: This mode lamp/label notifies the operator that the unit is in **RECIRCULATION** mode and will illuminate green when active.

5.3. SYSTEM STATUS DISPLAY

The **System Status Display** allows the operator to monitor the real time values for the **Process Temperature**, **Incoming Temperature**, **Flow Rate**, **Pressure**, **Voltage, Power,** and **Resistivity** (Optional). The **System Status Display** also includes functional features for **Recirculation** and **Auto-purge** options. The read only value for the **Temperature Set Point** is also displayed.

Table 5-2: System Status Display

DISPLAY	DESCRIPTION	UNITS
Temperature Set Point	The temperature set point of the process D.I. water discharge.	°C (default) or °F
Process Temperature	The actual temperature of the process D.I. water discharge.	°C (default) or °F
Incoming Temperature	The incoming or input temperature of the process D.I. water discharge.	°C (default) or °F
Flow Rate	The flow rate of the process D.I. water discharge.	gpm (default) or lpm
Pressure	The pressure of the system.	psi (default) or kPa
Voltage	The voltage of the system.	Volts (AC)
Power	The percentage of power delivered to the heater modules.	%
Resistivity (Located in User Selected Option Area when Ω is selected)	The resistivity of the system.	Mega Ohms
Recirculation (Located in User Selected Option Area when ∞ is selected)	The recirculation mode.	Demand, Venting, or Recirculating
Auto Purge (Located in User Selected Option Area when AP is selected)	The purge period and duration and the manual purge button.	% of Elapsed Time to Total Time

5.4. UNIT CHANGE KEY

The units for the **Temperature Set Point**, **Process Temperature**, **Incoming Temperature**, **Flow Rate**, and **Pressure** on the **System Status Display** can be changed from English units to Metric units or vice versa. To change the units, press the "unit description" located in the lower area of the respective box. This is indicated in Figure 5-1.

Note: The **"Unit Change Keys"** are available and functional only on the **System Status** screen and **Trend Graph** screen. All parameters and set points need to be entered according to the unit description on the parameter/set point label.

5.5. SYSTEM OPERATION KEYS

The **System Operation** keys give the operator control over the Aquarius® D.I. Water Heating System functions and features such as heating, purging, and recirculation.

Table 5-3: System Status Operation Keys

KEY	DESCRIPTION
RUN	This key is used to switch the system from **STANDBY** mode to **ACTIVE** mode. While in **STANDBY** mode, depression of this key will activate the system and the heater modules. This key will illuminate yellow when the system is in **ACTIVE** mode.
STOP	This key is used to switch the system from **ACTIVE** mode to **STANDBY** mode. While in **ACTIVE** mode, depression of this key will deactivate the system and the heater modules. This key will illuminate when the system is in **STANDBY** mode.

KEY	DESCRIPTION
PURGE (Located in User Selected Option Area when AP is selected)	This key is used to initiate manual purging. Depression of the **PURGE** key will activate the purging feature of the system. The system will continue purging until the **PURGE** key is pressed again to deactivate purging.
PURGE SETUP (Located in User Selected Option Area when AP is selected)	This key is used to access the Purge Mode Screen. See Section 11 for more information.
RECIRCULATION ENABLED/DISABLED (Located in User Selected Option Area when ∞ is selected)	This key is used to enable or disable the recirculation system. The recirculation system is enabled by pressing the **ENABLED/DISABLED** key. The recirculation system is enabled when the **ENABLED** label is displayed and illuminated yellow and disabled when the **DISABLED** label is displayed.

The **Purge** and **Enable/Disable (Recirculation)** keys, shown in Figure 5-3 and Figure 5-5, are available only when these options are installed on the unit.

5.6. SYSTEM SCREEN KEYS

The **System Screen Keys** are used to go to various system screens such as the **Main Menu**, **Alarm Menu**, **System Set Up Menu**, and/or the **Trend Graph** screens when present. The **Alarm Menu** key will also notify the operator of any alarm conditions that are present (critical or non-critical). When there are no alarms present, the **Alarm Menu** key lamp will illuminate green. When a critical alarm is present the **Alarm Menu** key lamp will illuminate red, while if a non-critical alarm is present **Alarm Menu** key lamp will illuminate yellow. In the instance that both a critical and non-critical alarm is present at the same time, any critical alarm that is present will supersede any of the non-critical alarms and will the lamp will illuminate red.

Note: The system may or may not go into **STANDBY** depending on the alarm type (critical or non-critical) or if **Automatic Reset** is enabled.

6. SYSTEM SET UP

The values that are entered into the various program settings, parameters and set points determine the actual operation of the system. While many of the parameters and set points will be specifically dictated by user requirements, the purpose of this section is to give a general indication of the meaning and effect of the control parameters.

The "**Process Temperature Set Point"** is the primary temperature control parameter for the system. This is the desired discharged temperature. It serves as the target around which all of the other control parameters function.

The Power-To-Flow® Control computations are based on the readings taken from the Flow Sensor, the Input Thermocouple, the Process Thermocouple and the Line Voltage. These inputs are used in conjunction with the "**Heater Amperage" (HA)** setting to compute the heater "on time". The **HA** parameter should be set to the nominal heater amperage at rated line voltage. This setting will allow the unit to compute the nominal available KW. Variations in the line voltage will allow the adjustment of this figure, should other than expected line voltages exist.

The Power-To-Flow® section automatically computes the first approximation of the KW required to establish the desired discharge temperature. The **"Power Reset" (PR)** parameter is utilized in conjunction with the **"Dead Band"** (**DB)** parameter to adjust further computations to compensate for any error that might exist. The **DB** setting should be made to establish a satisfaction band for the system. If, for example, it is desirable to maintain the discharge temperatures to within + or - 1.0 degrees, then the **DB** should be set to 1.0. This will inhibit any further adjustment when the temperature is within this tolerance band. Initially, it would appear that the tighter this band, the better the control. However, it should be noted that depending on system operations, if the band becomes too small, the system will simply oscillate, rather than becoming stable.

The **PR** parameter is the primary temperature compensation for the system. It functions much like the Reset parameter in a standard three-mode control algorithm. However, in this algorithm, the **PR** parameter actually adjusts the output power of the system to compensate for errors in discharge temperature. The **PR** setting is adjusted in seconds and roughly indicates the period at which power adjustments will be made in an attempt to compensate for errors in the discharge temperature. As an example, if the parameter is set to 30 seconds, the system will make an adjustment in the system power once every 30 seconds in a positive or negative direction depending on whether the discharge temperature is below or above the process temperature.

The control loop is capable of adjusting the power to the nearest half cycle. Therefore, at 60 Hz., this amounts to 120 half cycle adjustments every second. If the **"Cycle Rate"**

(CR) parameter is set to one second, there are 120 power adjustments that can be made. This is approximately a 1 percent resolution. If **CR** is set to 2 seconds, there are 240 adjustment points corresponding to approximately 0.4 percent resolution.

The **PR** parameter will make an adjustment of 1 resolution point after each time-out. Therefore, in a system with a **CR** of 1 second and a **PR** of 30 seconds, the system will adjust out at the rate of approximately 1 percent per 30 seconds. If the **CR** is increased to 2 seconds, this means that every 30 seconds the power is adjusted by approximately 0.4 percent (1/240).

In setting the **PR** parameter, it is desirable to examine the throughput for the system. The initial setting for this parameter should be such that the effect of the power change can be seen by the output sensor, prior to its making another change. In essence, this dictates the time that is approximately equal to the throughput time for a given system.

To compensate for this, the unit automatically adjusts the **PR** parameter in an inverse ratio to the flow. The **PR** setting should be made initially with the flow of 1 GPM. The system will then take this value and adjust it in accordance with varying flows. For example, when the flow is 2 GPM, the **PR** parameter will be cut in half.

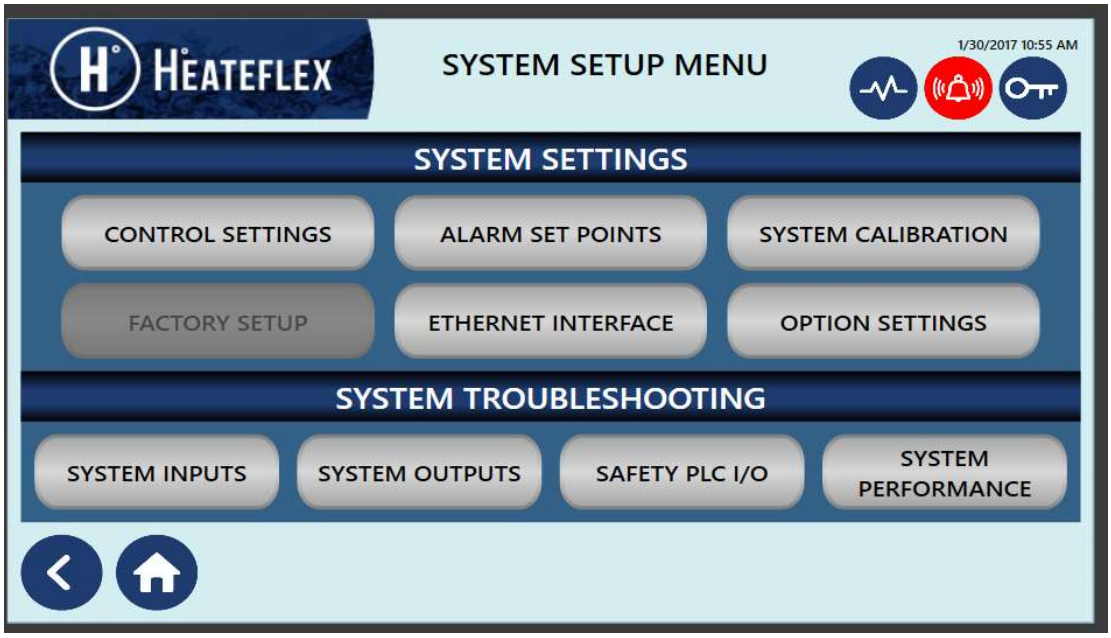
The net effect of the **PR** parameter is that it will compute a necessary addition or subtraction to the required KW to match the discharge temperature to the **"Process Temperature Set Point"**. The "**Power Adjust" (PA)** parameter is provided as a manual reset function for the system. The **PA** setting allows the user to directly input the offset to the power formula, if desirable. This setting is normally not necessary, but may be utilized, if it is found that for some reason, the system has either a fixed over temperature or under temperature initialization. The **PR** parameter will eventually adjust this error out, but if it is desirable to decrease the settling time, the **PA** parameter may be set. The net effect will be that the Power-to-Flow® computation will be completed and the **PA** parameter will be added to this computation as a percentage power, just as the **PR** parameter previously described. However, the **PA** parameter will not vary and will serve as a fixed constant in this computation. The **PR** parameter will continue to adjust and fine tune, if necessary, regardless of the setting of the **PA** parameter.

6.1. SYSTEM SET UP MENU

This is a guide to navigate through the **System Set Up** menus. To access the **System Set Up Menu** screen, start with the **Main Menu** screen, then select **System Set Up**. The **System Set Up Menu** screen (Figure 6-1) will appear and give you access to the following set up menus: **CONTROL SETTINGS, ALARM SET POINTS, SYSTEM CALIBRATION, FACTORY SETUP, ETHERNET INTERFACE,** and **OPTION SETTINGS.**

Note: The **SYSTEM TROUBLESHOOTING** and the **FACTORY SETUP** screens will be inaccessible without Factory Password. These screens are intended for Factory Use Only.

Figure 6-1: System Setup Menu Screen

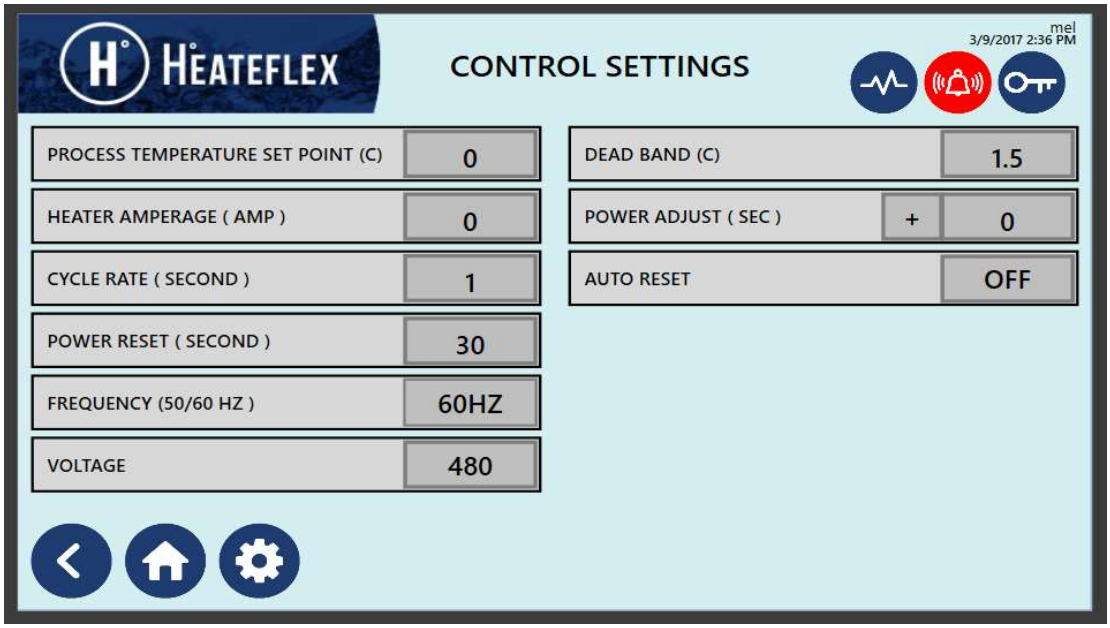


6.2. CONTROL SETTINGS SCREEN

A number of parameters are used to control the temperature of the process D.I. water discharge. To modify the values of any of these parameters, press the box with the value of the parameter to be changed (See Figure 6-2). The system will prompt you to enter the **User Password**. Once the correct password is entered, the number pad will appear. The parameter can now be changed. Enter the desired value, and press the **Return** key. The desired value for the selected parameter will be stored. Table 6-1 details all the parameters that can be modified on this screen. Certain parameters cannot be modified once the system is in the **ACTIVE** mode, such as the **Heater Amperage**, **Cycle Rate**, **Power Reset**, and **Frequency** parameters. These buttons will appear to be “depressed” when inactive. The **Process Temperature Set Point** value can be inputted in the **Control Settings** screen. The value inputted will be displayed in the **Temperature Set Points Options** screen (see Figure 14-1) under the **Local** value. Reference Section 14 for

more instructions on Temperature Set Points.

Figure 6-2: Control Settings Screen



Note: The appearance of the **Control Settings** screen may vary depending on the Aquarius® D.I. Water Heating System options.
The Process Temperature Set Point can be activated from a selection of pre-defined Set Points. Reference Figure 14-1 for further instructions.

Table 6-1: Control Settings Parameters and Ranges

PARAMETER NAME	SETTING RANGE	FACTORY DEFAULT
Process Temperature Set Point	0 to 95°C (Integers only)	0°C
Heater Amperage (HA)	0 to 400 Amps (Integers only)	Varies unit to unit
Cycle Rate (CR)	1 or 2 sec (Integers only)	1 sec
Power Reset (PR)	30 to 90 sec (Integers only)	45 sec
Dead Band (DB)	1.0 to 4.0°C	1.5°C
Power Adjust (PA)	Minus 99 to Plus 99 (Integers only)	Plus 0
Frequency	50 or 60 Hz.	60 Hz.
Auto Reset	Off or On	Off

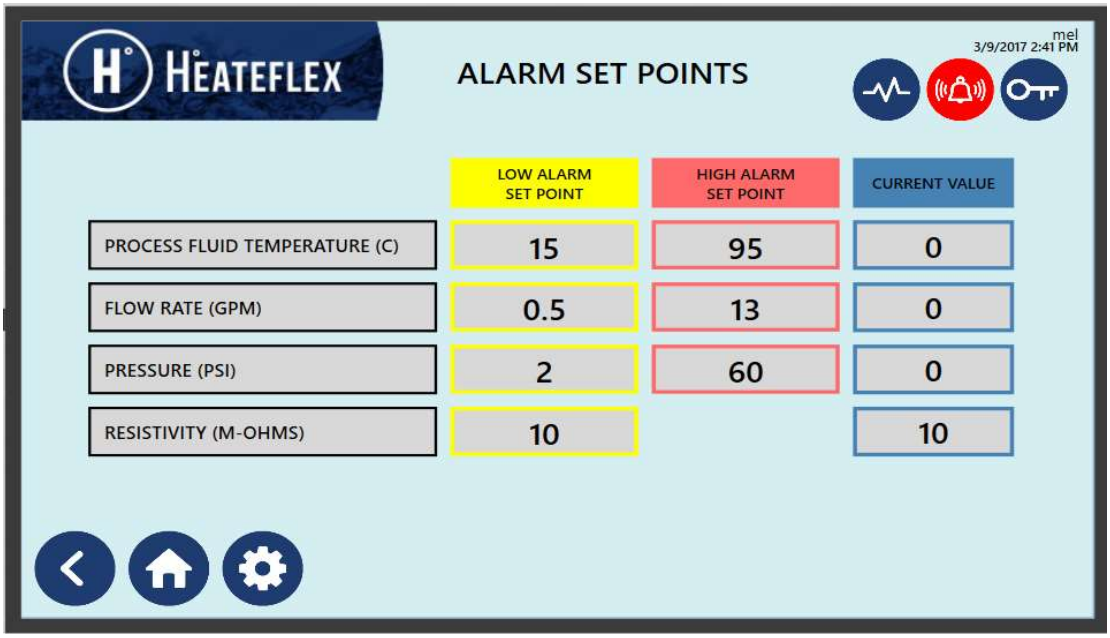
Note:

1. The **Voltage Selection Set Up** is for Factory Use Only and is inaccessible to the customer.
2. The Low Flow Alarm is not active when Auto Reset is set to ON or enabled.

6.3. ALARM SET POINTS SCREEN

A number of alarm set points may be set in this screen. To modify the values of any of these set points, press the box with the value of the alarm to be changed (See Figure 6-3). The system will prompt you to enter the **User Password**. Once the correct password is entered, the number pad will appear. The alarm set point can now be changed. Enter the desired value, and press the **Enter** key. The desired value for the selected alarm set point will be stored. Table 6-2 details all the alarm set points that can be modified on this screen.

Figure 6-3: Alarm Set Points Screen



Note: The appearance of the **Alarm Set Points** screen may vary depending on the Aquarius® D.I. Water Heating System options.

Table 6-2: Alarm Set Point Ranges

PARAMETER NAME	SETTING RANGE	FACTORY DEFAULT
Low Temperature Alarm	0.0 to 98.0°C	20.0°C
High Temperature Alarm	0.0 to 98.0°C	95.0°C
Low Flow Alarm ★	0.5 to 13.0 gpm	0.5 gpm
High Flow Alarm ★	0.0 to 13.0 gpm	13.0 gpm
Low Pressure Alarm	0.0 to 80.0 psi	2.0 psi
High Pressure Alarm	0.0 to 80.0 psi	60.0 psi
Low Resistivity Alarm (Optional)	0.0-20.0 M-Ohms	10.0 M-Ohms

★ Based on plumbing size, see Table 6-3.

Table 6-3: Plumbing and Minimum/Maximum Flow Rates

Flow Sensor Tee Connector Type	Minimum Flow [gpm]	Maximum Flow [gpm]
20mm Pipe, 1.9mm wall	0.3	10.0
3/4" Flare, 5/8" I.D.	0.5	13.0
25mm Pipe, 1.9mm wall	0.5	13.0
32mm Pipe, 2.4mm wall	0.8	18.0
40mm Pipe, 2.4mm wall	1.2	28.0

6.4. OPTIONS SCREEN

All of the optional features for the **PF2000** can be modified on the respective option screen by pressing the **OPTION SETTINGS** key on the **System Setup Menu** screen to access the **Option Settings** screen, which is shown in Figure 6-4 below. Note that this screen may vary depending on the options available. Select the option you wish to modify by pressing the respective key, i.e. depression of the **PURGE** key will switch to the **PURGE MODE** screen, as shown in Figure 6-5. To modify the values of any of these set points or parameters, press the box with the value of the parameter or set point to be changed. The system will prompt you to enter the **User Password**. Once the correct password is entered, the number pad will appear. The value can now be changed. Enter the desired value, press the **Enter** key, and the entered value will be stored. Access to the parameters and set points displayed on this screen will depend on the model and selected options for the Aquarius® D.I. Water Heating System. Inactive parameters are designated by a depressed box. See the Aquarius® D.I. Water Heating System Instruction Manual for a complete list and more information on **PF2000** optional features.

Figure 6-4: Option Settings Screen

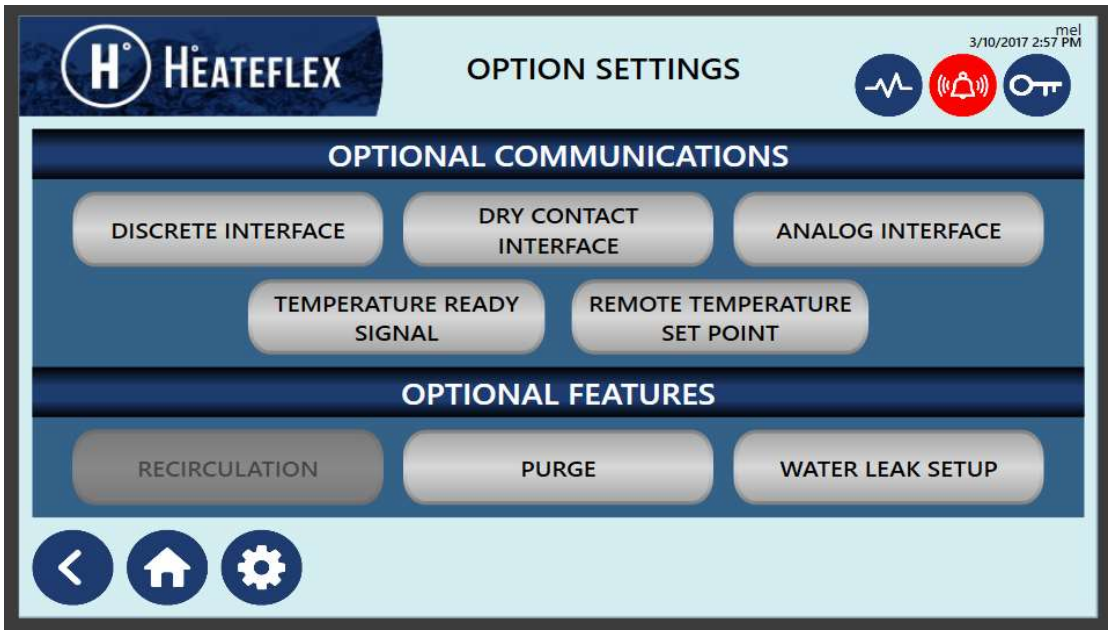
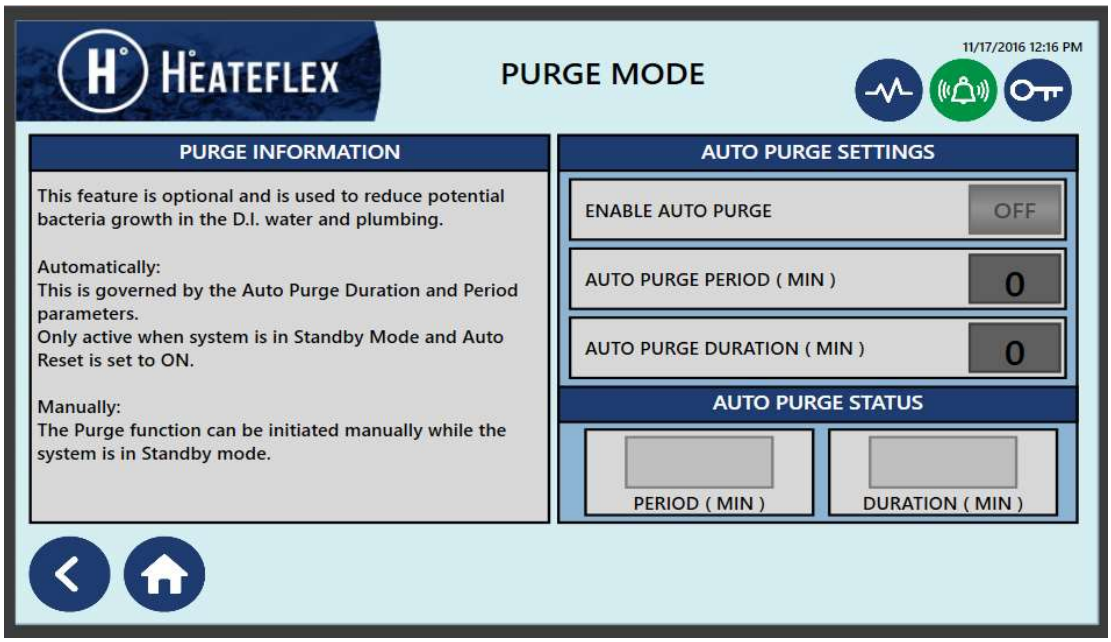


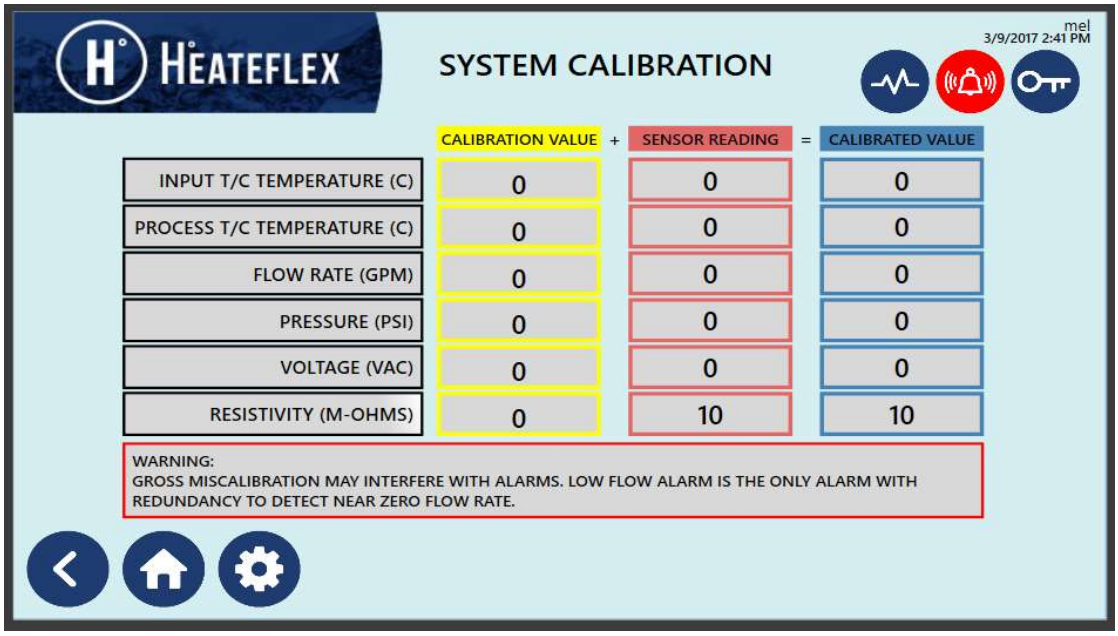
Figure 6-5: Purge Mode Screen



6.5. SYSTEM CALIBRATION SCREEN

The **System Calibration** screen (See Figure 6-6) is used to calibrate the system and to further compensate for any potential errors. This screen allows the user to adjust the reading from the following analog sensors or thermocouples: flow sensor, pressure transducer, voltage transducer, incoming temperature thermocouple, process temperature thermocouple, and optional resistivity sensor. To modify the calibration values of any of these sensors, press the box with the value of the sensor to be calibrated. The **PF2000** will prompt you to enter the **User Password**. Once the correct password is entered, the number pad will appear. The calibration can now be changed. Enter the desired value, and press the **Enter** key. The desired calibration value for the sensor will be stored. Table 6-4 details all the sensors that can be calibrated in this screen.

Figure 6-6: System Calibration Screen



Note: The appearance of the **System Calibration** screen may vary depending on the Aquarius® D.I. Water Heating System options.

Table 6-4: System Calibration Ranges

SENSOR	CALIBRATION RANGE
Incoming Thermocouple	-10.0 to +10.0°C
Process Thermocouple	-10.0 to +10.0°C
Flow Sensor	-2.0 to +4.0 gpm
Pressure Transducer	-5.0 to +5.0 psi
Voltage Transducer	-20 to +20 VAC (Integers Only)
Resistivity Sensor (Optional)	-5.0 to + 5.0 M-Ohms
Pump Air Cooling Calibration (Optional)	Off or On (will remain On for 60 seconds)

Note:

1) The calibration for the resistivity sensor is available only if the Resistivity option is available.

7. ALARM MENU

Various **Alarm** conditions are activated by many sources and are annunciated by the screen displays and by an audio tone. The flashing **ALARM MENU** key or illuminated lamp indicates that an **Alarm** condition has occurred. The alarms are either classified as "non-critical" or "critical". For more information on which alarms are "critical" or "non-critical" see Table 7-1. The non-critical alarms are automatic reset alarm types and will automatically be cleared by the **PF2000** when the alarm condition is no longer present. The non-critical alarms have no effect on the operation of the system and serves as a warning only. The critical alarms are manual reset alarm types. The critical alarms directly affect the operation of the system in various ways depending on the alarm that is triggered. All of the critical alarms when triggered will automatically send the unit from **ACTIVE** mode into **STANDBY** mode and shut off the signal to the heaters. The alarm condition needs to be resolved and a manual reset is required in order to return to normal operation. The critical **Alarm** triggered may remain active even after the condition has disappeared or resolved. To clear the alarm condition the **ALARM RESET** key must be pressed, which is located on the **Alarm Menu** screen and on all of the alarm description screens. Note that if any of the critical alarms has disabled the heaters, they will remain disabled to protect the equipment from any potential damage. In order to start processing the **RUN** key must be pressed.

All of the alarms activate an audio tone regardless of alarm type. If any alarms are present a solid red or yellow respective **Alarm Indicating Lamp** located on the **Alarm Menu** screen (shown in Figure 7-1 to 7-2) will appear. In addition, the **ALARM MENU** key will flicker yellow for non-critical alarms and red for critical alarms on various screens. The non-critical alarms are superseded by critical alarms in any situation when both alarm types are present. The **ALARM MENU** key is located on the **Main Menu** screen and **Alarm History** screen. The audio tone and the **ALARM MENU** key alternate ON and OFF to draw attention to the alarm. Depression of the **SILENCE ALARM** key temporarily eliminates the audio alarm. However, the **Alarm** keys and **ALARM MENU** key will continue to flash to annunciate the alarm condition.

A **Heater Master Relay** and **Heater Safety Relay** are provided as an additional mechanical interlock for the critical alarms. The **Heater Master Relay** is a normally open relay that is wired in series to control the **Master System Contactor**. When the system is processing the **Heater Master Relay** will close, thus providing power through the contactor. The **Heater Master Relay** will open, and shut off power to the heaters when specific critical alarms are triggered. The **Heater Safety Relay** is normally closed when no critical alarms are present. Should any of the critical alarms become active the **Heater Safety Relay** will open and drop out the relay. These relays may only be reset by a manual depression of the **ALARM RESET** key after the alarm condition has been cleared. For more information on which alarms effect the **Heater Master Relay** or the **Heater Safety Relay** see Table 7-1.

To determine which alarm has been activated, touch the **ALARM MENU** key to access the **Alarm Menu** screen (shown in Figure 7-1 to 7-2). This screen lists the different alarms of the system. Non-critical alarms that are active will be illuminated yellow, while critical alarms will be illuminated red. See Table 7-1 for detailed information on the various alarms.

Figure 7-1: Alarm Menu Screen 1

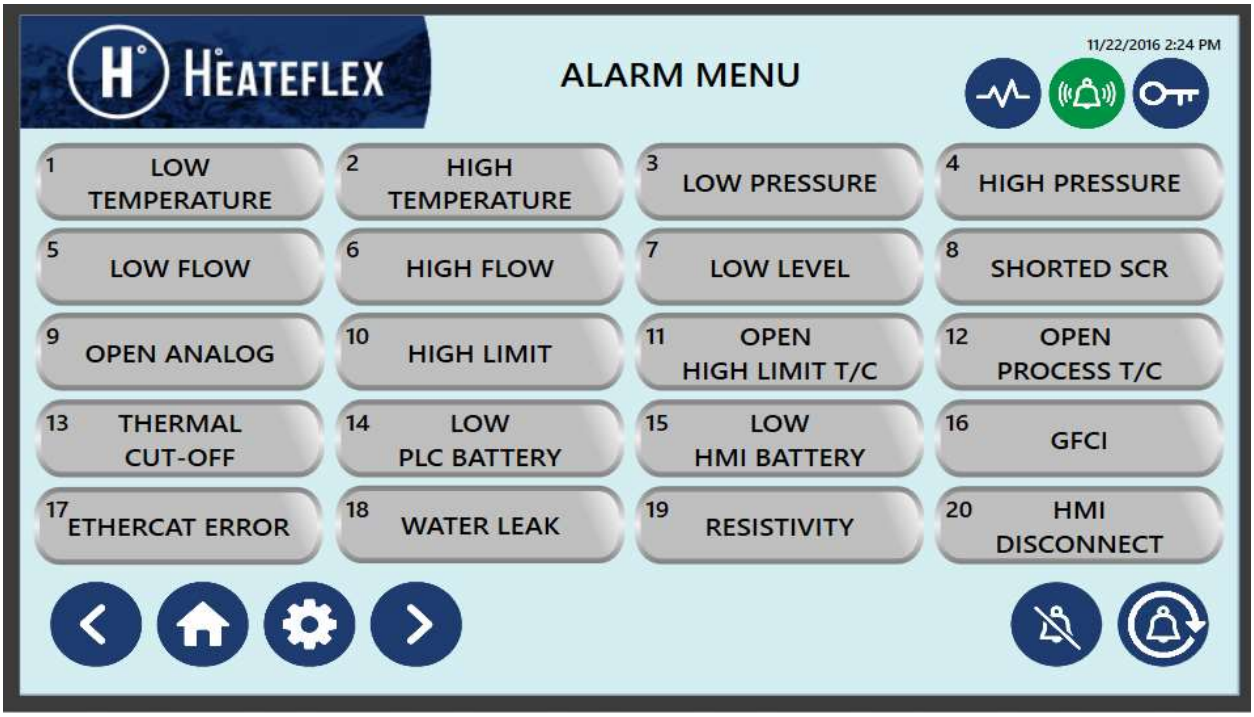
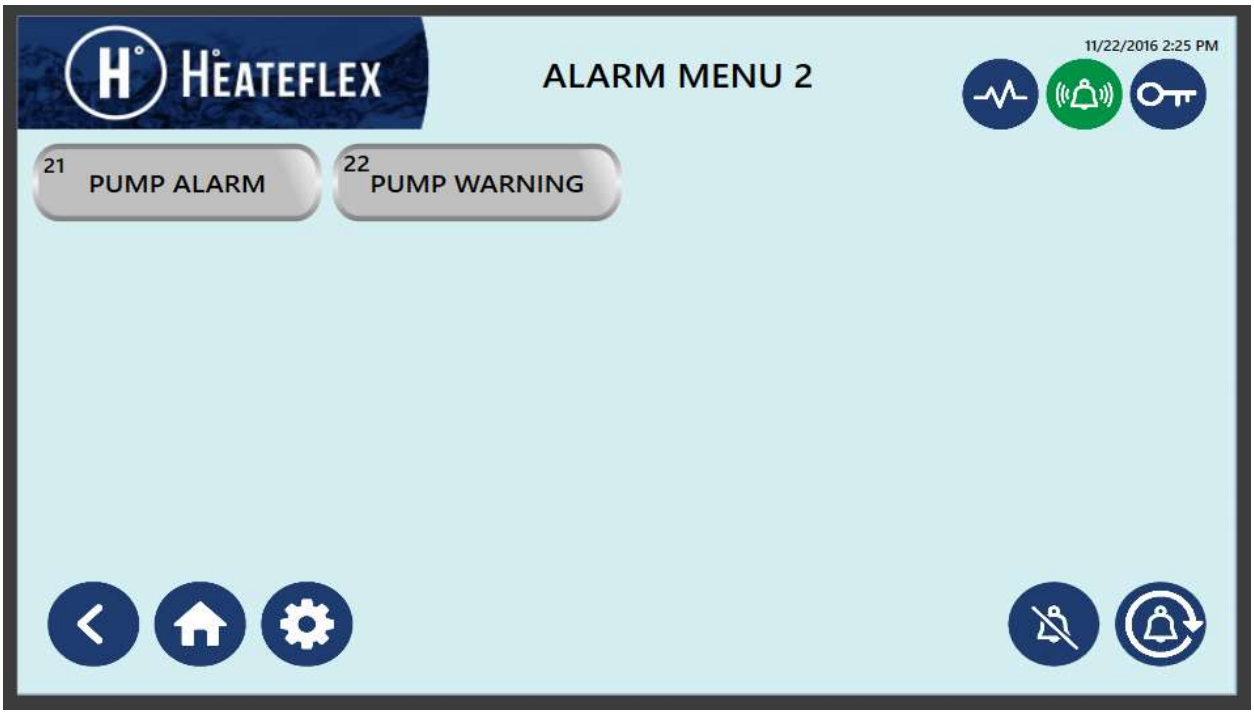


Figure 7-2: Alarm Menu Screen 2



Note: Not all of the **Alarms** will be active if the option is not installed in the unit. This is designated by a depressed box.

For alarm description and troubleshooting tips press on any of the alarm keys. See Figure 7-3 for a typical alarm description screen. If applicable, press the **NEXT** key to move to the next **Alarm Menu** screen. The **SILENCE ALARM** key is located on all of these types of screens while the **ALARM RESET** key appears on "critical" or manual reset alarm type screens. In addition several alarm types contain additional screen to provide more information about the alarm condition, such as the **Open Analog Sensor**, **High Limit T/C**, **Open High Limit T/C**, **Open Process T/C**, **GFCI** (Optional), and the **Resistivity** (Optional). To access these additional screens press the respective key on the alarm description screen. This is illustrated in Figure 7-3.

Figure 7-3: Typical Alarm Description and Troubleshooting Screen

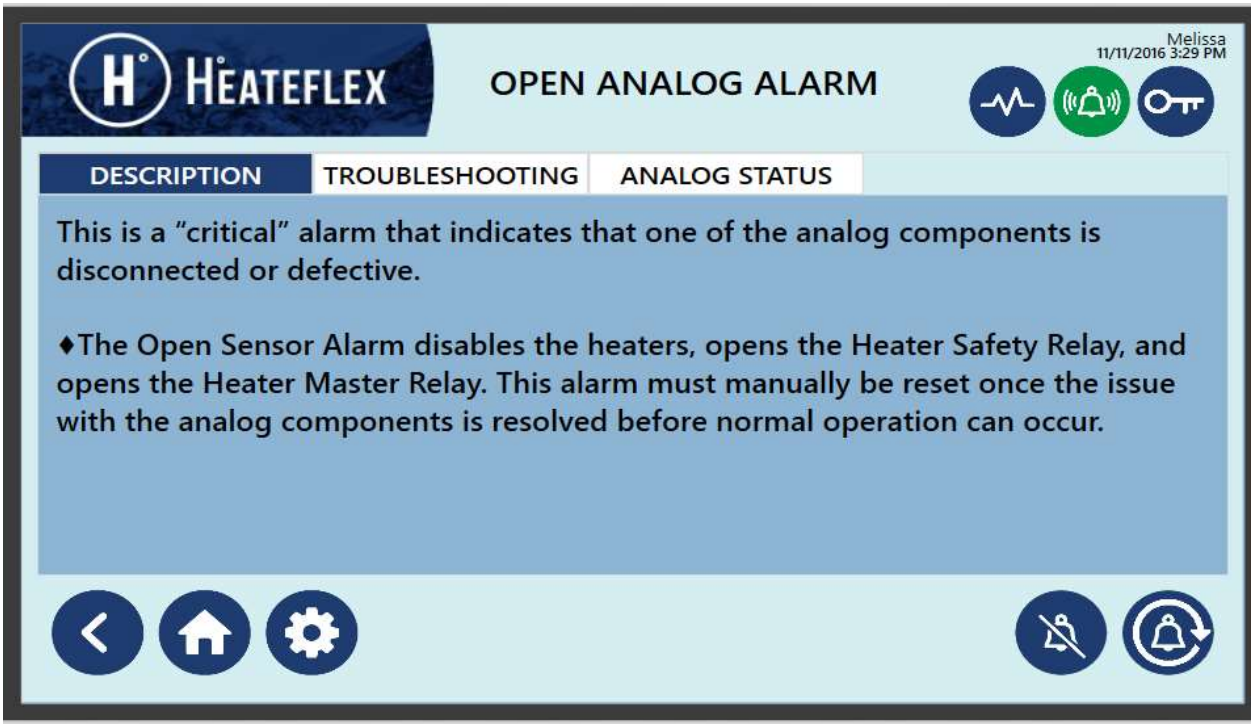
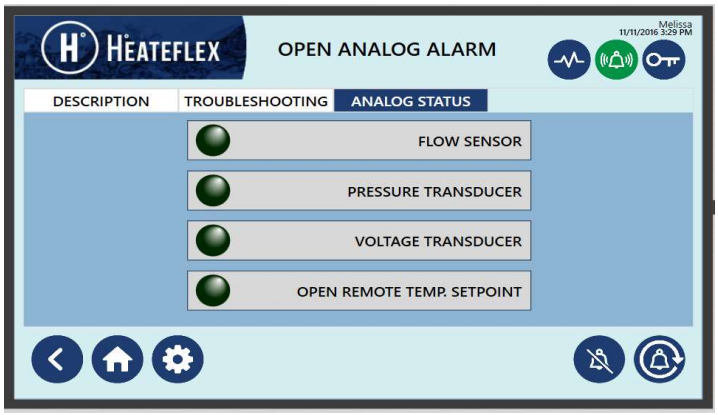
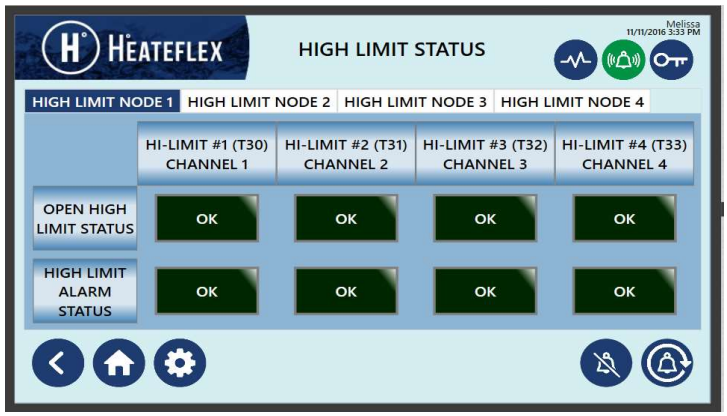


Table 7-1: Alarm Description and Troubleshooting

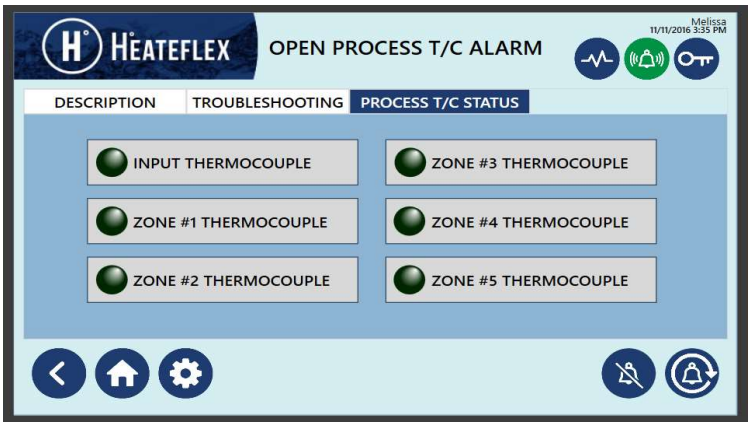
ALARM	DESCRIPTION/TROUBLESHOOTING
Low Temperature	❖ **Description** This is a "non-critical" alarm that indicates a process fluid temperature below the **"Low Temperature Alarm Set Point"**. ★The **Low Temperature Alarm** does not disable the heaters and automatically resets once the temperature is above the **"Low Temperature Alarm Set Point"**. ❖ **Troubleshooting** a. The **"Low Temperature Alarm Set Point"** is set too high. b. The **"Process Temperature Set Point"** is set too low.
High Temperature ★	❖ **Description** This is a "critical" alarm that indicates a process fluid temperature exceeding the **"High Temperature Alarm Set Point".** ★The **High Temperature Alarm** disables the heaters, opens the **Heater Safety Relay** and must be manually reset once the temperature is below the **"High Temperature Alarm Set Point"** before normal operation can occur. ❖ **Troubleshooting** a. The **"High Temperature Alarm Set Point"** is set too low. b. The **"Process Temperature Set Point"** is set too high.

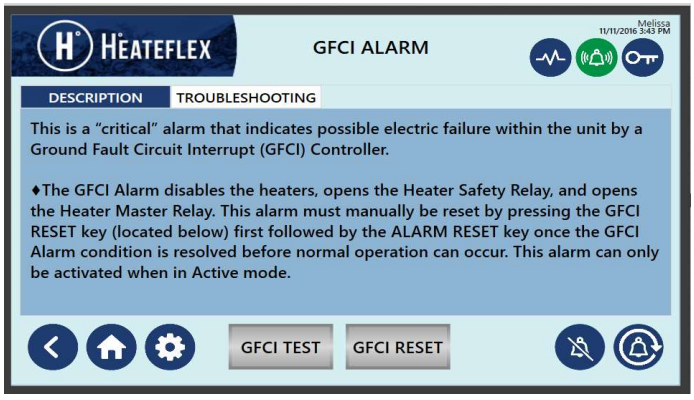
ALARM	DESCRIPTION/TROUBLESHOOTING
Low Pressure	❖ **Description** This is a "non-critical" alarm that indicates a system pressure below the **"Low Pressure Alarm Set Point".** ★The **Low Pressure Alarm** does not disable the heaters and automatically resets once the system pressure is above the **"Low Pressure Alarm Set Point"**. ❖ **Troubleshooting** a. Incoming pressure to the unit is too low. Increase the incoming pressure. b. The **"Low Pressure Alarm Set Point"** is set too high. c. The pressure transducer is faulty or defective. Replace the pressure transducer.
High Pressure★	❖ **Description** This is a "critical" alarm that indicates a system pressure exceeding the **"High Pressure Alarm Set Point".** ★The **High Pressure Alarm** disables the heaters, opens the **Heater Safety Relay** and must manually be reset once the system pressure is below the **"High Pressure Alarm Set Point"** before normal operation can occur. ❖ **Troubleshooting** a. Incoming pressure to the unit is too high. Regulate the incoming pressure. b. The **"High Pressure Alarm Set Point"** is set too low. c. The pressure transducer is faulty or defective. Replace the pressure transducer.
Low Flow★	❖ **Description** This is a "critical" alarm that indicates a flow rate below the **"Low Flow Alarm Set Point"**. ★The **Low Flow Alarm** disables the heaters, opens the **Heater Safety Relay** and must manually be reset once the flow rate is above the **"Low Flow Alarm Set Point"** before normal operation can occur. ★When the **"Automatic Reset"** function is **ON**. The **Low Flow Alarm** will be disabled. ❖ **Troubleshooting** a. Verify that there is fluid flow through the unit. b. The **"Low Flow Alarm Set Point"** is set too high. c. The flow sensor is not calibrated properly. Calibrate the flow sensor. d. The flow sensor is faulty or defective. Replace the flow sensor. e. Verify that the input solenoid valve is operational.
High Flow	❖ **Description** This is a "non-critical" alarm that indicates a flow rate exceeding the **"High Flow Alarm Set Point"**. ★The **High Flow Alarm** does not disable the heaters and automatically resets once the flow rate is below the **"High Flow Alarm Set Point"**. ❖ **Troubleshooting** a. Verify that the flow sensor is connected. b. The flow sensor is not calibrated properly. Calibrate the flow sensor. c. The **"High Flow Alarm Set Point"**. is set too low. d. The flow sensor is faulty or defective. Replace the flow sensor.

ALARM	DESCRIPTION/TROUBLESHOOTING
Open Analog★	❖ **Description** This is a “critical” alarm that indicates that one of the analog components is disconnected or defective. ★The **Open Sensor Alarm** disables the heaters, opens the **Heater Safety Relay**, and opens the **Heater Master Relay**. This alarm must manually be reset once the issue with the analog components is resolved before normal operation can occur. ❖ **Troubleshooting** a. There is a loose connection in the sensor wiring. Check the analog components for loose wires. b. There is a faulty or defective analog component. Replace the respective component. ❖ **Open Analog Sensor Screen** When the **Open Analog Alarm** is triggered, this screen can be used to determine which of the analog sensors or signals is having an issue. This screen, shown below in Figure 7-4, will display which analog sensor is initiating the alarm by illuminating a red lamp. ★The analog sensors or signals that are monitored are: a. Flow Sensor b. Pressure Transducer c. Pressure Transducer d. Remote Temperature Set Point Signal (Optional) **Figure 7-4: Open Analog Alarm Screen** 

ALARM	DESCRIPTION/TROUBLESHOOTING
High Limit T/C★	❖ **Description** This is a "critical" alarm that indicates an over-temperature condition in one of the heater modules. ★The **High Limit Alarm** disables the heaters, opens the **Heater Safety Relay**, and opens the **Heater Master Relay**. This alarm must manually be reset once the over temperature condition is resolved before normal operation can occur. ❖ **Troubleshooting** a. The **"High Limit Set Points"** are set up incorrectly. b. There is a loose connection in the electrical wiring. Check sensors for loose wires. c. There is a faulty or defective thermocouple (T/C) sensor. Replace the T/C sensor. d. Verify that communication is present between the respective High Limit Node and the Safety PLC. ❖ **High Limit Node Screens** When the **High Limit Alarm** is triggered, the screen shown below in Figure 7-5 will display which heater high limit thermocouple is initiating the alarm by illuminating a red lamp underneath the corresponding high limit T/C. If the alarm condition is resolved the indicating lamp on this screen will disappear but the alarm will still be latched. The **ALARM RESET** key must be pressed in order to clear the alarm. See Open High Limit T/C Alarm for more information. **Figure 7-5: High Limit Node #1 Screen** 

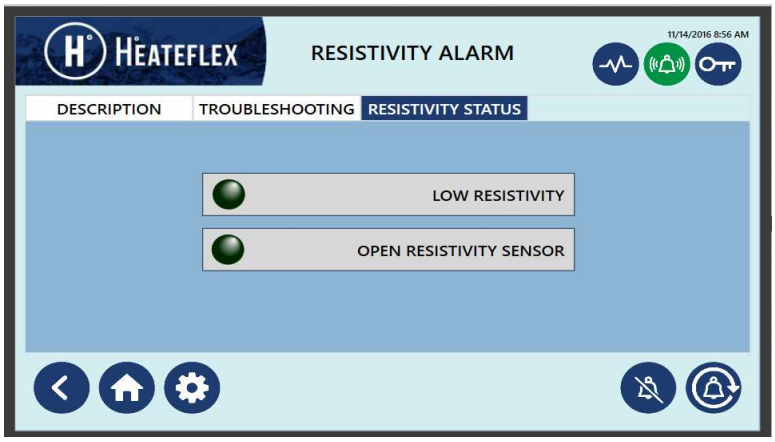
ALARM	DESCRIPTION/TROUBLESHOOTING
Open High Limit T/C★	❖ **Description** This is a "critical" alarm that indicates an open or defective high limit sensor (T/C) in one of the heater modules. ★The **Open High Limit T/C Alarm** disables the heaters, opens the **Heater Safety Relay**, and opens the **Heater Master Relay**. This alarm must manually be reset once the issue with the high limit sensors is resolved before normal operation can occur. ❖ **Troubleshooting** a. There is a loose connection in the sensor wiring. Check sensors for loose wires. b. There is a faulty sensor or sensor failure. Replace the thermocouple sensor. c. Check the High Limit Controller for loose High Limit Nodes or EDU. ❖ **High-Limit Info.** When the **Open High Limit T/C Alarm** is triggered, the screen shown in Figure 7-5 will display which heater high limit thermocouple is initiating the alarm by illuminating a red lamp underneath the corresponding high limit T/C. If the alarm condition is resolved the indicating lamp on this screen will disappear but the alarm will still be latched. The **ALARM RESET** key must be pressed in order to clear the alarm. In addition, the communication status of the Node channels appears on this screen to notify the operator that communication is present between the High Limit Node and the Safety PLC. If communication is present, the **Communications Status Lamp** underneath the corresponding high limit T/C or Channel will flicker a green lamp. The actual amount of High Limit Nodes will vary depending on the model of the unit. Use the **High Limit Information Menu** screen to toggle between the different **High Limit Node** screens. ❖ ❖ **High Limit T/C Node Locations** Node #1 - High Limit T/C #1 - #4 Node #2 - High Limit T/C #5 - #8 Node #3 - High Limit T/C #9 - #12 Node #4 - High Limit T/C #13 - #16 Node #5 - High Limit T/C #17 - #20 Node #6 - High Limit T/C #21 - #24
Low Level★	❖ **Description** This is a "critical" alarm that indicates a low fluid level condition in the unit. ★The **Low Level Alarm** disables the heaters, opens the **Heater Safety Relay** and must manually be reset once the liquid level sensor detects fluid before normal operation can occur. ❖ **Troubleshooting** a. Verify that the fluid is flowing through the unit. b. Adjust the sensitivity of the liquid level sensor. c. There is a loose connection in the sensor wiring. Check the sensor for loose wires. d. Check the valves and solenoid valves. e. There is a faulty sensor or sensor failure. Replace the sensor.

ALARM	DESCRIPTION/TROUBLESHOOTING
Open Process T/C★	❖ **Description** This is a "critical" alarm that indicates an open or defective thermocouple sensor in one of the master zone heater modules or in the incoming thermocouple. ★The **Open Process T/C Alarm** disables the heaters, opens the **Heater Safety Relay**, and opens the **Heater Master Relay**. This alarm must manually be reset once the issue with the process sensors is resolved before normal operation can occur. ❖ **Troubleshooting** a. There is a loose connection in the sensor wiring. Check the sensors for loose wires. b. There is a faulty sensor or sensor failure. Replace the thermocouple. ❖ **Open Process Thermocouple Screen** When the **Open Process Alarm** is triggered, the screen shown below in Figure 7-6, will display which process thermocouple(s) is initiating the alarm with a green illuminated indicating light. The actual number of "zones" shown on this screen will vary according to the model of the unit. **Figure 7-6: Open Process Thermocouple Screen** 

ALARM	DESCRIPTION/TROUBLESHOOTING
GFCI★ (Option)	❖ **Description** This is a "critical" alarm that indicates possible electric failure within the unit by a Ground Fault Circuit Interrupt (GFCI) Controller. ★The **GFCI Alarm** disables the heaters, opens the **Heater Safety Relay**, and opens the **Heater Master Relay**. This alarm must manually be reset by pressing the **GFCI RESET** key first followed by the **ALARM RESET** key once the GFCI Alarm condition is resolved before normal operation can occur. ❖ **Troubleshooting** a. Verify that the "**GFCI Control Settings"** are correct. b. There is a loose connection in the electrical wiring. Check for loose wires. c. Resolve any possible shorts. d. Check the GFCI controller or Current Transformer (CT). e. The GFCI controller or Current Transformer (CT) is faulty or defective. Replace the respective component. ❖ **GFCI Alarm Screen** The **GFCI Alarm** can be tested by pressing the **GFCI TEST** key shown in Figure 7-7. The GFCI test function requires that the **User Password** be entered. In addition, in order to clear the **GFCI Alarm** the **GFCI RESET** key must be pressed prior to the **ALARM RESET** key. Note that the **GFCI Alarm** can only be triggered when in **ACTIVE** mode or the heaters are ON. **Figure 7-7: GFCI Alarm Screen** 

ALARM	DESCRIPTION/TROUBLESHOOTING
Low PLC Battery	❖ **Description** This is a "non-critical" alarm that indicates that the battery level of the Safety PLC is low and must be replaced. ★The **Low PLC Battery Alarm** does not disable the heaters and automatically resets once the battery is replaced. It is recommended that the battery is replaced immediately to prevent memory loss. The battery must be **replaced within 5 days** of the alarm to prevent memory loss. *If power to the Safety PLC is removed when a low battery condition is present the Safety PLC program and memory may be lost. *Please take appropriate measures to: (1) ensure that the Safety PLC battery is replaced in a reasonable amount of time and (2) when replacing the Safety PLC battery. *Please note that the Safety PLC will retain the Safety PLC program even with a low battery condition as long as power is maintained to the PLC. ❖ **Troubleshooting** a. Replace the battery located in the Safety PLC.
Low TS Battery	❖ **Description** This is a "non-critical" alarm that indicates that the battery level of the touch screen is low and must be replaced. ★The **Low TS Battery Alarm** does not disable the heaters and automatically resets once the battery is replaced. It is recommended that the battery is replaced immediately to prevent memory loss. The battery must be **replaced within 5 days** of the alarm to prevent memory loss. *If power to the touch screen is removed when a low battery condition is present the touch screen program and memory may be lost. *Please take appropriate measures to: (1) ensure that the touch screen battery is replaced in a reasonable amount of time and (2) when replacing the touch screen battery. *Please note that the touch screen will retain the touch screen program even with a low battery condition as long as power is maintained to the PLC. ❖ **Troubleshooting** a. Replace the battery located in the touch screen and then cycle power.
Shorted SCR Alarm★	❖ **Description** This is a "critical" alarm that indicates failure in at least one of the heater silicon controlled rectifier (SCR). ★The Shorted SCR Alarm disables the heaters, opens the Heater Safety Relay, and opens the Heater Master Relay. This alarm must manually be reset once the issue with the SCR is resolved before normal operation can occur. ❖ **Troubleshooting** a. There is a loose connection in the electrical wiring. Check the sensor for loose wires. b. There is a faulty or defective SSR. Replace the respective component.

ALARM	DESCRIPTION/TROUBLESHOOTING
Water Leak★ (Option)	❖ **Description** This is an alarm that indicates a fluid leak in the drip pan of the unit. The alarm type is user defined. (Factory Default Water Leak Type is Non-Critical) ★If Water Leak Alarm Type is set to NON-CRITICAL, the heaters ARE NOT disabled and the alarm resets once the leak condition is resolved. (Factory Default) ★If Water Leak Alarm Type is set to CRITICAL, the heaters ARE disabled and requires a manual reset once the leak condition is resolved before normal operation can occur. If Isolation Valve is enabled, the incoming water AOV valve (Critical Leak Valve) will close preventing any fluid from entering into the unit. ❖ **Troubleshooting** a. There is a loose connection in the electrical wiring. Check the sensor for loose wires. b. Check the plumbing for possible leaks. c. Check for faulty/defective sensor or plumbing components.
Thermal Cut-Off Alarm★	❖ **Description** This is a “critical” alarm that indicates an over-temperature condition, open, or defective thermal cut-off in one of the heater modules. ★The **Thermal Cut-Off Alarm** disables the heaters, opens the **Heater Safety Relay**, and opens the **Heater Master Relay**. This alarm must manually be reset once the thermal cut-off is physically replaced before normal operation can occur. ❖ **Troubleshooting** a. There is a loose connection in the electrical wiring. Check he sensors for loose wires. b. The thermal cut-off sensor was exposed to temperatures exceeding its threshold. Replace the thermal cut-off sensor. c. There is a faulty or defective thermal cut-off. Replace the thermal cut-off.

ALARM	DESCRIPTION/TROUBLESHOOTING
Resistivity (Option)	❖ **Description** This is a "non-critical" alarm that indicates a resistivity value below the **"Low Resistivity Alarm Set Point"** or an **Open Resistivity Sensor**. ★The **Resistivity Alarm** does not disable the heaters and automatically resets once the resistivity value is above **the "Low Resistivity Alarm Set Point"** or the open sensor condition is resolved. ❖ **Troubleshooting** a. The **"Low Resistivity Alarm Set Point"** is set too high. b. There is a loose connection in the electrical wiring. Check the sensor for loose wires. c. Check for faulty/defective sensor or an open resistivity sensor. ❖ **Resistivity Alarm Type Screen** The type of **Resistivity Alarm** that is triggered can be determined on the screen shown below (See Figure 7-8). This screen will display which type of **Resistivity Alarm** is being triggered with a red illuminated indicating light. **Figure 7-8: Resistivity Alarm Type Screen** 
Pump Alarm★	❖ **Description** This is a "critical" alarm that indicates an error with the recirculation pump and/or pump controller. ★The **Pump Alarm** disables the heaters and turns OFF the pump. This alarm must manually be reset once the issue with the pump and/or pump controller is resolved before normal operation can occur. ❖ **Troubleshooting** a. Check the temperature of the pump and/or pump controller. b. Check for loose connections in the electrical wiring, including the pump and/or pump controller. c. Refer to the pump manual for more information or for troubleshooting.

ALARM	DESCRIPTION/TROUBLESHOOTING
Pump Warning	❖ **Description** This is a “non-critical” alarm that indicates a potential problem with the recirculation pump and/or pump controller. ★The **Pump Warning Alarm** does not disable the heaters or affect the operation of the pump and automatically resets. ❖ **Troubleshooting** a. Check the temperature of the pump and/or pump controller. b. Check for loose connections in the electrical wiring, including the pump and/or pump controller. c. Refer to the pump manual for more information or for troubleshooting.

★ Denotes a “critical” alarm condition

8. ALARM HISTORY

The **Alarm History** screen is used to log alarm events, shown in Figure 8-1. The alarms will be logged as they occur and "roll off" older alarm logs as the maximum number of log entries (100) is reached. The active alarms are indicated by a "red flag" while resolved or cleared alarms are indicated by a "blue flag". This is illustrated on the screen below. In addition, the date, time, process temperature, and the flow rate will also be recorded during the occurrence of the alarm event. The **"Alarm Code"** is used to differentiate between which alarm has been triggered. The section under the **"Alarm Code"** label will display a numeric value that indicates which alarm event has occurred. See Figure 8-2 and Table 8-1 for the location of the numeric designations and a numeric list for the **Alarms**, respectively. The scroll bar on the right of the screen is used to scroll through the various alarm logs. The Alarm History can be cleared by pressing the **CLEAR HISTORY** key. Note that a **User Password** is required in order to access the **CLEAR HISTORY** key and clear the screen.

Figure 8-1: Alarm History Screen

Table 8-1: Alarm History Codes

ALARM TYPE	ALARM CODE
Low Temperature	1
High Temperature	2
Low Pressure	3
High Pressure	4
Low Flow	5
High Flow	6
Low Level	7
Shorted SCR	8
Open Analog (Global)	9
Open Flow Sensor	9A
Open Pressure Transducer	9B
Open Voltage Transducer	9C
Open Remote Temperature Set Point (Optional)	9D
High Limit T/C	10
Open High Limit T/C	11
Open Process T/C (Global)	12
Open Input T/C	12A
Open Zone #1 T/C	12B
Open Zone #2 T/C	12C
Open Zone #3 T/C	12D
Open Zone #4 T/C	12E
Open Zone #5 T/C	12F
Thermal Cut-Off	13
Low PLC Battery	14
Low HMI Battery	15
GFCI (Optional)	16
EtherCAT Error	17
Water Leak (Optional)	18
Resistivity (Global/Optional)	19
Open Resistivity Sensor (Optional)	19A
Low Resistivity Alarm (Optional)	19B
HMI Disconnect	20
Pump Alarm (Optional)	21
Pump Warning (Optional)	22

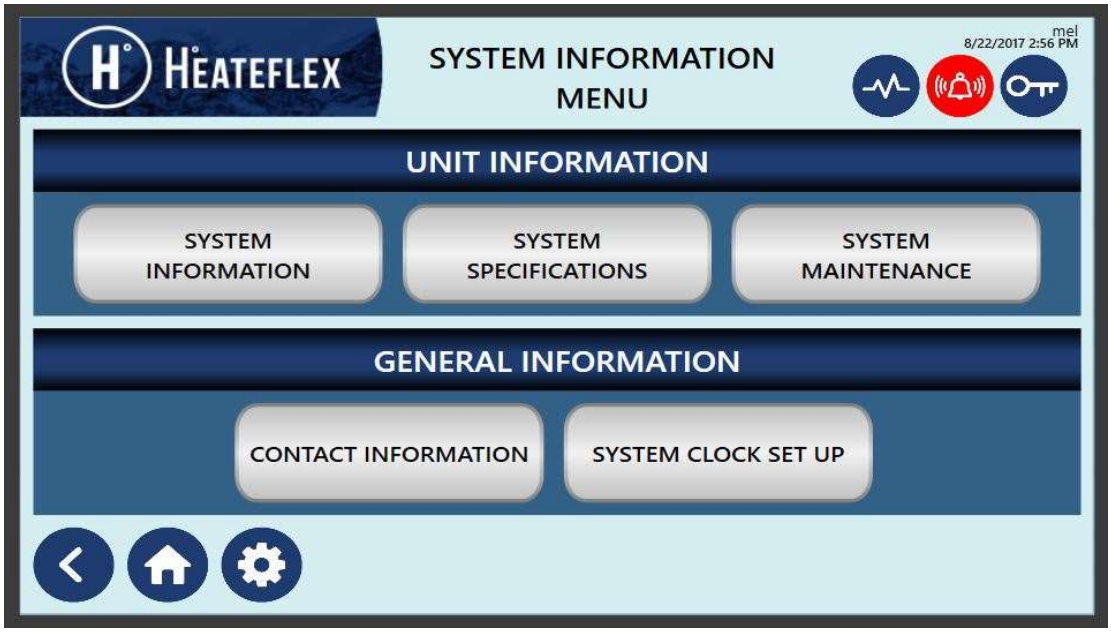
9. SYSTEM INFORMATION

The System Information screens are intended to provide more information about the Aquarius® D.I. Water Heating System. The **System Information Menu** screen can be accessed by pressing the **System Information** key located on the **Main Menu** screen (see Figure 1-1).

9.1. SYSTEM INFORMATION MENU SCREEN

The **System Information**, **System Specifications**, **System Maintenance**, and **Contact Information** screens can be accessed by pressing the respective keys shown in Figure 9-1 below.

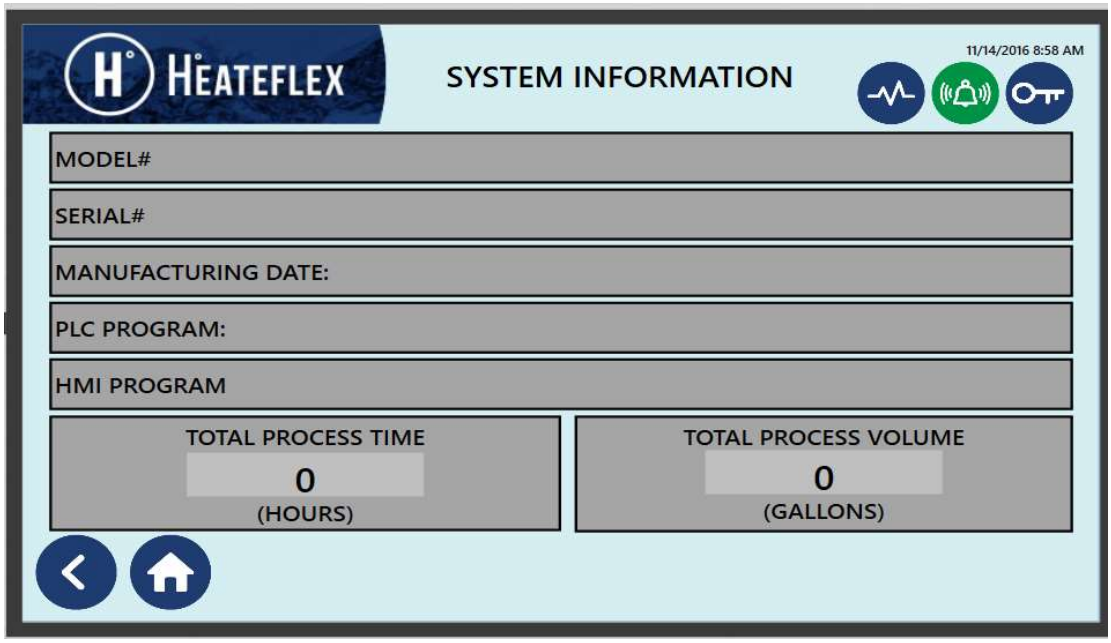
Figure 9-1: System Information Menu Screen



9.2. SYSTEM INFORMATION SCREEN

The **System Information** screen (Figure 9-2) provides more information about the Aquarius® D.I. Water Heating System, such as the Model Number, Serial Number, Manufacturing Date, and the **PF2000** program names, versions and data memory. In addition, there are two totalizers on this screen which track the "TOTAL PROCESS TIME" and the "TOTAL PROCESS VOLUME" passing through the unit. These totalizers cannot be reset.

Figure 9-2: System Information Screen



9.3. SYSTEM SPECIFICATIONS SCREEN

The **System Specifications** screens (Figures 9-3 to 9-5) display information about the Aquarius® D.I. Water Heating System specifications, such as the power, the voltage, the amperage, the frequency, the plumbing fitting requirements, etc.

Figure 9-3: System Specifications Screen - Electrical

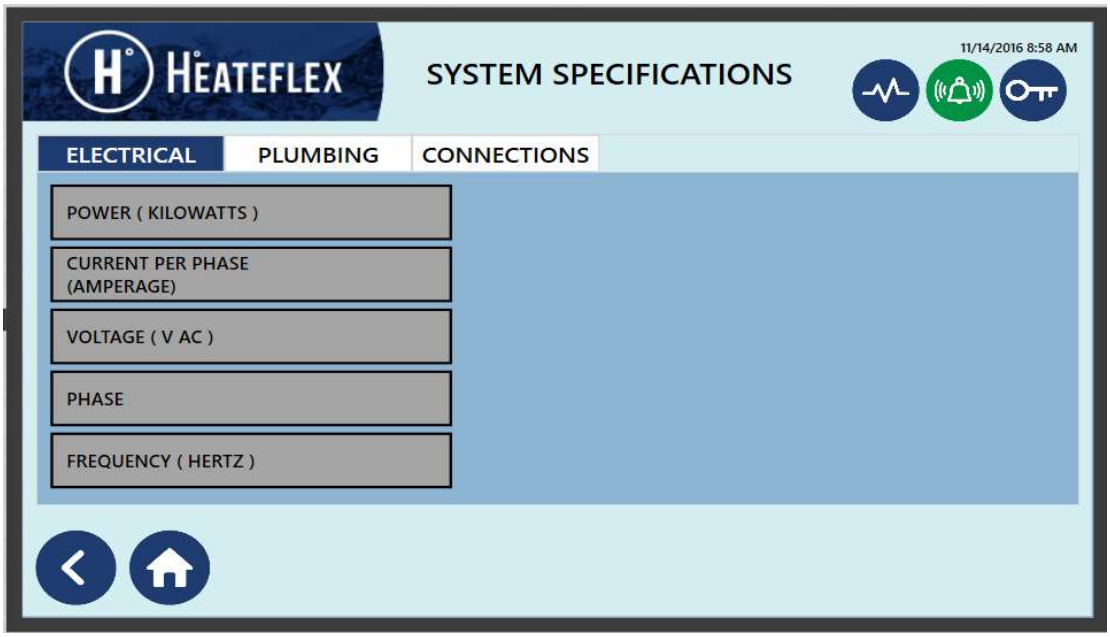


Figure 9-4: System Specifications Screen - Plumbing

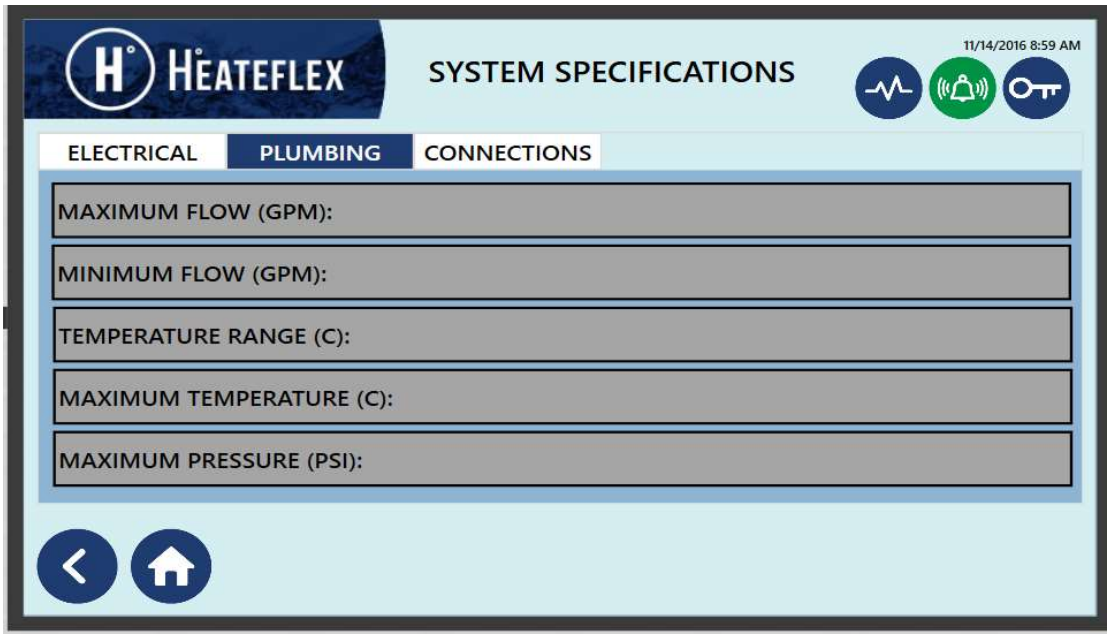
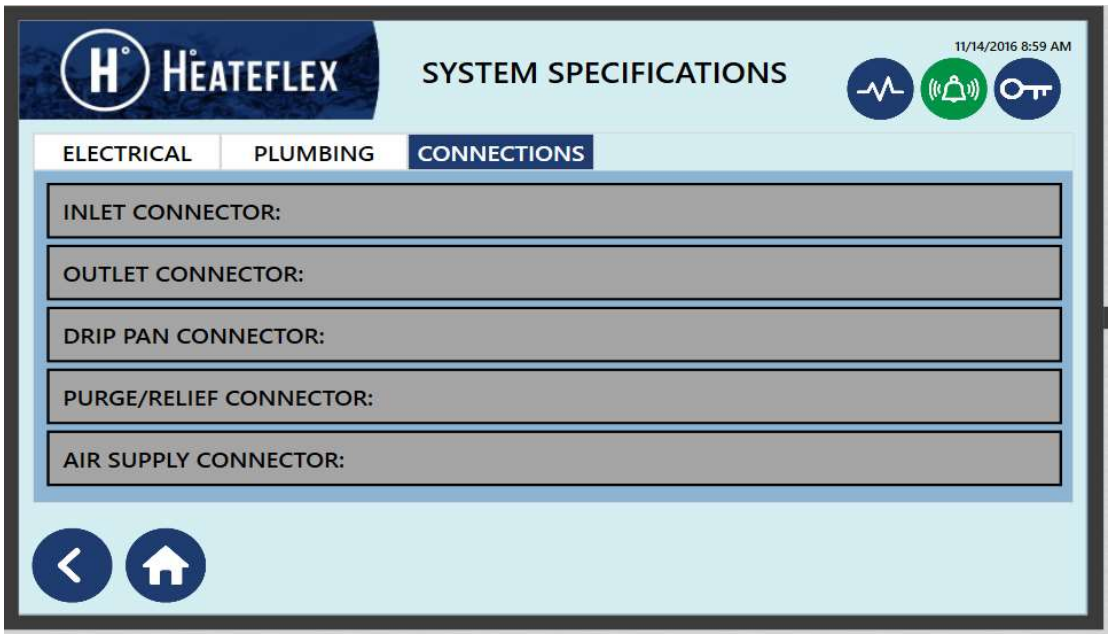


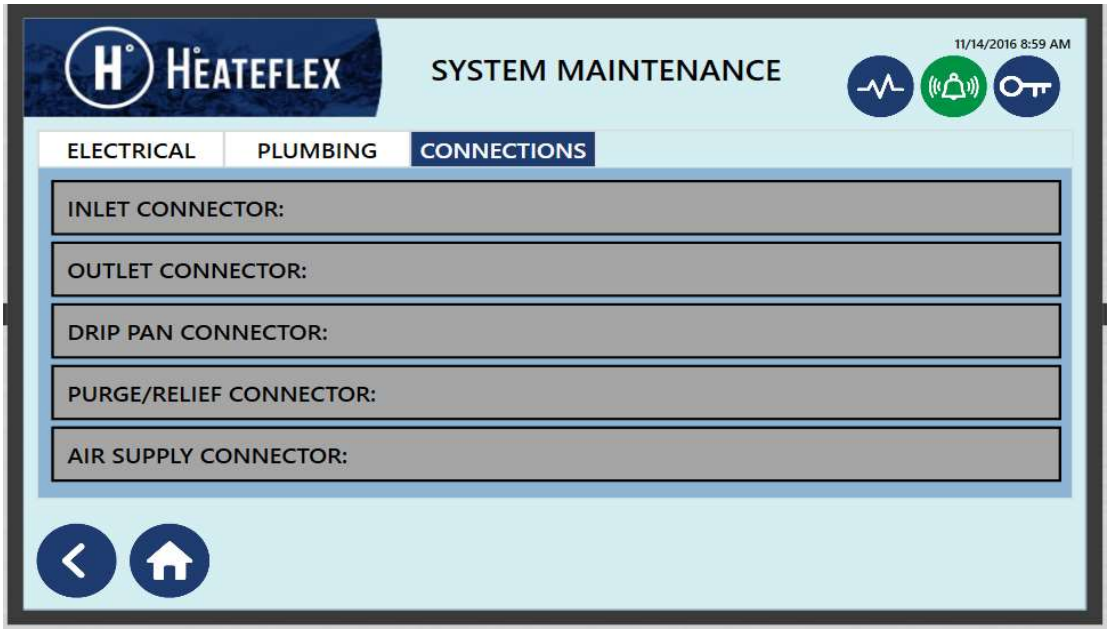
Figure 9-5: System Specifications Screen - Connections



9.4. SYSTEM MAINTENANCE SCREEN

The **System Maintenance** screen (Figure 9-6) provides general information for the component life and maintenance of the Aquarius® D.I. Water Heating System and components.

Figure 9-6: System Maintenance Screen



9.5. CONTACT INFORMATION SCREEN

The **Contact Information** screen (Figure 9-7) displays the company and contact information for Heateflex Corporation.

Figure 9-7: Contact Information Screen

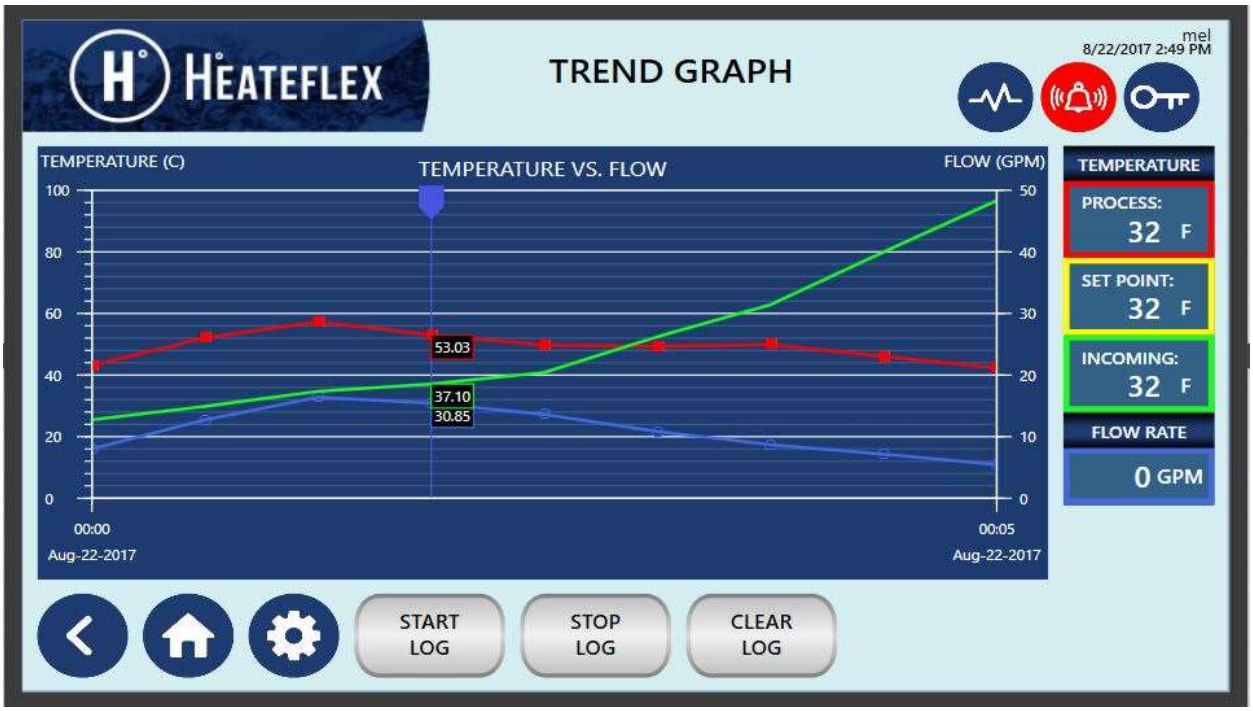
10. TREND GRAPH

The **Trend Graph** screen, as shown in Figure 10-1 below, can be accessed by pressing the **TREND GRAPH** key located on the **Main Menu** screen. The **Trend Graph** screen is used to track the system performance of the Aquarius® D.I. Water Heating System. This graph tracks the actual process temperature and flow rate of the system. The temperature data is shown in red while the flow rate data is shown in blue.

To start recording the performance of the system, the **"RECORD"** key needs to be pressed. To stop recording the data press the **"STOP"** key. The scroll bar on the top of the graph is used to scroll back through the graph. In order to see previous data not currently on the screen, the **"PAUSE"** key needs to be pressed first. This will allow you to use the scroll bar at the top of the graph and continues logging data. The data on the graph can be cleared by pressing the **LOG CLEAR** or **C** key.

The temperature and flow rate units shown on this screen can also be changed from English to SI units by pressing the **TEMP. F** key or the **FLOW. GPM** key as shown in Figure 10-1. When these keys are depressed the button will illuminate yellow. The **TEMP. F** key label will switch to **TEMP. C** and the **FLOW. GPM** label will switch to **FLOW, LPM**.

Figure 10-1: Trend Graph Screen



11. AUTO PURGE

This feature is optional for the Aquarius® and is used to reduce the risk of potential bacteria growth in the D.I. water, Aquarius® System and plumbing. An indicating light which can be found next to the **Purge Status** label on the **System Status** screen notifies the user that the Purge/Vent is active. The Purge feature can be activated three ways as detailed below – Automatically, manually, or remotely:

1) Automatically: This is governed by the "Auto Purge Duration" and the "Auto Purge Period" parameters. The "**Auto Purge Duration**" parameter is the length of time that the unit is allowed to remain in idle before the **Auto Purge** initiates. The "**Auto Purge Period**" is the actual length of time that the **Auto Purge** will remain active for, it is during this time that the Aquarius® System will purge/vent D.I. water. The **Auto Purge** feature can only be utilized while the system is in **STANDBY** mode, the **AUTO RESET** is set to "**ON**" (refer to Table 5-1 for more information), and there is a no flow condition through the unit. Table 11-1 details all the parameters that can be modified on this screen.

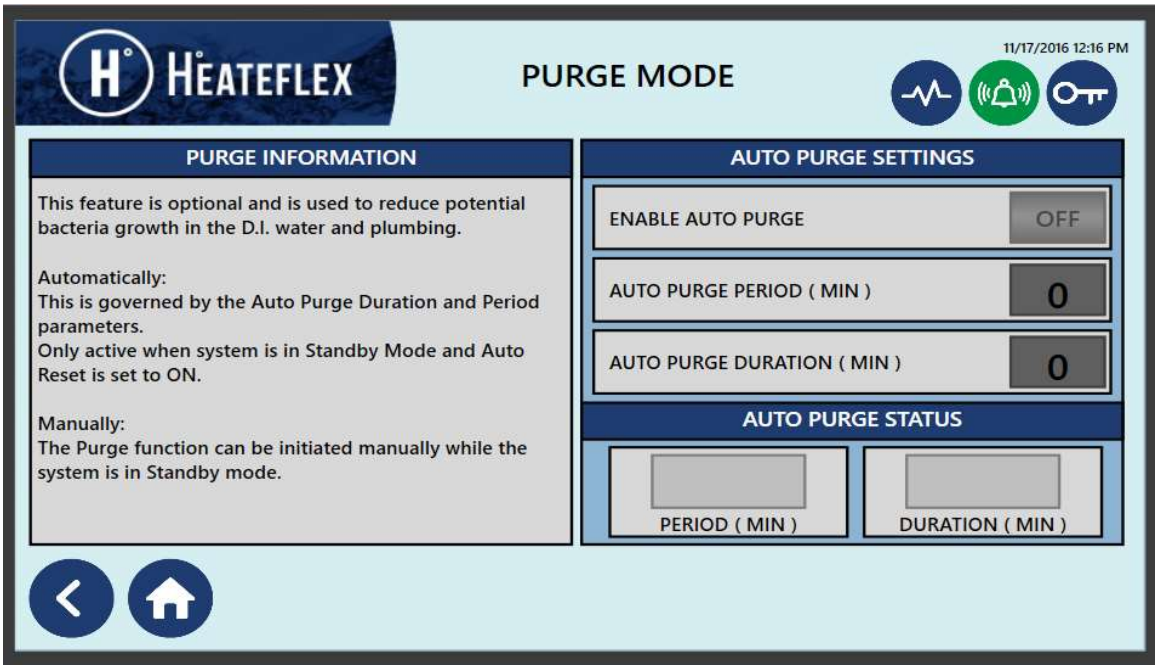
Table 11-1: Auto Purge Parameters

PARAMETER NAME	SETTING RANGE	FACTORY DEFAULT
Enable Auto Purge	Off or On	Off
Auto Purge Period	0 to 600 min (10 hrs) (Integers Only)	1 min
Auto Purge Duration	0 to 60 min (Integers Only)	1 min

Please note that the **PF2000** will prompt you to enter the **User Password** in order to access the **Auto Purge** parameters and enable the **Auto Purge** feature.

a. To access the **Auto Purge** screen, start with the **Main Menu** screen, then select **System Set Up**, next select **Options Menu**, and finally select **Auto Purge**. The **Auto Purge** screen will appear as shown below.
b. Enter the desired values for both the "**Auto Purge Duration**" and the "**Auto Purge Period**" parameters respectively. These values will be stored.
c. Press the "**OFF**" key located next to the "**Enable Auto Purge**" label. The "**OFF**" key will then change to "**ON**" and will be illuminated yellow indicating that the **Auto Purge** feature is active.

Figure 11-1: Purge Mode Screen



2) Manually: by pressing the "**PURGE**" key located in the **Auto Purge** User Selected Display on the **System Status** screen. Reference Figure 5-1 and 5-3. Please note that the Purge/Vent can only be manually initiated when the system is in **STANDBY** mode.

3) Remotely (if applicable): by pressing a remote momentary switch or signal through a communications interface. Please refer to Section 15 of this Instruction Manual or the Electrical Schematic Drawing for more information. Please note that the Purge/Vent can only be initiated remotely when the system is in **STANDBY** mode.

12. RECIRCULATION

The Aquarius® D.I. Water Heating Systems feature a built-in recirculation system and is equipped with an ultra–pure PFA-PTFE bearing-less pump, a pump air cooling system, and safety interlocks that are controlled with the PF2000 Controller.

Please follow all Pre-Installation Preparation, Installation, Suggested Operational Inspection procedures and the Pump Air Cooling System Set Up and Calibration prior to activating recirculation. This includes the connection of an external maintain switch/signal to the Aquarius® "Recirculation Signal". Please refer to the specific Electrical Component Layout drawing and the Electrical Schematic drawing for more information.

The Aquarius® D.I. Water Heating Recirculation System Recirculation modes are indicated on the **System Status** screen as shown in Figure 5-5. The three different modes are illustrated by a series of labels and/or lamps which are detailed in Table 12-1. Note, the Recirculation Menu will be displayed when the Recirculation Key is selected.

Note: The screen shown above is representative and may vary in appearance depending on the options selected.

Table 12-1: Recirculation Modes

MODE LAMP	DESCRIPTION
DEMAND	This is the default mode of the system. The system is in **DEMAND** mode and the recirculation system is not active. When the **DEMAND** mode is active the "Demand" lamp will illuminate green and/or the "Demand" label may be displayed.
VENTING	During the **VENTING** mode the recirculation system is preparing to initiate and is either filling the pump and/or evacuating the system plumbing of any air/bubbles that may exist. Once the system plumbing is free of excessive air/bubbles the **RECIRCULATION** mode will activate. When the **VENTING** mode is active the "Venting" lamp will illuminate green and/or the "Venting" label may be displayed. Please note that the **VENTING** mode will activate if excessive air/bubbles are detected within the recirculation plumbing.
RECIRCULATION	The system is in **RECIRCULATION** mode and no fluid is being diverted to process. When the **RECIRCULATION** mode is active the "Recirculation" lamp will illuminate green and/or the "Recirculation" label may be displayed.

The following conditions are necessary to place the Aquarius® into the **RECIRCULATION** mode:

- The Recirculation System must be enabled.
- A customer provided "Recirculation Signal" is required to send the system into the Recirculation mode.
- The Venting mode cannot be active.

If the above conditions are not met the Aquarius® will fail to enter the **RECIRCULATION** mode and remain in the **DEMAND** mode. Please note that the "Recirculation Signal" has no affect on the system if the Recirculation System is disabled. Table 12-1 details all recirculation settings. See Table 12-3 for details on the Recirculation Signal.

Table 12-2: Recirculation Parameters

SETTING NAME	SETTING RANGE	FACTORY DEFAULT
Recirculation System Enabled/Disabled	Disabled or Enabled	Disabled

Table 12-3: Recirculation Signal

RECIRCULATION SIGNAL	RECIRCULATION SYSTEM STATUS
Relay Open (Default)	Inactive
Relay Closed	Active

NOTE:

- The presence of any "critical" alarms will abort recirculation by shutting off the pump and deactivating the heaters. Once the "critical" alarms have been resolved, recirculation will automatically resume but the Aquarius® will be in **STANDBY** mode and the heaters will remain OFF until the system is placed back into the **ACTIVE** mode.
- The Process Temperature Set Point cannot be changed while Recirculation is active (System Status Screen Recirculation System is set to Enabled and the Remote User Recirculation Signal is in Active Status).

12.1. ACTIVATING RECIRCULATION

1. Enable the Recirculation System by pressing the **DISABLED** key on the **System Status** screen. The **"Disabled"** label will change to **"Enabled"** which will be illuminated yellow. The **ENABLED / DISABLED** is illustrated in Figure 5-5.
2. Send the closed "Recirculation Signal" to the Aquarius® system to switch from **DEMAND** mode and to enter the **RECIRCULATION** mode.

12.2. DEACTIVATING RECIRCULATION

Open the "Recirculation Signal" to the Aquarius® system to switch from **RECIRCULATION** mode to **DEMAND** mode.

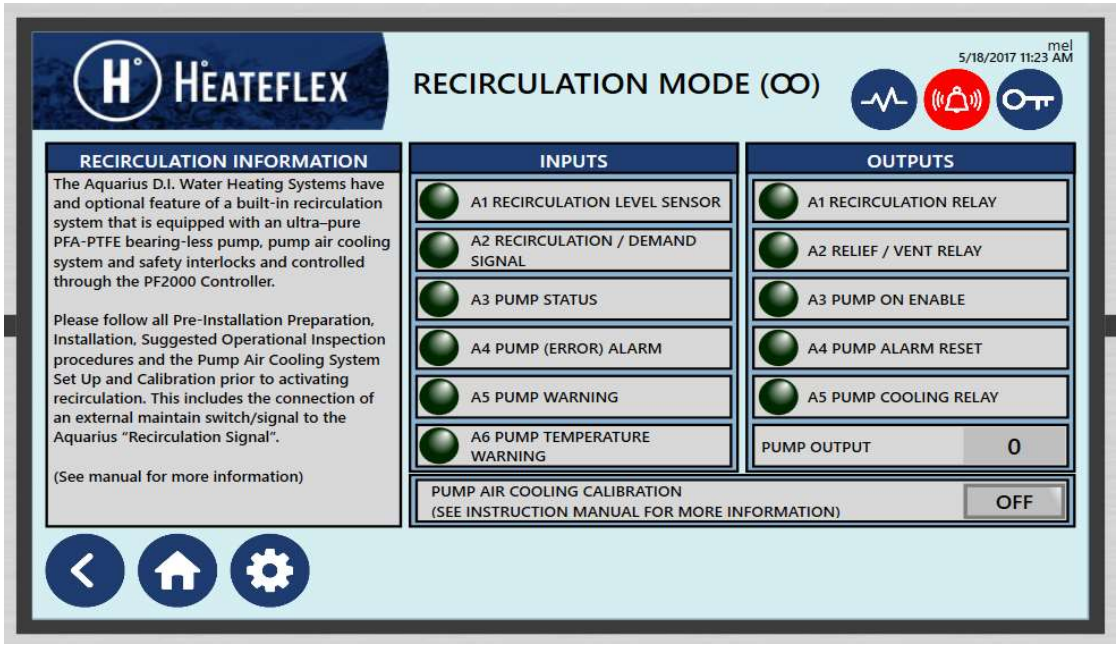
Or

Disable the Recirculation System by pressing the **ENABLED** key on the **System Status** screen. The **"Enabled"** label will change to **"Disabled"** and the system will automatically return to **DEMAND** mode. This particular method to deactivate recirculation will override the "Recirculation Signal" since the Recirculation System has been disabled.

12.3. PUMP AIR COOLING SYSTEM CALIBRATION

The pump air cooling system calibration can easily be done provided that all air supply connections for the pump air cooling system have been facilitated by pressing the **"Pump Air Cooling Calibration ON/OFF"** key located on the **Recirculation Mode Screen**. Along with the **"Pump Air Cooling Calibration ON/OFF"** key, the **Recirculation Mode Screen** includes general information and input and output status indicating lamps. These features are illustrated in Figure 12-1.

Figure 12-1: Recirculation Mode Screen



This pump air cooling system calibration is achieved by regulating the air pressure of the pump air cooling system when it is active. To perform this calibration procedure access to the interior enclosure of the Aquarius® D.I. Water Heating System with the system powered ON is required.

Please take extreme cautionary measures as live voltage will be present in the Aquarius® D.I. Water Heating System during the Pump Air Cooling System Calibration procedure.

1) Take the appropriate steps necessary to have the Aquarius® D.I. Water Heating System powered ON with the enclosure door open. Please note that the Door Interlock switch will prevent the unit from powering ON when the enclosure door is open.
2) Verify that an adequate steady supply of air is being supplied to the pump air cooling system (60 psi maximum).
3) Locate the pump air cooling system pressure regulator/gauge in the heater compartment of the Aquarius® D.I. Water Heating System and take note of the air pressure reading on the pressure gauge. Please refer to the Mechanical Layout Drawing in **SECTION II** for its specific location.
4) Turn the Aquarius® D.I. Water Heating System ON, once again with the enclosure door open.

5) Verify that the Recirculation System is enabled which is indicated by an illuminated yellow **"Enabled"** key on the **System Status** screen. If the Recirculation System is not enabled press the **DISABLED** key.

6) Send the unit into Recirculation mode by providing a closed "Recirculation Signal".

7) Once the unit is in Recirculation mode, activate the pump air cooling system temporarily by pressing the **"Pump Air Cooling System Calibration ON/OFF"** key located on the **System Calibration screen**.

8) The pump air cooling system will activate for approximately 60 seconds and then shut off. Please note that the air pressure reading on the pressure gauge may drop when the pump air cooling system is actively cooling.

9) With the pump air cooling system active, check the air pressure reading on the pressure gauge and regulate the air pressure of the pump air cooling system to a pressure greater than the air regulator pressure setting. See plumbing schematic for air regulator setting.

During normal recirculation, the pump air cooling feature will activate when the pump motor temperature exceeds an internally programmed temperature.

13. TEMPERATURE READY DEAD BAND (DB) SIGNAL

The **Temperature Ready Dead Band Signal** is an optional feature for the Aquarius® D.I. Water Heating System that provides an external digital signal or dry contact signal to notify the user that the process fluid temperature is within a customer specified dead band range. Refer to Table 13-1 for detailed information on the **Temperature Ready Dead Band Signal**.

Table 13-1: Temperature Ready Dead Band Signal

SIGNAL INVERSION			OFF (DEFAULT)		ON		
DISCRETE INTERFACE	POWER OFF	OPTION N/A	INACTIVE	ACTIVE	INACTIVE	ACTIVE	SIGNAL INVERSION CAPABILITY
Temperature Ready Dead Band Signal[2]	0	Std.	1	0	0	1	Yes

NOTE:

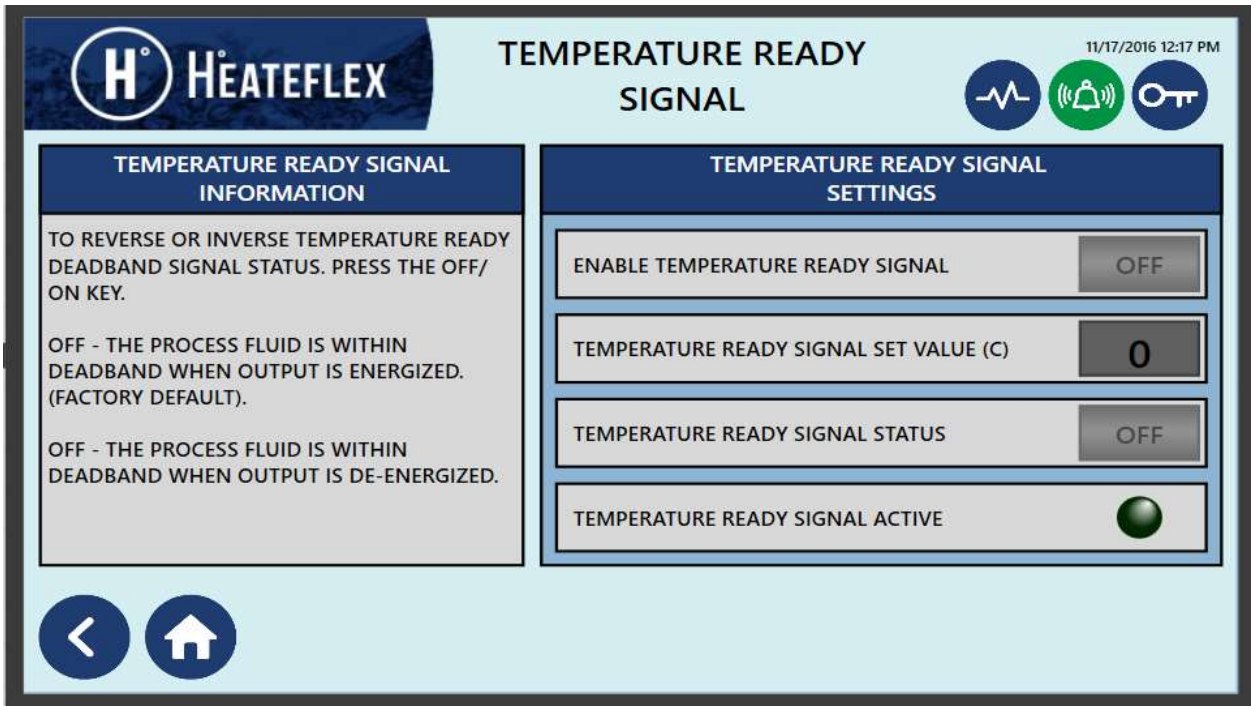
1. 0 – Open Signal
   1 – Closed Signal
2. Signal inversion is specific to the respective Communication Interface. Same signal types must be inverted on each respective communication interface.

To access the **Temperature Ready Signal** screen, start with the **Main Menu** screen, then select **System Set Up**, next select **Options Settings**, and finally select **Temperature Ready Signal**. The **Temperature Ready Signal** screen will appear and is shown in Figure 13-1.

Please note that the **PF2000** will prompt you to enter the **User Password** in order to modify or change the **"Temperature Ready Signal Set Value"**, the **"Temperature Ready Signal Status"** and to enable the **Temperature Ready Dead Band Signal** feature.

To utilize the **Temperature Ready Dead Band Signal** feature, the **"Enable Temperature Ready Signal"** setting must be set to ON and a value must be entered into the **"Temperature Ready Signal Set Value"** setting as illustrated in Figure 13-1.

Figure 13-1: Temperature Ready Signal Screen



The Temperature Ready Dead Band Signal is Factory Defaulted to be normally open or de-energized when outside of the dead band (**"Temp. Ready Signal Status"** set to the OFF position). Once the process fluid temperature is within the dead band the Temperature Ready Dead Band Signal will close or become energized. Please note that the Temperature Ready Dead Band Signal may be inverted if desired. To invert this signal, set the **"Temp. Ready Signal Status"** setting to ON. Instructions on how to invert this signal is also detailed on the **Temperature Ready Signal** screen.

Table 13-2 details all the parameters that can be modified on this screen as well as the Factory Default settings or values.

Table 13-2: Temperature Ready DB Signal Parameters and Settings

PARAMETER NAME	SETTING RANGE	FACTORY DEFAULT
Enable Temperature Ready Signal	Off or On	Off
Temperature Ready Signal Set Value	0.0 to 10.0°C	5.0°C
Temperature Ready Signal Status	Off = The process fluid is within the Temperature Ready DB Signal Set Point when the output is energized. (Factory Default) On = The process fluid is within the Temperature Ready DB Signal Set Point when the output is de-energized.	Off
Temperature Ready Signal Active	No illumination = Inactive Illuminated Green = Active	-

13.1. TEMPERATURE READY DEAD BAND SIGNAL WIRING

The wiring detail listed in Table 13-3 is the "standard" configurations for Aquarius® D.I. Water Heating Systems. Please refer to the specific Electrical Schematic Diagram for more information.

Table 13-3: Temperature Ready Dead Band Signal Wiring Configuration

NUMBER	COLOR	STRIPE	FUNCTION
1	Brown	N/A	Signal Out
2	Blue	N/A	Common

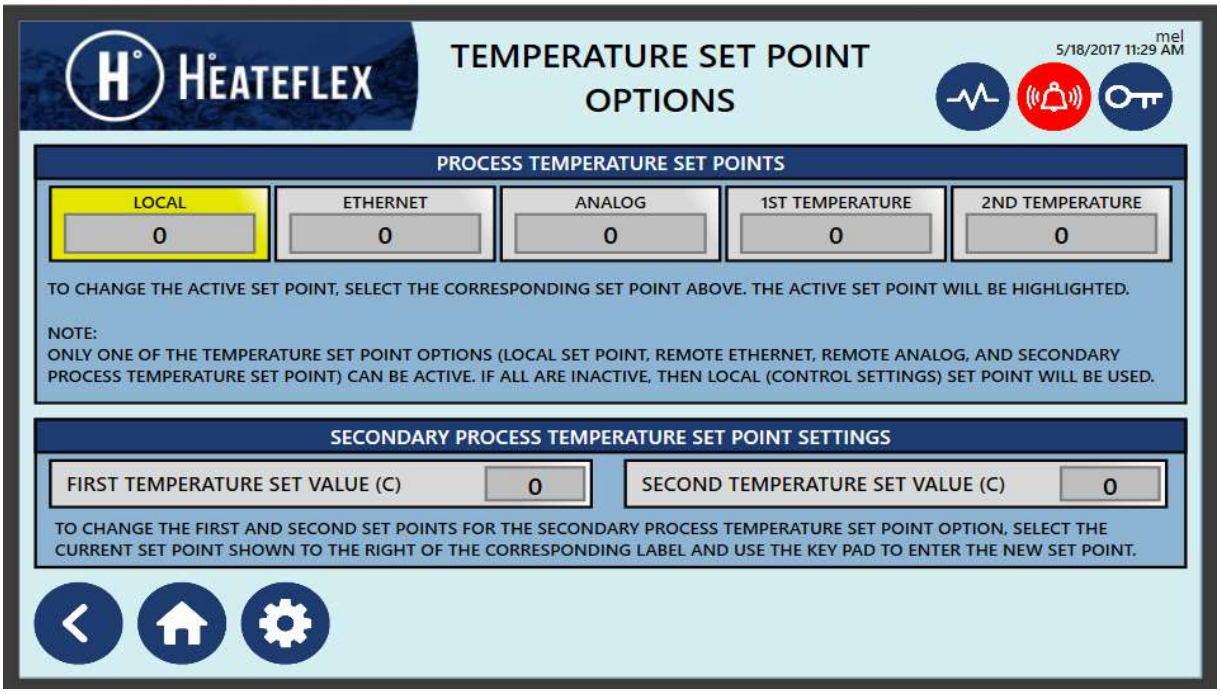
14. SECONDARY PROCESS TEMPERATURE SETPOINT

The **Secondary Process Temperature Set Point** is a Temperature Set Point option for the Aquarius® D.I. Water Heating System and is used to quickly change from a primary process temperature set point to a secondary process temperature set point using a remote digital signal or dry contact signal.

To access the **Temperature Set Point Options Screen**, start with the **Main Menu** screen, then select **System Set Up**, next select **Options Settings**, and finally select **Temperature Set Point Options**. The **Temperature Set Point Options** screen will appear.

The **Temperature Set Points Options Screen** is used to select an active temperature set point and to change set values for 1st and 2nd Temperatures. On the **Temperature Set Point Options** Screen there are two sub-menus – **Process Temperature Set Points** and **Secondary Process Temperature Set Point Settings**. This is shown in Figure 14-1. The **Process Temperature Set Points** sub-menu displays set point values for Local, Ethernet, Analog, 1st Temperature, and 2nd Temperature. The active set point will be highlighted. To change the active set point, select the desired set point. Below the **Process Temperature Set Points** is the **Secondary Process Temperature Set Points Settings** sub-menu. Here, the 1st and 2nd Temperature Set Values can be inputted. Table 14-1 details all the parameters that can be modified on this screen.

Figure 14-1: Temperature Set Point Options Screen



Note: The appearance of the **Temperature Set Point Options** screen may vary depending on the Aquarius® D.I. Water Heating System options.

Table 14-1: Secondary Process Temp. Set Point Parameters and Settings

PARAMETER NAME	SETTING RANGE	FACTORY DEFAULT	Dry Contact Signal
Process Temperature Set Point Selection	Local, Ethernet, Analog, 1st Temperature, 2nd Temperature.	Local	-
First Temperature Set Value (Default)	0 to 95°C (Integers Only)	0°C	Open / "OFF"
Second Temperature Set Value	0 to 95°C (Integers Only)	0°C	Closed / "ON"

Please note that the **PF2000** will prompt you to enter the **User Password** in order to modify or change the "**First Temperature Set Value**", the "**Second Temperature Set Value**" parameters and enable the **Secondary Process Temperature Set Point** feature.

Enter the desired values for "**First Temperature Set Value**" and the "**Second Temperature Set Value**" parameters respectively.

Press the "**OFF**" key located next to the "**Enable Second Temperature Set Point**" label. The "**OFF**" key will then change to "**ON**" and will be illuminated yellow indicating that the **Secondary Process Temperature Set Point** feature is active. Please note that this parameter needs to be enabled in order for the Aquarius® System to recognize the dry contact Signal. Please refer to the respective Electrical Schematic Drawing for actual connections.

Provide a dry contact signal to the Aquarius® indicating which temperature set point to initiate. The "**First Temperature Set Value**" is the default temperature set point parameter and requires no remote signal. To toggle or switch to the "**Second Temperature Set Value**" provide a closed or "ON" signal to the Aquarius® System. The "**First Temperature Set Value**" or "**Second Temperature Set Value**" on this screen will illuminate yellow indicating which temperature set point is active. In addition, the corresponding active temperature set point label will be indicated on the **System Status** screen as shown in Figure 5-1 when active.

Setting the "**Enable Second Temperature Set Point**" from "ON" to "OFF" or disabling the **Secondary Process Temperature Set Point** feature even with the presence of the dry contact signal will automatically switch the unit to the "**First Temperature Set Point**" with a value of 0ºC for safety.

Please note that the **Remote Process Temperature Set Point** and/or the **Secondary Process Temperature Set Point** options cannot be operated at the same time, operation of these features is permitted to the use of one option at any one time.

15. ANALOG INTERFACE

The **Analog Interface** option is a communications feature for the Aquarius® D.I. Water Heating System. The **Analog Interface** allows the ability to remotely enter a **"Process Temperature Set Point"** and to monitor the temperature and flow rate of the Aquarius® D.I. Water Heating System. Refer to Table 15-1 for all the analog signals.

Table 15-1: Analog Interface

ANALOG INTERFACE	SIGNAL	RANGE
Remote Temperature Set Point	4-20mA	0.0 to 95.0°C
Process Temperature Retransmit	4-20mA	0.0 to 100.0°C
Flow Rate Retransmit [1]	4-20mA	0.0 to 13.0 gpm 0.0 to 18.0 gpm 0.0 to 28.0 gpm

NOTE:

1. Maximum Flow Rate Range will vary depending on the Aquarius® plumbing size selected as detailed below:
   * Standard ¾" Tube or 25mm plumbing = 13.0 gpm
   * 32mm plumbing = 18.0 gpm
   * 40mm plumbing = 28.0 gpm

Reference Section 14 for more information on **Temperature Set Point Options.**

To utilize the **Remote Process Temperature Set Point** feature, the **"Enable Remote Temperature Set Point"** setting must be set to ON and a 4-20mA signal must be sent to the Aquarius® D.I. Water Heating System. Please note that the **Open Analog Alarm**, specifically the **Remote Temperature Set Point Alarm** will trigger if **Remote Process Temperature Set Point** is enabled and no 4-20mA signal is present. Table 15-2 details all the settings that can be modified on this screen.

Table 15-2: Remote Process Temperature Set Point Setting

SETTING NAME	SETTING RANGE	FACTORY DEFAULT
Enable Remote Temp. Set Point	Off or On	Off

15.1. ANALOG INTERFACE WIRING CONFIGURATION

The wiring detail listed in Table 15-3 is the "standard" configurations for Aquarius® D.I. Water Heating Systems. Please refer to the specific Electrical Schematic Diagram for more information.

Table 15-3: Analog Interface Wiring Configuration

NUMBER	COLOR	STRIPE	FUNCTION
1	White	N/A	Remote Set Point (+)
2	Brown	N/A	Remote Set Point (-)
3	Green	N/A	Ground
4	Yellow	N/A	Temperature Retransmit (+)
5	Grey	Brown	Temperature Retransmit (-)
6	Pink	N/A	Flow Retransmit (+)
7	Blue	N/A	Flow Retransmit (-)
8	Red	N/A	Not Used

16. DISCRETE INTERFACE

The **Discrete Interface** option is a communications feature for the Aquarius® D.I. Water Heating System. The **Discrete Interface** allows remote operation of the Aquarius® unit such as **"Remote Emergency Off (EMO)"**, **"Remote Stop (Standby)"**, **"Remote Alarm Reset"**, and **"Remote Purge"**. In addition the **Discrete Interface** also provides external digital signals for the **Purge Status** and for the status of "critical alarms" and/or "non-critical alarms".

The **Discrete Interface** package includes the following:

- **Remote Emergency Off (EMO)**
  - Allows the Aquarius® unit to be shut off from a remote location and/or from other equipment associated with the Aquarius® D.I. Water Heating System.
- **Remote Stop (Standby)**
  - Allows the user to "Stop" the Aquarius® and place the system into Standby mode, thus disabling the heaters from a remote location.
- **Remote Alarm Reset**
  - Allows the user to reset most of the Aquarius® alarms from a remote location.
- **Remote Purge**
  - Allows the user to initiate the Aquarius® **Purge** feature from a remote location (provided that the **Auto Purge** option is selected).
- **Purge Status**
  - Allows the user to monitor the Aquarius® D.I. Water Heating System **Purge** feature through an external signal to a remote location.
- **Critical Alarms Status**
  - Allows the user to monitor for any "critical alarms" from the Aquarius® D.I. Water Heating System through an external signal to a remote location.
- **Non-Critical Alarm Status**
  - Allows the user to monitor for any "non-critical alarms" from the Aquarius® D.I. Water Heating System through an external signal to a remote location.
- **Temperature Ready Dead Band**
  - An external signal that notifies the user that the process fluid temperature is within a customer specified dead band range. Reference Section 13 for more information.

Refer to Table 16-1 for more information on the **Discrete Interface** option.

Table 16-1: Discrete Interface

SIGNAL INVERSION			OFF (DEFAULT)		ON		
DISCRETE INTERFACE	POWER OFF	OPTION N/A	INACTIVE	ACTIVE	INACTIVE	ACTIVE	SIGNAL INVERSION CAPABILITY
Non-Critical Alarm Status [3]	0	Std.	1	0	0	1	Yes
Critical Alarm Status [3]	0	Std.	1	0	0	1	Yes
Purge Status [2, 6]	0	0	0	1	-	-	No
Remote Purge [2]	-	-	0	1	-	-	-
Remote Emergency OFF (EMO)	-	-	1	0	-	-	-
Remote Alarm Reset [4]	-	-	0	1	-	-	-
Remote Stop (Standby) [5]	-	-	0	1	-	-	-
Temperature Ready Dead Band							

NOTE:

1. 0 – Open Signal
   1 – Closed Signal
2. Available when specific option is selected.
3. Signal inversion is specific to the respective Communication interface. Same signal types must be inverted on each respective communication interface.
4. The **"Remote Alarm Reset"** will not reset the GFCI Alarm. The GFCI Alarm must be reset locally on the unit.
5. The **RUN** key on the System Status screen must be pressed first in order to utilize the **"Remote Stop"** feature.
6. Purge Status signal is sent through a relay and not through the PLC.

Signal Inversion is permitted on certain signals of the **Discrete Interface** and can be modified on the **Discrete Interface Signals** screen. To access the **Discrete Interface** screen, start with the **Main Menu** screen, then select **System Set Up**, next select **Options Settings**, and finally select **Discrete Interface**. The **Discrete Interface Signals** screen will appear.

Table 16-2 details all the settings that can be modified on this screen as well as the Factory Default settings.

Figure 16-1: Discrete Interface Signals Screen

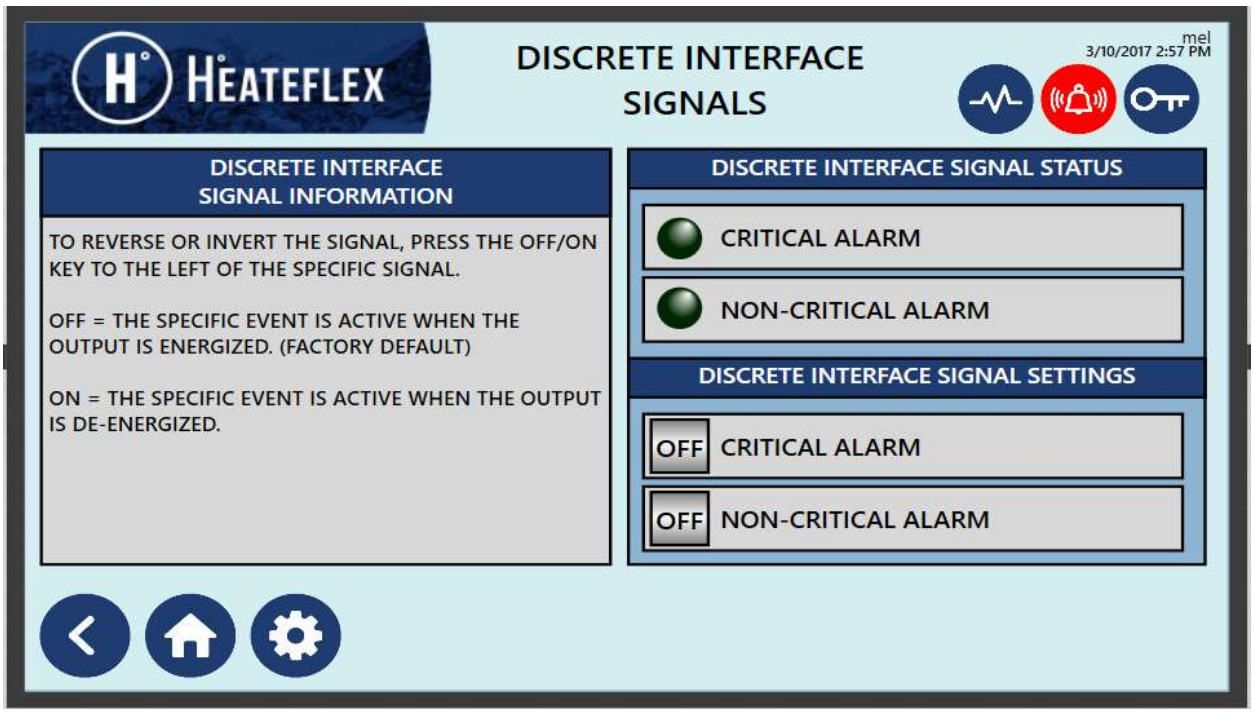


Table 16-2: Discrete Interface Settings

SETTING NAME	SETTING RANGE	FACTORY DEFAULT
Non-Critical Alarm Status	Off or On	Off
Critical Alarm Status	Off or On	Off

16.1. DISCRETE INTERFACE WIRING CONFIGURATION

The wiring detail listed in Table 16-3 is the "standard" configurations for Aquarius® D.I. Water Heating Systems. Please refer to the specific Electrical Schematic Diagram for more information.

Table 16-3: Discrete Interface Wiring Configuration

NUMBER	COLOR	STRIPE	FUNCTION
A	Brown	N/A	2nd Pole EMO
C	Red	Blue	2nd Pole EMO
E	Black	N/A	Remote EMO
G	Pink	N/A	Remote EMO
J	Green	N/A	Spare
L	Blue	N/A	Common
M	Orange	N/A	Common
N	Grey	Brown	Remote Purge Status (OUT)
O	Violet	N/A	Non-critical Alarm Status (OUT)
P	White	N/A	Critical Alarm Status (OUT)
R	Red	N/A	Remote Alarm Reset (IN)
S	Grey	N/A	Remote Purge Start/Stop (IN)
T	Yellow	N/A	Remote Standby/Active (IN)
U	Tan	N/A	Temperature Ready Dead Band

17. DRY CONTACT INTERFACE

The **Dry Contact Interface** option is a communications feature for the Aquarius® D.I. Water Heating System. The **Dry Contact Interface** provides 16 dry contact relays for remote monitoring of the Aquarius® D.I. Water Heating System.

The standard **Dry Contact Interface** package includes the following:

- **Active mode**
- **Thermal Cut-Off Alarm**
- **High Limit Alarm**
- **Open Sensor Alarm** – Analog Sensors, Process Thermocouples, and High Limit Thermocouples
- **Low Level Alarm**
- **High Temperature Alarm**
- **Low Temperature Alarm**
- **High Flow Alarm**
- **Low Flow Alarm**
- **High Pressure Alarm**
- **Low Pressure Alarm**
- **Main Alarm** – Critical and Non-Critical Alarms
- **Water Leak Alarm***
- **GFCI Alarm***
- **Temperature Ready Dead Band Signal*** (reference Section 13)

* Represents optional features on the Aquarius® D.I. Water Heating System.

Refer to Table 17-1 for more information on the **Dry Contact Interface** option.

Table 17-1: Dry Contact Interface

SIGNAL INVERSION			OFF (DEFAULT)		ON		
DRY CONTACT INTERFACE	POWER OFF	OPTION N/A	INACTIVE	ACTIVE	INACTIVE	ACTIVE	SIGNAL INVERSION CAPABILITY
Active Mode	0	Std.	0	1	1	0	Yes
Thermal Cut-Off Alarm	0	Std.	1	0	0	1	Yes
High Limit Alarm	0	Std.	1	0	0	1	Yes
Open Sensor Alarm	0	Std.	1	0	0	1	Yes
Low Level Alarm	0	Std.	1	0	0	1	Yes
High Temperature Alarm	0	Std.	1	0	0	1	Yes
Low Temperature Alarm	0	Std.	1	0	0	1	Yes
High Flow Alarm	0	Std.	1	0	0	1	Yes
Low Flow Alarm	0	Std.	1	0	0	1	Yes
High Pressure Alarm	0	Std.	1	0	0	1	Yes
Low Pressure Alarm	0	Std.	1	0	0	1	Yes
Main Alarm	0	0	1	0	0	1	Yes
Water Leak Alarm [3]	0	0	1	0	0	1	Yes
GFCI Alarm [3]	0	0	1	0	0	1	Yes
Temperature Ready Dead Band Signal [3]	0	0	0	1	1	0	Yes

NOTE:

1. 0 – Open Signal
   1 – Closed Signal
2. Signal inversion is specific to the respective Communication Interface. Same signal types must be inverted on each respective communication interface.
3. Available when specific option is selected.

Signal Inversion is permitted on all of the signals on the **Dry Contact Interface** provided that the optional feature is available and can be modified on the **Dry Contact Interface** screen. To access the **Dry Contact Interface** screen, start with the **Main Menu** screen, then select **System Set Up**, next select **Option Settings**, and finally select **Dry Contact Interface**. The **Dry Contact Interface Signals** screen will appear as shown in Figure 17-1 and Figure 17-2. To move between the screens press the **NEXT** or **BACK** key respectively.

Aquarius® optional features that are not available will appear as recessed button as shown in Figure 17-2.

Figure 17-1: Dry Contact Interface Signals Screen #1

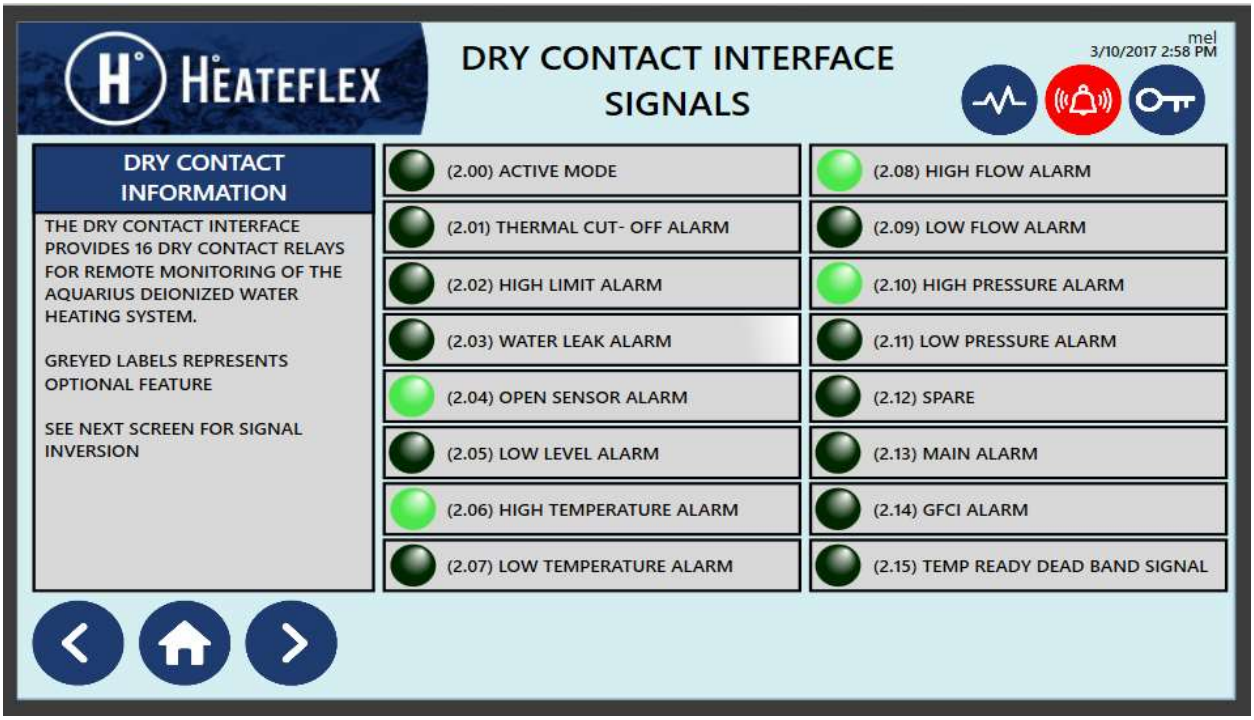


Figure 17-2: Dry Contact Interface Signals Screen #2

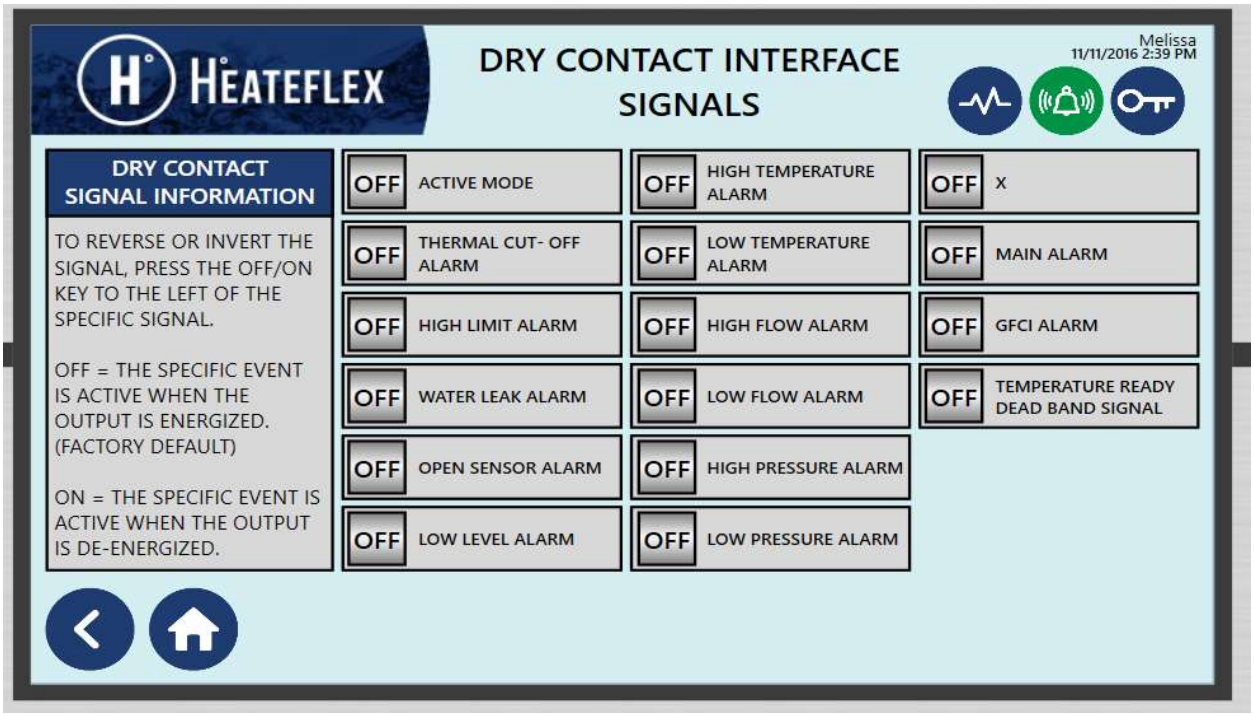


Table 17-2 details all the settings that can be modified on these screens as well as the Factory Default settings.

Table 17-2: Dry Contact Interface Settings

SETTING NAME	SETTING RANGE	FACTORY DEFAULT
Active Mode	Off or On	Off
Thermal Cut-Off Alarm	Off or On	Off
High Limit Alarm	Off or On	Off
Water Leak Alarm[2]	Off or On	Off
Open Sensor Alarm	Off or On	Off
Low Level Alarm	Off or On	Off
High Temperature Alarm	Off or On	Off
Low Temperature Alarm	Off or On	Off
High Flow Alarm	Off or On	Off
Low Flow Alarm	Off or On	Off
High Pressure Alarm	Off or On	Off
Low Pressure Alarm	Off or On	Off
Main Alarm	Off or On	Off
GFCI Alarm[2]	Off or On	Off
Temperature Ready Dead Band Signal[2]	Off or On	Off

NOTE:

1. Signal inversion is specific to the respective Communication Interface. Same signal types must be inverted on each respective communication interface.
2. Available when specific option is selected.

The **Dry Contact Interface** settings for features that are optional on the Aquarius® D.I. Water Heating System will be disabled if the option is unavailable or not selected.

17.2. DRY CONTACT INTERFACE WIRING CONFIGURATION

The wiring detail listed in Table 17-3 is the “standard” configurations for Aquarius® D.I. Water Heating Systems. Please refer to the specific Electrical Schematic Diagram for more information.

Table 17-3: Dry Contact Interface Wiring Configuration

NUMBER	COLOR	STRIPE	FUNCTION
1	Brown	N/A	Spare
2	White	Grey	Door Open & EPO (Common)
3	Blue	Grey	Door Open
4	Brown	Grey	EPO
5	Black	Yellow	GFCI Alarm[1]
6	White	Yellow	Open Sensor Alarm
7	Blue	Yellow	Low Level Alarm
8	Brown	Yellow	Common
9	Black	Red	Main Alarm
10	White	Red	Water Leak Sensor Alarm[1] (Critical)
~~11~~	~~Blue~~	~~Red~~	~~Drip Leak Sensor Alarm[1] (Non-critical)~~
12	Brown	Red	Thermal Cut-Off Alarm
13	Black	N/A	Active Mode
14	White	N/A	Spare
15	Blue	N/A	Spare
16	Black	Grey	Temperature Ready Dead Band Signal[1]
17	Brown	Orange	High Limit Alarm
18	White	Orange	High Temperature Alarm
19	Black	Orange	Low Temperature Alarm
20	Black	Green	High Flow Alarm
21	White	Green	Low Flow Alarm
22	Blue	Green	High Pressure Alarm
23	Brown	Green	Low Pressure Alarm
24	Blue	Orange	Spare
25	Green	Yellow	Common

Note:
1. Available when specific option is selected.

18. ETHERNET COMMUNICATIONS

The **Ethernet Communications** option provides a data connection to the Aquarius® D.I. Water Heating System and allows global remote monitoring of the Aquarius® D.I. Water Heating System.

The **Ethernet Communications** option allows you to retrieve "read only" and "write enabled" real time data, such as temperature, flow rate, pressure, voltage, resistivity (if available), system set points and system settings, and send data for select settings.. The data sent from the Aquarius® D.I. Water Heating System Ethernet communication is in Real number format. Refer to Table 18-1 for a complete list of all the system values, set points and settings that are available, as well as the memory registers.

In addition, the Aquarius® D.I. Water Heating System status, modes alarm conditions can be easily monitored. Refer to Table 18-2 for a complete list of system status, modes and alarms that are available, as well as the memory registers.

Please note that a crossover Ethernet cable is required in order to communicate with the Aquarius® D.I. Water Heating System.

The Aquarius® **PF2000** also provides a method for troubleshooting the **Ethernet Communications** via the **PF2000** Human Machine Interface (HMI) Touch Screen. These screens provide a method to verify that the Aquarius® System is sending out the respective data through the Ethernet module. For more information on these screens see Section 18.1 of this Instruction Manual.

NOTE:

1) In order to retrieve the data via Ethernet, a communications protocol, such as Kepware OPC server or similar is required. The end user is ultimately responsible for developing this required communications protocol.

Table 18-1: Ethernet System Values, Settings and Set Points

		MEMORY REGISTERS		
ETHERNET SYSTEM VALUES, SET POINTS & SETTINGS	**TYPE**	**READ**	**WRITE**	**UNITS**
Process Temperature	Values	ETH_R_Process_Temperature	N/A	°C
Incoming Temperature	Values	ETH_R_Incoming_Temperature	N/A	°C
Flow Rate	Values	ETH_R_Flow_Rate	N/A	gpm
Pressure	Values	ETH_R_Pressure	N/A	Psi
Voltage	Values	ETH_R_Voltage	N/A	VAC
Resistivity[1]	Values	ETH_R_Resistivity	N/A	M-Ohms
Process Temperature Set Point	Set Point	ETH_R_Process_Temperature_Set_Point	ETH_W_Process_Temperature_Set_Point	°C
Remote Temperature Set Point[1]	Set Point	ETH_R_Remote_Temperature_Set_Point	N/A	°C
First Temperature Set Point[1]	Set Point	ETH_R_First_Temperature_Set_Point	N/A	°C
Second Temperature Set Point[2]	Set Point	ETH_R_Second_Temperature_Set_Point	N/A	°C
High Temperature Alarm Set Point	Set Point	ETH_R_High_Temperature_Alarm_Set_Point	ETH_W_High_Temperature_Alarm_Set_Point	°C
Low Temperature Alarm Set Point	Set Point	ETH_R_Low_Temperature_Alarm_Set_Point	ETH_W_Low_Temperature_Alarm_Set_Point	°C
High Flow Alarm Set Point	Set Point	ETH_R_High_Flow_Alarm_Set_Point	ETH_W_High_Flow_Alarm_Set_Point	gpm
Low Flow Alarm Set Point	Set Point	ETH_R_Low_Flow_Alarm_Set_Point	N/A	gpm
High Pressure Set Point	Set Point	ETH_R_High_Pressure_Set_Point	ETH_W_High_Pressure_Set_Point	psi
Low Pressure Set Point	Set Point	ETH_R_Low_Pressure_Set_Point	ETH_W_Low_Pressure_Set_Point	psi
Low Resistivity Alarm Set Point[1]	Set Point	ETH_R_Low_Resistivity_Alarm_Set_Point	ETH_W_Low_Resistivity_Alarm_Set_Point	M-Ohms
Temperature Ready Dead Band Signal Set Point[1]	Set Point	ETH_R_Temperature_Ready_Dead_Band_Signal_Set_Point	ETH_W_Temperature_Ready_Dead_Band_Signal_Set_Point	°C
Heater Amperage	Setting	ETH_R_Heater_Amperage	N/A	amps
Cycle Rate	Setting	ETH_R_Cycle_Rate	N/A	sec
Power Reset	Setting	ETH_R_Power_Reset	N/A	sec
Frequency	Setting	ETH_R_Frequency	N/A	Hz
Dead Band	Setting	ETH_R_Dead_Band	N/A	°C
Power Adjust	Setting	ETH_R_Power_Adjust	N/A	sec
Auto Reset[4]	Setting	ETH_R_Auto_Reset	N/A	-
Input T/C Temperature Calibration[2]	Setting	ETH_R_Input_TC_Temperature_Calibration	N/A	°C
T/C Temp. Calibration[2]	Setting	ETH_R_TC_Temp_Calibration	N/A	°C
Flow Rate Calibration[2]	Setting	ETH_R_Flow_Rate_Calibration	N/A	gpm
Pressure Calibration[2]	Setting	ETH_R_Pressure_Calibration	N/A	psi
Voltage Calibration[2]	Setting	ETH_R_Voltage_Calibration	N/A	VAC
Resistivity Calibration[1,2]	Setting	ETH_R_Resistivity_Calibration	N/A	M-Ohms
Auto Purge Period[1]	Setting	ETH_R_Auto_Purge_Period	ETH_W_Auto_Purge_Period	min
Auto Purge Duration[1]	Setting	ETH_R_Auto_Purge_Duration	ETH_W_Auto_Purge_Duration	min

NOTE:

1. Available when specific option is selected. If option is unavailable a value of 0 will be sent.
2. In the BCD Format, a value of 0 will be sent if any negative number is Entered.
3. For Power Adjust “Sign” Values of:
   0 = System is turned Off
   1 = Positive
   2 = Negative
4. For Auto Reset “Sign” Values of:
   0 = System is turned Off
   1 = Active
   2 = Inactive

Table 18-2: Ethernet System Status and Alarms

ETHERNET SYSTEM VALUES & ALARMS	POWER OFF	OPTION N/A	INACTIVE (INV OFF)	ACTIVE (INV OFF)	INACTIVE (INV ON)	ACTIVE (INV ON)	SIGNAL INVERSION AVAILABLE	MEMORY REGISTER
Stop Mode	0	Std	0	1	1	0	Yes	Ethernet_Stop_Mode_Active
Run Mode	0	Std	0	1	1	0	Yes	Ethernet_Run_Mode_Active
Standby Mode	0	Std	0	1	1	0	Yes	Ethernet_Standby_Mode_Active
Active Mode	0	Std	0	1	1	0	Yes	Ethernet_Active_Mode_Active
Auto Purge Enabled[3]	0	0	0	1	1	0	Yes	Ethernet_Auto_Purge_Enabled
Purge Mode[3]	0	0	0	1	1	0	Yes	Ethernet_Purge_Mode_Active
Remote Process Temperature Set Point Active[3]	0	0	0	1	1	0	Yes	Ethernet_Rem_Temp_SP_Active
Temperature Ready Dead Band Signal Enabled[3]	0	0	0	1	1	0	Yes	Ethernet_Water_at_Temp_DB_Signal_Customer_Enabled
Temperature Ready Dead Band Signal[3]	0	0	0	1	1	0	Yes	Ethernet_Water_at_Temperature_DB_Signal_Active
Secondary Process Temperature Set Point Enabled[3]	0	0	0	1	1	0	Yes	Ethernet_2nd_Process_Temp_SP_Customer_Enabled
Secondary Process Temperature Set Point Active[3]	0	0	0	1	1	0	Yes	Ethernet_Secondary_Process_Temperature_Set_Point_Active
Recirculation Enabled[3]	0	0	0	1	1	0	Yes	Ethernet_Recirculation_Customer_Enabled
Demand Mode[3]	0	0	0	1	1	0	Yes	Ethernet_Demand_Mode_Active
Venting Mode[3]	0	0	0	1	1	0	Yes	Ethernet_Venting_Mode_Active
Recirculation Mode[3]	0	0	0	1	1	0	Yes	Ethernet_Recirculation_Mode_Active
Recirculation Signal Active[3]	0	0	0	1	1	0	Yes	Ethernet_Customer_Recirculation_Signal_Active
Pump Air Cooling System Active[3]	0	0	0	1	1	0	Yes	Ethernet_Pump_Air_Cooling_System_Active
PLC to Communications Alarm	0	Std	1	0	0	1	Yes	Ethernet_PLC_to_HMI_TS_Comms_Alarm
Global Alarm	0	0	1	0	0	1	Yes	Ethernet_Global_Alarm
Critical Alarm Status	0	0	1	0	0	1	Yes	Ethernet_Critical_Alarm
Non-Critical Alarm Status	0	0	1	0	0	1	Yes	Ethernet_NonCritical_Alarm
Low Temperature Alarm	0	Std	1	0	0	1	Yes	Ethernet_Low_Temperature_Alarm
High Temperature Alarm	0	Std	1	0	0	1	Yes	Ethernet_High_Temperature_Alarm
Low Pressure Alarm	0	Std	1	0	0	1	Yes	Ethernet_Low_Pressure_Alarm
High Pressure Alarm	0	Std	1	0	0	1	Yes	Ethernet_High_Pressure_Alarm
Low Flow Alarm	0	Std	1	0	0	1	Yes	Ethernet_Low_Flow_Alarm
High Flow Alarm	0	Std	1	0	0	1	Yes	Ethernet_High_Flow_Alarm
Low Level Alarm	0	Std	1	0	0	1	Yes	Ethernet_Low_Level_Alarm
SCR Alarm	0	Std	1	0	0	1	Yes	Ethernet_SCR_Alarm
Open Analog Alarm (Global)	0	Std	1	0	0	1	Yes	Ethernet_Open_Analog_Alarm_global
Open Flow Sensor	0	Std	1	0	0	1	Yes	Ethernet_Open_Flow_Sensor_Alarm
Open Pressure Transducer	0	Std	1	0	0	1	Yes	Ethernet_Open_Pressure_Transducer_Alarm
Open Voltage Transducer	0	Std	1	0	0	1	Yes	Ethernet_Open_Voltage_Transducer_Alarm
Open Remote Temperature SP[3]	0	0	1	0	0	1	Yes	Ethernet_Open_Remote_Temp_SP_Alarm
High Limit T/C Alarm (Global)	0	Std	1	0	0	1	Yes	Ethernet_High_Limit_TC_Alarm_global
Open High Limit T/C Alarm (Global)	0	Std	1	0	0	1	Yes	Ethernet_Open_High_Limit_TC_Alarm_global
Open Process T/C Alarm (Global)	0	Std	1	0	0	1	Yes	Ethernet_Open_Process_TC_Alarm_global
Open Input T/C Alarm	0	Std	1	0	0	1	Yes	Ethernet_Open_Input_TC_Alarm
Open Zone #1 T/C Alarm	0	Std	1	0	0	1	Yes	Ethernet_Open_Zone_1_TC_Alarm
Open Zone #2 T/C Alarm	0	Std	1	0	0	1	Yes	Ethernet_Open_Zone_2_T_C_Alarm
Open Zone #3 T/C Alarm	0	Std	1	0	0	1	Yes	Ethernet_Open_Zone_3_TC_Alarm
Open Zone #4 T/C Alarm	0	Std	1	0	0	1	Yes	Ethernet_Open_Zone_4_TC_Alarm
Open Zone #5 T/C Alarm	0	Std	1	0	0	1	Yes	Ethernet_Open_Zone_5_TC_Alarm
Thermal Fuse Alarm	0	Std	1	0	0	1	Yes	Ethernet_Thermal_Cutoff_Alarm
Low PLC Battery	0	Std	1	0	0	1	Yes	Ethernet_Low_PLC_Battery_Alarm
Low TS Battery	0	Std	1	0	0	1	Yes	Ethernet_Low_TS_Battery_Alarm
Ground Fault Circuit Interrupt (GFCI) Alarm[3]	0	0	1	0	0	1	Yes	Ethernet_GFCI_Alarm
Water Leak Alarm[3]	0	0	1	0	0	1	Yes	Ethernet_Water_Leak_Alarm
Resistivity alarm[3] (Global)	0	0	1	0	0	1	Yes	Ethernet_Restivity_Alarm_global
Open Resistivity Alarm[3]	0	0	1	0	0	1	Yes	Ethernet_Open_Resistivity_Alarm
Low Resistivity Alarm[3]	0	0	1	0	0	1	Yes	Ethernet_Low_Resistivity_Alarm
Pump Alarm[3]	0	0	1	0	0	1	Yes	Ethernet_Pump_Alarm
Pump Warning[3]	0	0	1	0	0	1	Yes	Ethernet_Pump_Warning_Alarm

NOTE:

1. 0 – Open Signal
   1 – Closed Signal
2. Signal inversion is specific to the respective Communication Interface. Same signal types must be inverted on each respective communication interface.
3. Available when specific option is selected.

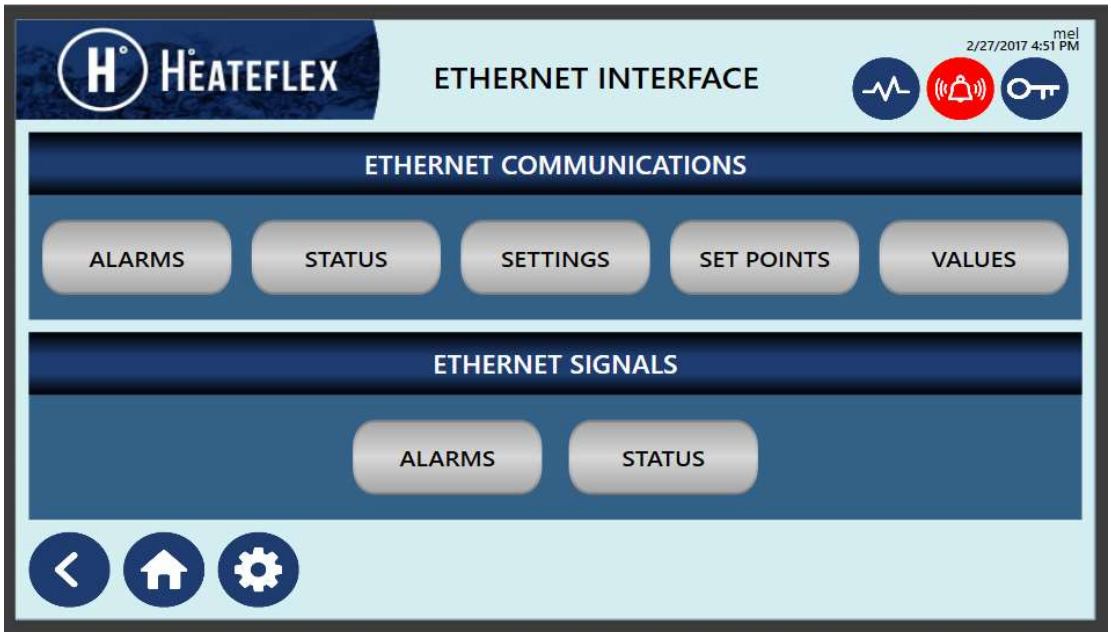
18.1. ETHERNET SCREENS

To access the Ethernet screens, start with the **Main Menu** screen, then select **System Set Up**, and finally select **Ethernet Interface**. The **Ethernet Interface** screen will appear as shown below in Figure 18-1. This screen allows access to the **Ethernet Communications** menu and the **Ethernet Signals** menu.

Refer to Section 18.2 for more information on troubleshooting the **Ethernet Communications** via the **PF2000** Human Machine Interface (HMI) Touch Screen.

Refer to Section 18.3 for more information on signal inversion of the Ethernet Alarm and Status Signals.

Figure 18-1: Ethernet Interface Screen



18.2. ETHERNET COMMUNICATIONS MENU

The **Ethernet Communications Menu** is located within the **Ethernet Interface Screen** (see Figure 18-1).

The **Ethernet Communications Menu** consists of several keys to allow access to respective screens, such as the:

- **Ethernet Alarms** screens (Figure 18-3 to 18-4),
- **Ethernet Status** screen (Figure 18-5),
- **Ethernet Values** screen (Figure 18-6),
- **Ethernet Set Points** screen (Figure 18-7), and the
- **Ethernet Settings** screens (Figure 18-8).

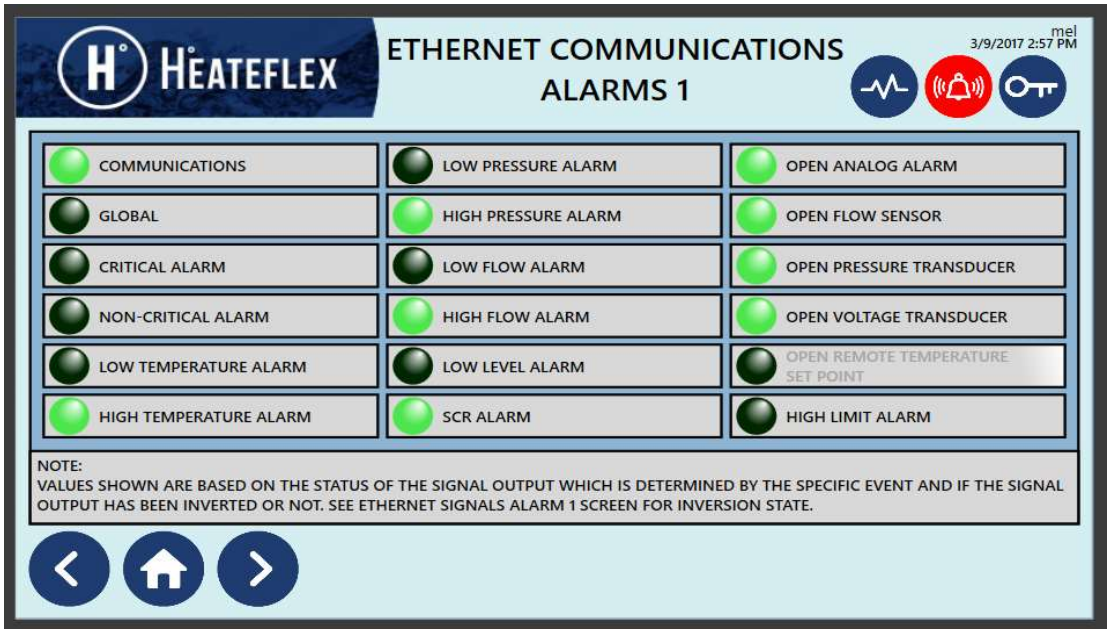
Press the desired key to get to the respective screen. It is on these following screens where you can monitor the data from the Aquarius® System and troubleshoot the **Ethernet Communications** if desired.

The Aquarius® D.I. Water Heating System status, modes alarm conditions can be monitored in Figure 18-2 to Figure 18-3. To move between the screens press the **NEXT** or **BACK** key respectively.

Please note that the lamps shown on the **Ethernet Alarms** screens and the **Ethernet Status** screen are affected by the orientation of the signal (normally open or normally closed) and whether or not the respective signal has been inverted. See Section 18.3 of this instruction manual for system status signal and alarm signal inversion.

Table 18-2 lists the memory registers for all of the system status, system modes and system alarms

Figure 18-2: Ethernet Communications Alarms 1 Screen



Note: This screen indicates that Low Flow Alarm is present.

Figure 18-3: Ethernet Communications Alarms 2 Screen

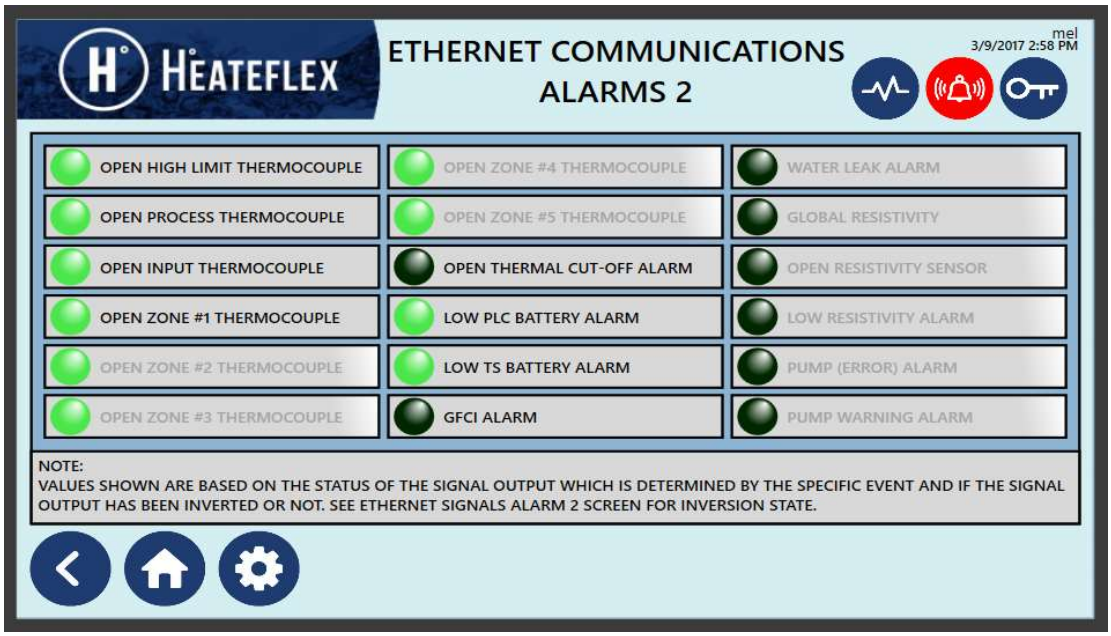
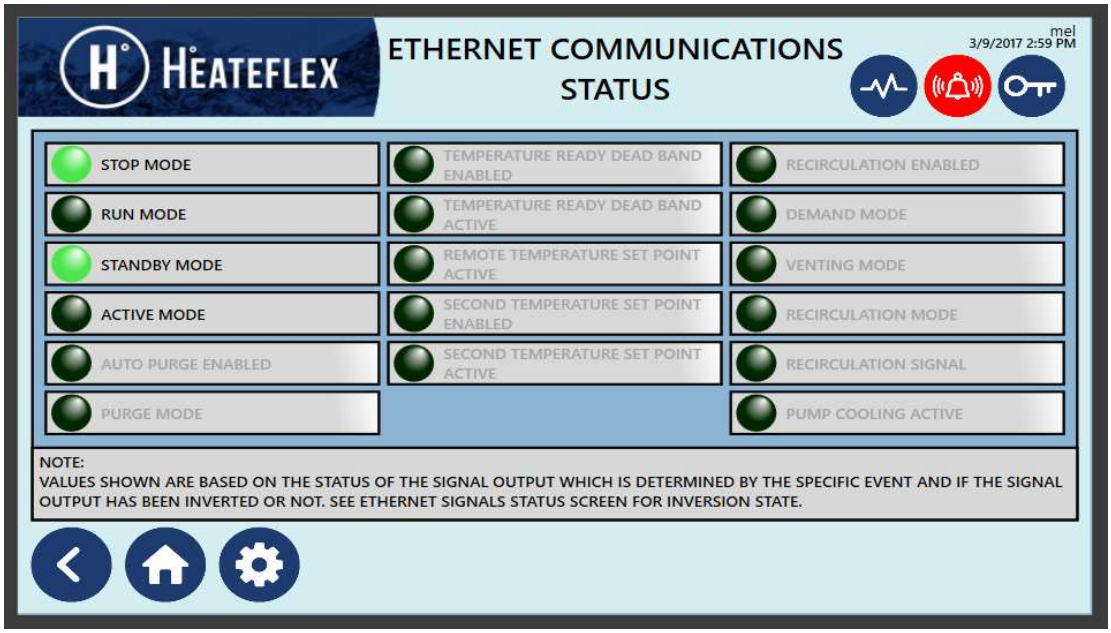


Figure 18-4: Ethernet Communications Status



Note: This screen indicates that the system is in **"Stop"** mode and **"Standby"** mode.

The Aquarius® D.I. system values, system settings and system set points can be monitored in Figure 18-5 to Figure 18-7.

Table 18-1 lists the memory registers for all of the system values, set points and settings.

Figure 18-5: Ethernet Communications Values Screen

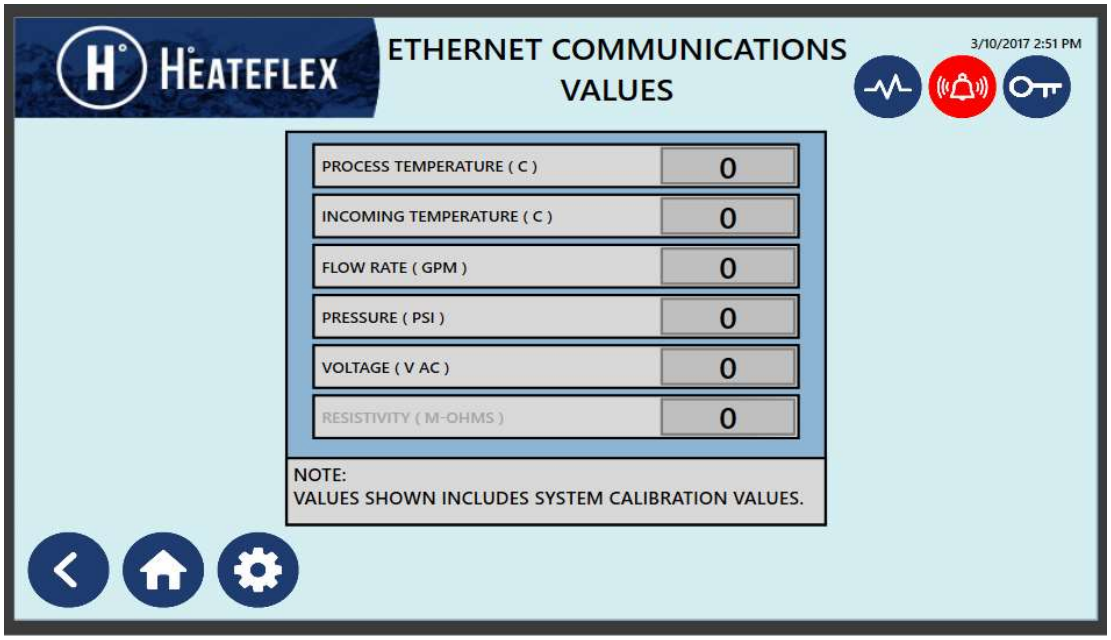


Figure 18-6: Ethernet Communications Set Points Screen

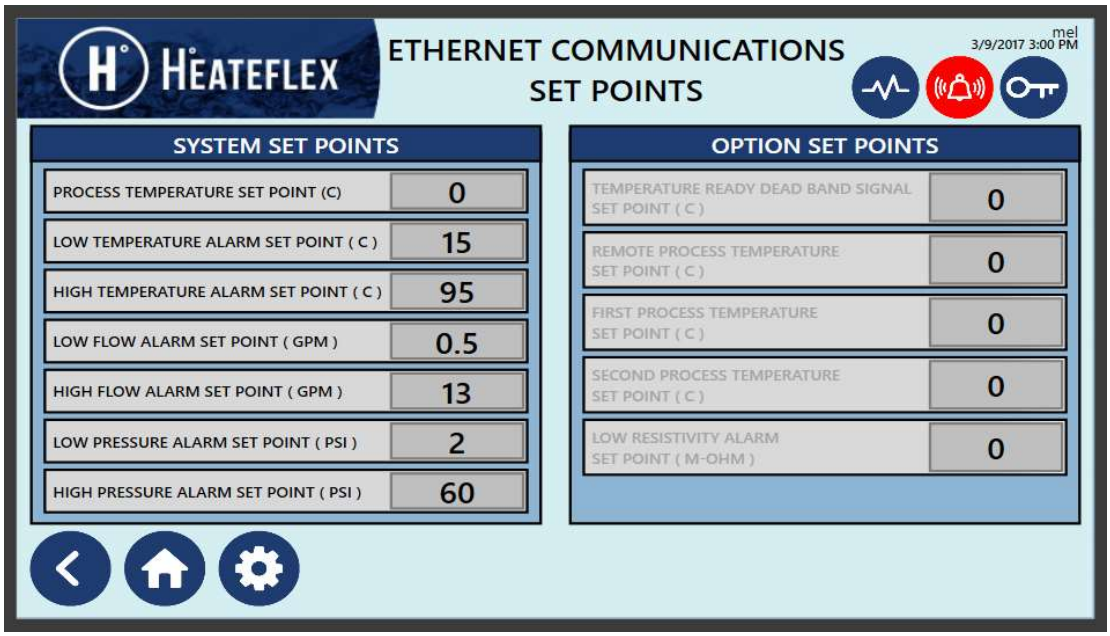
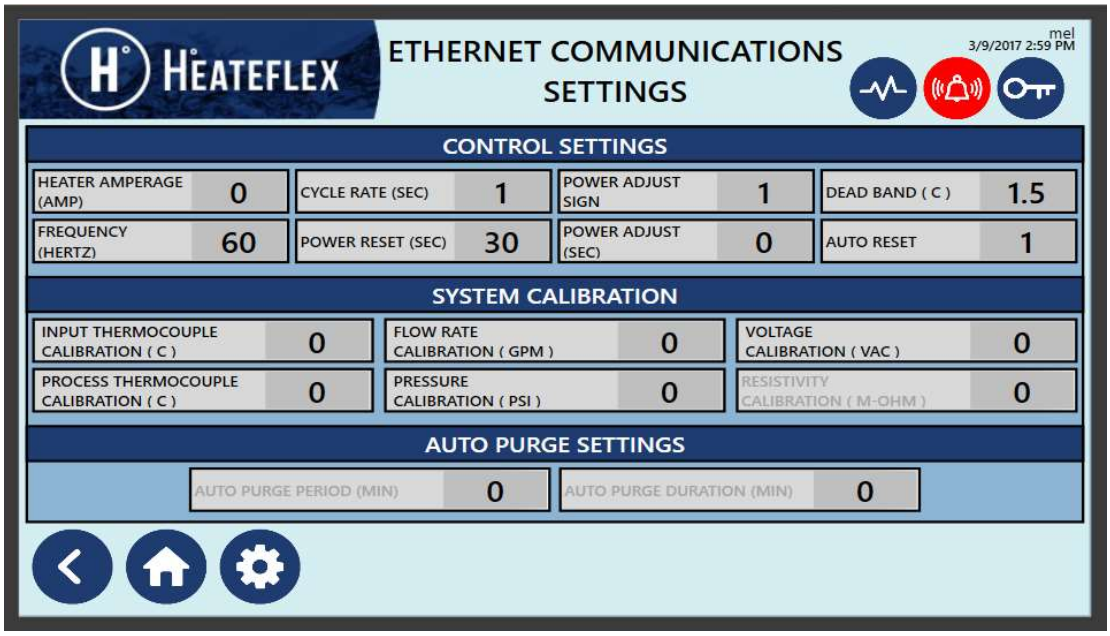


Figure 18-7: Ethernet Communications Settings Screen



18.3. ETHERNET ALARM AND STATUS SIGNALS

Signal Inversion is permitted on most of the **Ethernet Communications** system status signals and alarm signals provided that optional features are available and can be modified on the **Ethernet Alarm Signals** screen and the **Ethernet Status Signals** screens. To access these screens, press the **Alarms** or **Status** key located on the **Ethernet Signals** sub-menu (Figure 18-1). The **Ethernet Signals** screen will appear with two screen keys, the **Alarms** key and the **Status** key as shown in Figure 18-9.

Press the **Alarms** key to access the **Ethernet Alarms Signals** screens (Figures 18-10 to 18-11). Press the **STATUS SIGNALS** key to access the **Ethernet Status Signals** screen (Figures 18-12).

To invert a signal set the specific signal setting to ON. Instructions on how to invert a signal is also detailed on the **Ethernet Alarm Signals** screen and the **Ethernet Status Signals** screens.

Aquarius® optional features that are not available will appear as recessed button.

Please note that inverting any of the signals will affect the data that is sent out from the Aquarius® and will directly affect the lamps on the **Ethernet Alarms** screens and the **Ethernet Status** screen.

Refer to Table 18-2 for the Factory Default settings for all of the Ethernet alarm and status signals.

Figure 18-8: Ethernet Signals Alarms 1 Screen

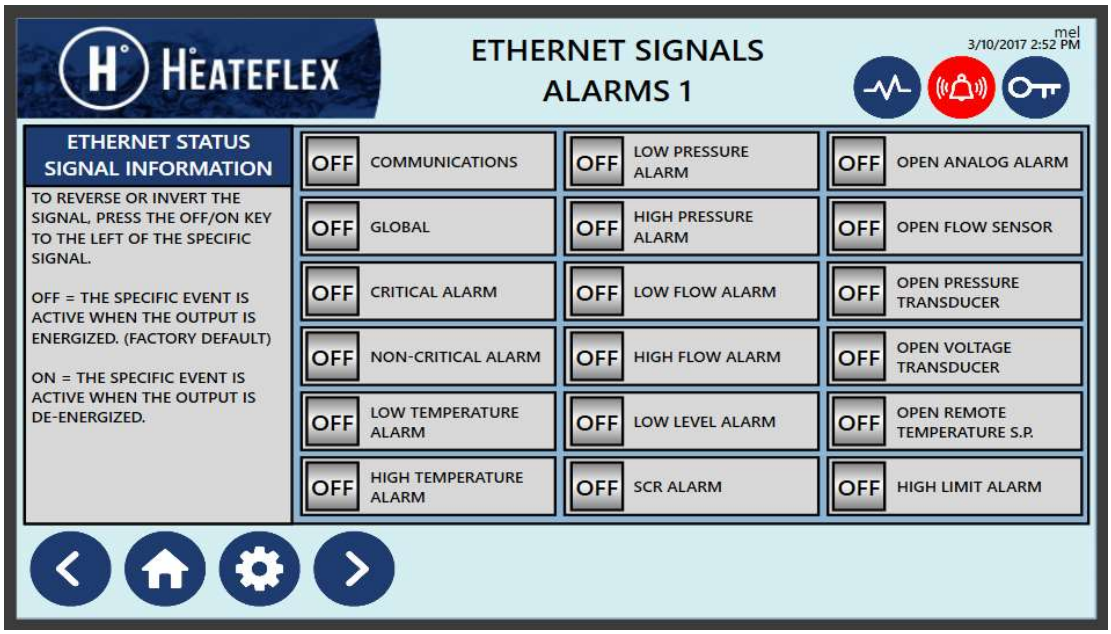


Figure 18-9: Ethernet Signals Alarms 2 Screen

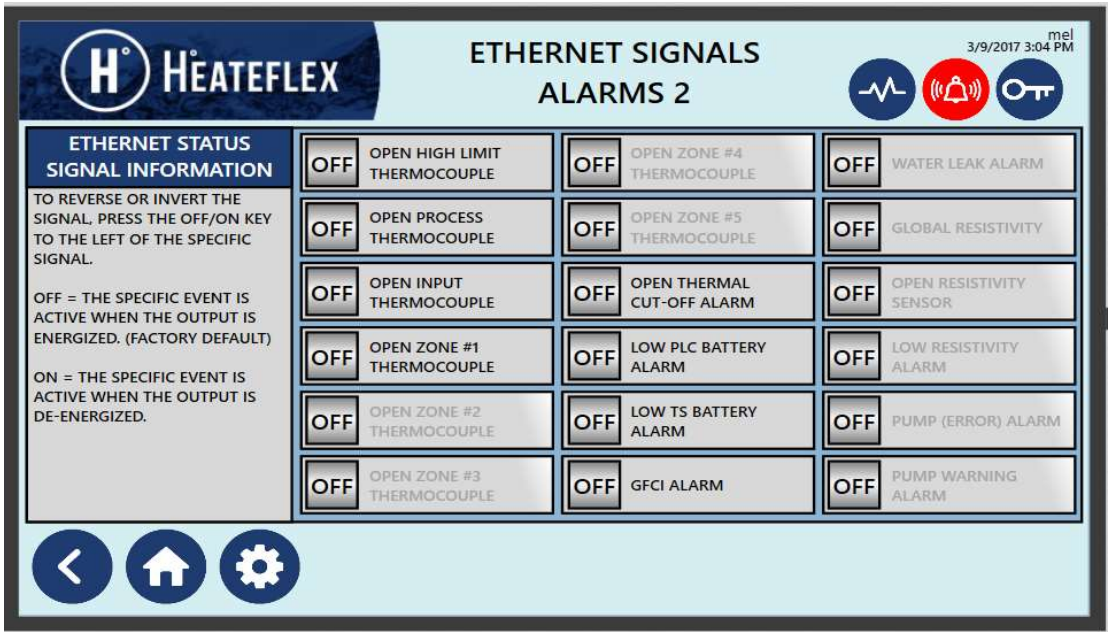
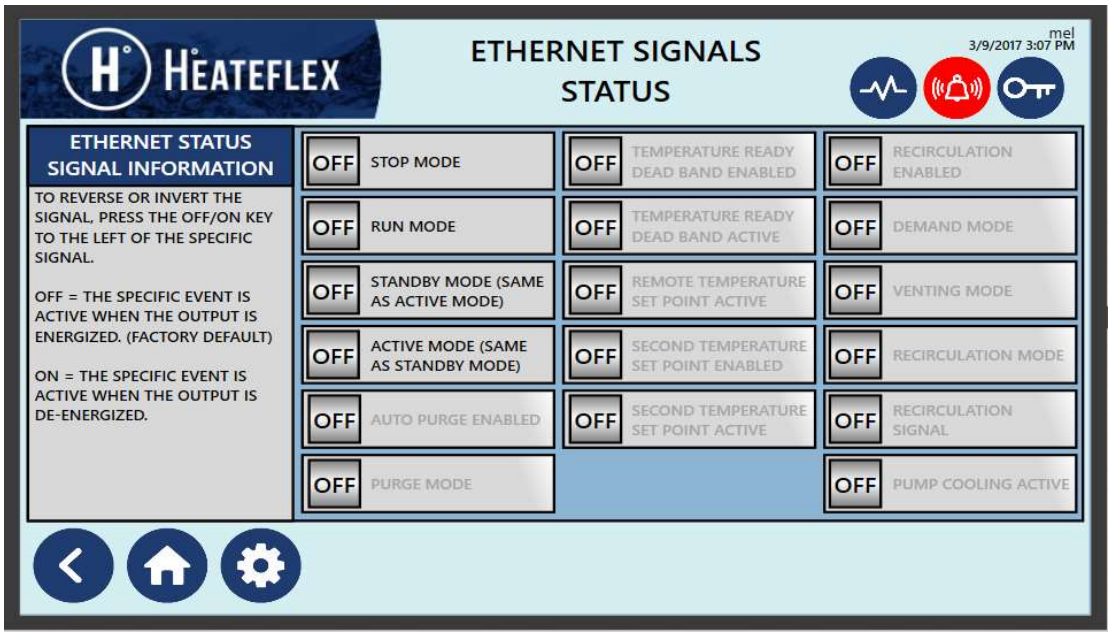


Figure 18-10: Ethernet Signals Status Screen



19. SPECIFICATIONS

AQUARIUS® DEIONIZED WATER HEATING SYSTEM
PF2000 CONTROLLER SPECIFICATIONS

Range:	Temperature: 0.0 to 95°C Flow: Varies depending on model Pressure: 0.0 to 80 PSIG Resistivity: 0.0 to 20.0 Mega Ohms (Option)
Resolution:	Temperature: 0.1 Flow: 0.1 Pressure: 0.1 Resistivity: 0.1 (Option)
Execution Time:	0.1 □s
Processing Time:	0.7 ms
A/D Resolution:	1/6000 or 1/12000 (Full Scale)
Displays:	7” STN Color Touch Screen, 320 x 240 Dots.
Communication:	None Provided (Capable of Ethernet, Controller Link, Serial, DeviceNet, Profibus-DP, CAN, CompoBus/S)
Standard Alarms:	Low & High Temperature, Low & High Flow, Low & High Pressure, Low Liquid Level, SSR, Open Analog, High Limit T/C, Open High Limit T/C, Open Process T/C, Thermal Cut-Off, and Low Battery.
Program Memory:	20K Steps, 40 Kwords
Battery Service Life:	5 years @ 25°C
Sensors:	Temperature: Standard Type J Thermocouple Pressure: 1-5 VDC = 0-100 PSI, +12 VDC Powered Flow: 4-20mA Input, +5 VDC Powered Resistivity: 0.05 Standard Cell Voltage: 4-20mA = 0 to 480 VAC
Control:	Power-To-Flow® Custom Algorithm with Power Reset Offset

Adjustment:	Cycle Rate: 1-2 Power Reset: 30-90 sec Dead Band: 1.0-2.0°C Calibration Offset: Flow Rate: -2.0°C to +4.0°C Pressure: ±5.0 psi Voltage: ±20 VAC Temperature: ±10.0°C
Operating Range:	0-55°C, No corrosive gas
Storage Range:	-20 to 75°C (Excluding battery)
Size:	4.33” x 5.91” x 3.35” (110 x 150 x 85 mm) (W x H x D)
Weight:	1.63lbf (740 g max)
Digital Inputs:	16 (Standard)
Analog Inputs:	4 (Standard)
Digital Outputs:	16 (Standard)
Analog Outputs:	0 (Standard)
Power:	24 VDC, 300 Ma

20. LIST OF FIGURES

21. LIST OF TABLES

22. MANUAL REVISIONS

Revision	Description	Program Files
00	PLC program configured for 1-3 zones PLC program configured for 1-5 zones	DI_3_V0 DI_5_V0
01		
02		