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System Integration
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FLEXETER

Controls Manual

Rev. 05/24

!!!WARNING!!!

YOU SHOULD HAVE A GOOD UNDERSTANDING OF THE ENTIRE SYSTEM AND ITS MECHANICAL COMPONENTS BEFORE CHANGING ANY SETPOINTS. IN ORDER TO REMAIN FLEXIBLE THERE ARE VERY FEW SOFTWARE RESTRICTIONS FOR SETPOINTS AND ONE MUST BE AWARE THAT CHANGING THESE SET POINTS COULD HAVE CATISTROPHIC EFFECTS.

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1) System Overview

APPLICATION and OVERVIEW

The FLEXETER or FLEX panel in its very nature is completely flexible. We can program it to control virtually anything. In this manual we describe the programs we have developed to control Building Systems. Not all buildings are the same.

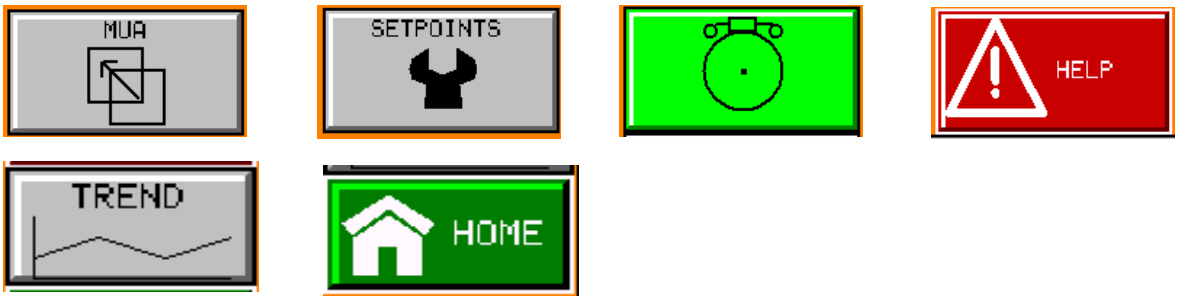
This manual includes all of the programs developed for Building systems, however only some of them may be applicable to your application.

Upon installation or ordering the FLEX control panel we will add and remove the systems to fit your needs. If none of the systems already developed fit then we can customize a program that will work.

Program Basic Navigation

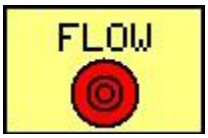
Screen Jump Buttons

These buttons navigate you through the different screens in the program. Below are some examples.



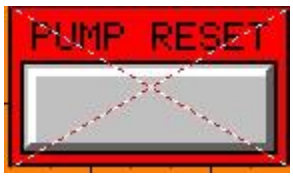
Status Indicators

Some screens have light indicators to give instant feedback on the status of different program functions. A red light indicates the equipment is off and a green light indicates the equipment is running. In the case of the SNOW indicator, a *red light* means no snow has been detected and a *green light* means snow has been detected.



BUTTONS and Switches

Buttons control ON/OFF functions. Sometimes they can be toggle swithes and other times they can be momentary buttons.



Temperature/value Indicators

Gauges, Bar Graphs and Numerical indicators show what's happening in the system(s) and program. You cannot change these values.

Editable Numerical Set points

These are system set points that can be changed. As long as you have permissions to do so. When you press these values a keypad will pop up where you can enter a new value.

LOGIN/Security

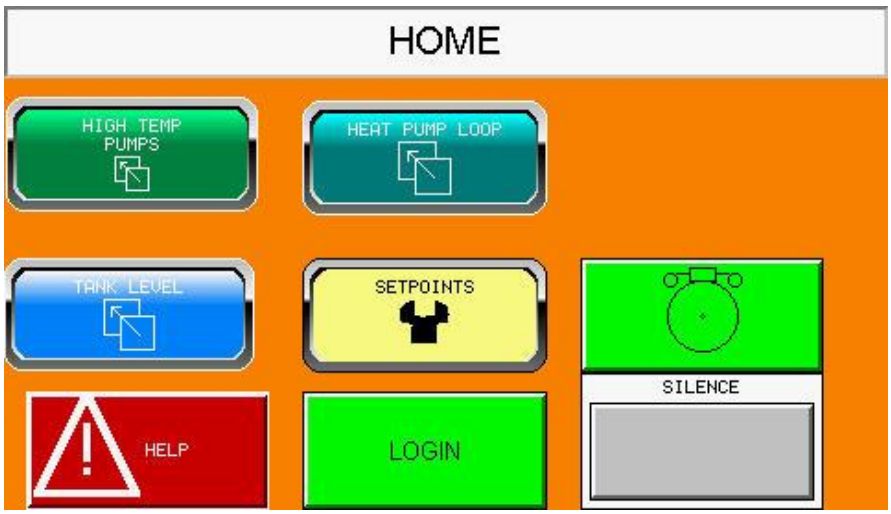
Typically the button below is located on the Main or Home screen. Some of the pages and/or set points in the program may be password protected. If you get an "ACCESS DENIED" message then this is the case.

Navigate to the screen with the LOGIN button and enter your user name and password.

DEFAULT Username = set

DEFAULT Password = 1074

2) HOME SCREEN



This is the main screen for the controls program. All functions of the program can be navigated to from here. This screen can be navigated back to by pressing the “HOME” button on any other screen in the program.

The PLC will revert back to this screen in the event of a power-loss.

If your building does not control some of item here, for example the MUA, then the screen jump button will be removed.

3) Tank Level

Usually used for Evaporator Cooling towers. In a nutshell; we monitor the tank level with a sensor. If the level gets to low we fill it up. If something goes wrong there are High and low alarms. It can be user customized to fit any sized tank up to 277” in height.

Set points

These Set points control when the Fill Solenoid should energize given water level.

The two categories of set points are PUMP OFF and PUMP ON. The PUMP ON set points will go into effect only when the pump is running and there is water flowing through the system. It is for this reason that these PUMP ON set points should be set lower than the PUMP OFF set points. When the pump turns off the water will flow back into the tank and could risk an over-flow should the two set point categories be set equally.

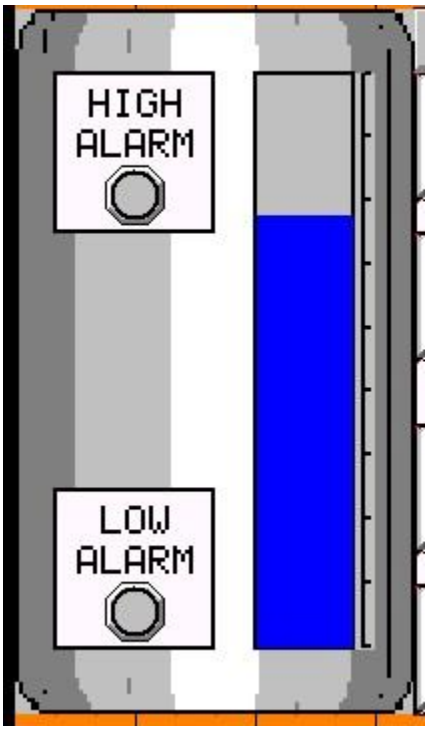
The *HIGH ALARM* set point will trigger a high alarm should the water level rise above this point, taking into account the PUMP OFF HIGH ALARM will only take control when the pump is not turned on. This goes for all set points.

The *FILL OFF* set point will turn off the fill solenoid once the water has reached its mark.

The *FILL ON* set point will turn on the fill solenoid once the water has reached its mark.

The *LOW ALARM* set point will trigger a low alarm if the water has dropped below this point.

Tank Chart



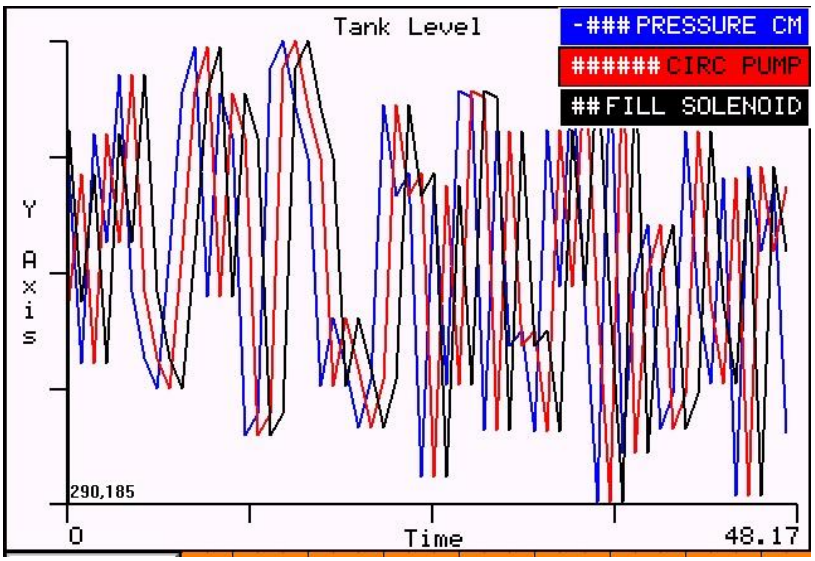
This chart will provide a graphical representation of how full the water tank is. There are also indicator lamps for high and low alarms.

The UNITS button will toggle the measurement of water level from Centimetres to Inches of Water Column

The Tank Info button will navigate to a screen that modifies the tank size within the program. This screen is only to be used in the calibration stage.

Trend

The trend jump button will navigate the PLC to the Trend screen

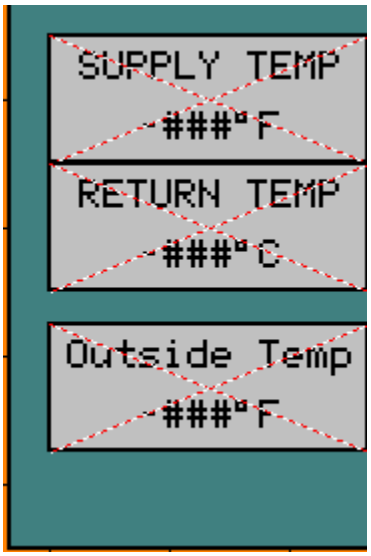


The Tank Level Trend is a 48-hour graph that will sample different information and place it on the graph. The three elements of information will come from the Water Level, the Circulation Pump status, and Fill Solenoid status. In essence, the trend documents the normal operation of the water level system over a 2-day period by tracking the water level behaviour as influenced by the Circulation Pump and Fill Solenoid.

4) Snow Melt

Used for concrete pad snow melt systems with a Tekmar snowmelt sensor.

Loop Temperature Readings

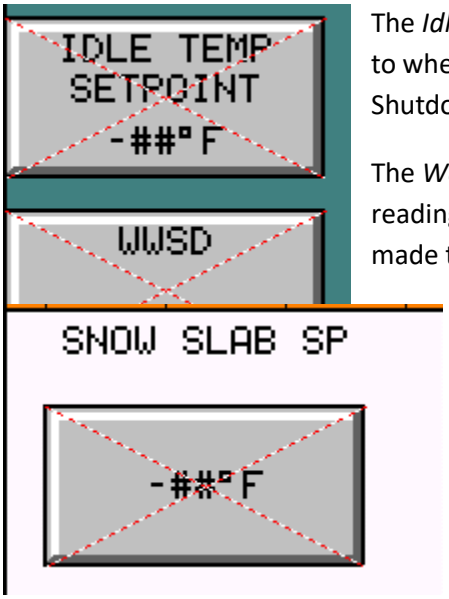


The "*Return Temp*" indicates the temperature read by the temperature sensor on the return line of the boiler loop.

The "*Supply Temp*" indicates temperature read by the temperature sensor on the supply lone of the boiler loop.

The "*Outside Temp*" indicates the temperature read by the Outside Air Temperature sensor.

Snow Melt Set points

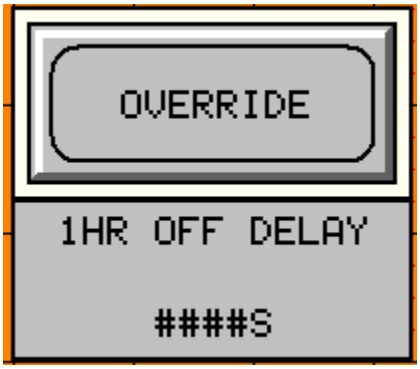


The *Idle Temp Set point* is the temperature the program will heat the slab to when the Outside Air Temperature is below the Warm Weather Shutdown Temperature but no snow has been detected.

The *Warm Weather Shutdown (WWSD*) Temperature is the outside temp reading that will turn off the SNOW MELT system so that no effort is made to regulate its heat. Ex. 10◦C

The *Snow Slab Set point* is the temperature the slab will be heated to in the event of snow. Ex. 5◦C

Manual Override



The *Manual Override* for the Snow Melt System will perform as though there is a snow condition. The Slab will be heated to the inputted *Snow Slab Set point*. The Manual Override shuts off automatically after 1 hour.

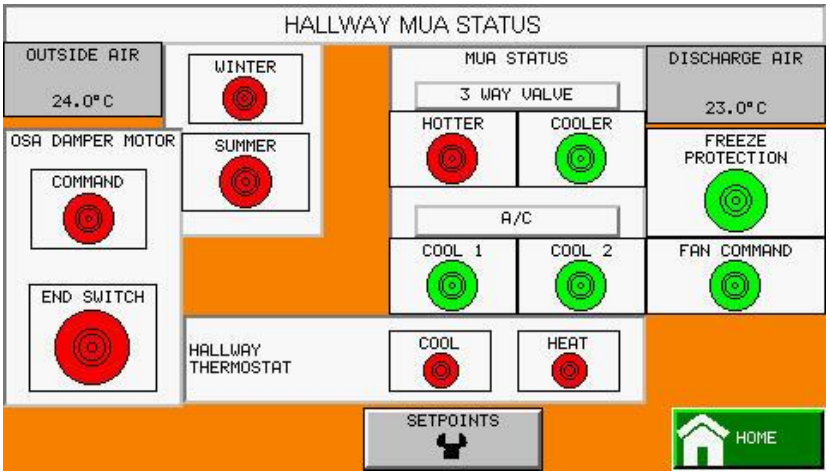
5) MUA Schedule

Pressing the "MUA SCHEDULE" button on the previous screen will navigate to the schedule editing screen. The schedule is based on a 24-hour clock. Each setting has an hour set point and a minute set point to start, and another set to stop. Setting up the schedule to have the MUA/EF run from 5pm-6:30pm the layout would look as shown.

6) Corridor/Hallway Pressurization

Controls the Discharge air temperature of an Air Handling Unit or Makeup Air unit for pressurizing the hallways of an apartment or office building.

Overview



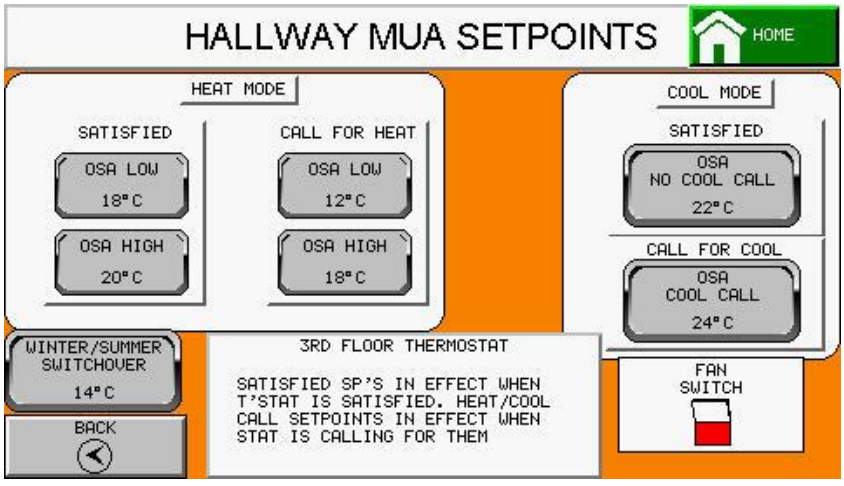
In this application there is a conventional hallway thermostat. The system maintains a constant discharge air temperature from the MUA. If the hallway stat calls for heat then we increase the discharge air set point. If the thermostat calls for cooling then we decrease the discharge air set point.

In winter mode we only use the heating source and the cooling is free cooling.

In Summer mode only the AC us used and heating is free heating.

The fan runs 100% of the time and only stop in the event of a problem (Low discharge air and Damper motor end switch not met).

Set Points



The system uses an outside air temperature to automatically switch the HEATING/COOLING or Winter/Summer modes.

In Heating mode when the hallway stat is satisfied we maintain the temperature between the low and high setpoints. When there is a call for heat then we increase the discharge air.

In cooling mode the discharge air remains constant. If the hallway stat calls for cooling then we turn on the AC.

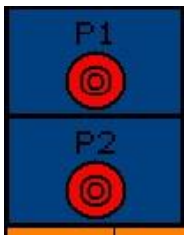
7) Heat Pump Loop

This control sequence is ment as an equivalent for the old Exeter System. It is used in buildings with Heat Pumps as the main climate controls.

Stages

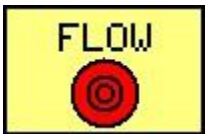
Displayed at the top of the screen is the Active Stages indicator. This text field will display what heat/cool stage is currently active. In instances where no stage is active the text field will display "None". The text field will also indicate if an error has occurred and the system is put into shutdown.

Pump Lights



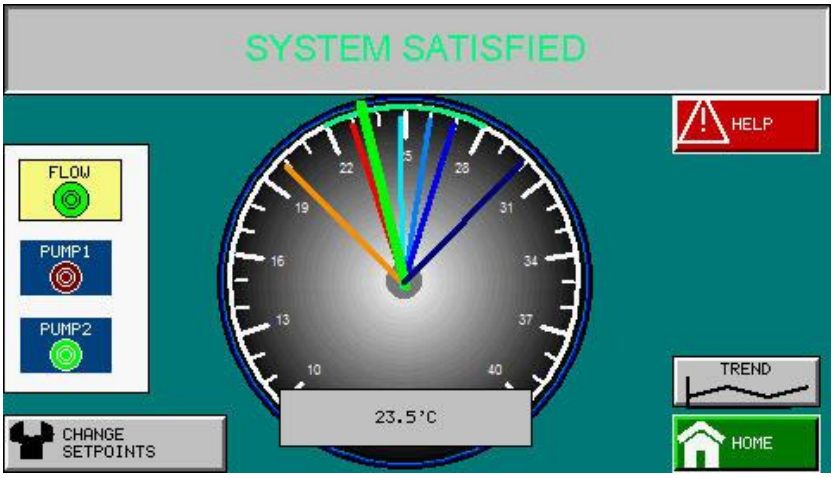
These pump lights indicate which pump is active. Red represents an off state and green represents an on state. They are scheduled on a lead/lag system so that one pump will be running for 7 days and then the other one runs for 7 days.

Flow Light



The flow light indicates that the flow switch has closed due to a flow of water from one of the pumps. If one of the pumps is energized but the flow switch doesn't close within 9 seconds, there is something wrong with the pump. In this case the lagging pump will automatically start. In order to attempt to start the trouble pump the Pump Reset button will need to be pressed. More information about this is in the Pump Control section.

Temperature Gauges



This temperature indicator represents the temperature read from *the return thermistor*. Also on display are the Cool Stage 1 and Heat Stage 1 set points. When the loop temperature reaches one of these set points the appropriate stage of control will initiate (once the pre-determined ON-delay concludes, more below). If the return water temperature gets below the heat set point, heat stage 1 will activate. If the water temp rises above the cool set point, the cool stage 1 will activate.

Indicators on the temperature gauge are indicated as follows:

Actual Return Temp = Black, Actual temperature of the water returning from the system.

Heat 1 Set Point = Orange, when actual temp is less than this set point HEAT 1 will come on.

Heat 2 Set Point = Red, when actual temp is less than this set point HEAT 2 will come on.

When actual temp is between Heat 1 Set point and Cool 1 set point the system is satisfied

Cool 1 Set Point = Light Blue, when actual temp is greater than this set point COOL 1 will come on.

Cool 2 Set Point = Blue, when actual temp is greater than this set point COOL 2 will come on.

Cool 3 Set Point = Dark Blue, when actual temp is greater than this set point COOL 3 will come on.

Help Button

Pressing this button will navigate you to the help screen. On this screen you will find the name of our company as well as our phone number and after hours phone numbers. Also access to the Celsius to Fahrenheit converter.

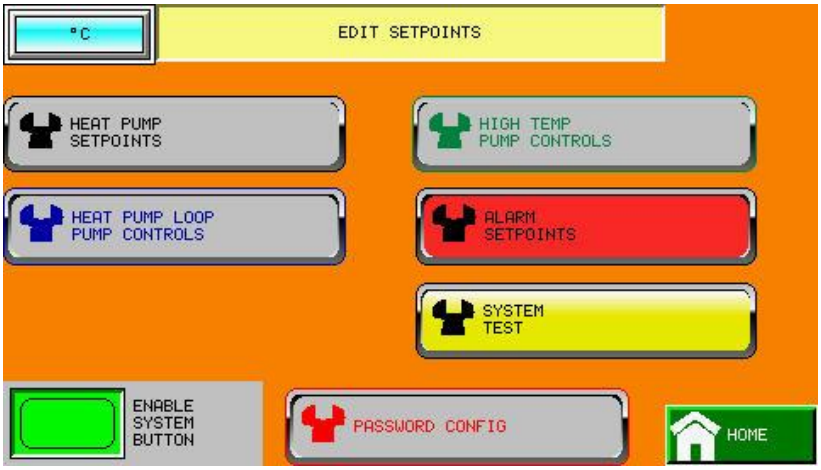
Home Screen Jump

The Home button will take you back to the Main Menu

Edit Set Points Jump Screen Button

The “Edit Set points” screen jump button is located on the Heat Pump Screen.

Heat Pump - Edit Set Points Selection Screen



Access will be granted to the Edit Set points screen once the correct password is entered. This screen can be thought of as the Main Menu of all the adjustable settings the program has to offer.

Changing Temperature Set points for Heating and Cooling Stages

Once access has been granted to the change set point screen, you can edit the water heat and cool set points. The set points are buttons and have some fading around the parameter, indicating that they are editable. To edit these set points, press the set point button. A number pad pops up, enter the appropriate set point and press enter.

The Heat Set Points determine when the heat stages energize. If Heat Stage 1 has a set point of 60 degrees C, Heat Stage 1 will energize when the sensed water temperature drops below this set point. If Heat Stage 2 is 55 degrees C, Heat Stage 2 and Heat Stage 1 will be energized when the sensed water temperature drops below 55 degrees C.

The Cool Set Points operate in a similar way as the Heat Set Points. When the sensed water temperature rises above a Cool Set Point the correlating stage will energize. A further rise in temperature passed the next set point will energize the next stage of cooling as well.

An example of set points could look like the following:

Cooling Stage 3 – 90 degrees F

Cooling Stage 2 – 85 degrees F

Cooling Stage 1 – 80 degrees F

Heating Stage 1 – 70 degrees F

Heating Stage 2 – 64 degrees F

Saving Temperature Set points and Reverting Back to Saved Set points

Once new set points have been entered they can be saved by pressing the "Save As Default" button at the bottom of the screen. If a set point is changed accidentally, pressing the "Revert" button will change all staging set points back to what is saved as default. The set points will also revert back to what is saved in the case of a system reboot. This Save and Revert system can be found on the Alarm Set point screen as well, more below.

Setting ON-Delay for the System Stages

Both Heating and Cooling have an ON-Delay timer that counts down before a stage is initiated. The default for these timers is 4 seconds. Ex. If the Cool 1 stage set point is 100 degrees F the loop temperature must be over that cool set point temperature for 4 seconds before the Cool Stage 1 will energize.

The purpose of this is because the temperature of the water will tend to fluctuate up and down. Without the utilisation of an ON-Delay, the stage coil would energize and de-energize a couple times a second along with this water temperature fluctuation. This is not good for the health and longevity of the equipment.

Setting OFF-Delay for System Stages

The OFF-Delay is similar to the ON-Delay except this is the amount of time the stage will stay energized after the stage set point has been satisfied.

If the OFF-Delay is 20 seconds, and the Cool 1 set point is 100 degrees F, Cool 1 will remain on for 20 seconds after the water temperature has dropped below 100 degrees F.

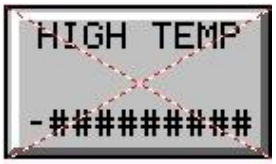
The purpose of this is to ensure the system runs in an efficient manner. To prevent the stages from unnecessarily turning on and off frequently, this OFF-Delay allows the stage to remain on to adjust the water temperature a little further passed the specific set point.

Alarm Set points

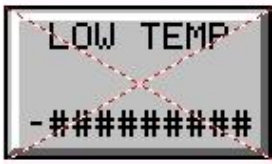
Alarm Silence Timer

The Silence button appears whenever an Alarm is present. The amount of time the alarm can be silenced is configurable from this Set Point Edit screen. The timer is read in seconds, so an allowed silence time of 1 hour would require the operator to enter the number 3600. Being that there are 3600 seconds in an hour.

Programmed Alarm Set points



If the return water rises above the High Temp set point the High Temp Alarm will sound. This alarm will disable the Heat Stages of the system.



If the return water temperature drops below the Low Temp set point the Low Temp Alarm will sound. This alarm will disable the Cooling stages of the system.

Alarms will be displayed in an Alarm Text Field that appears when a trouble is found. All protective measures will be returned as normal once the corresponding alarm has cleared.

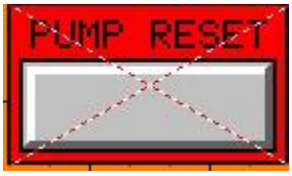
The Max Temp Differential is the maximum allowable difference in temperature between the supply and return temperature sensors. If the Max Temp Diff is set at 30 degrees C this means the return temperature can never be 30 degrees C above or below what the supply temperature is. In the event that this alarm is tripped the Alarm Text Field will indicate what the problem is and all stages will go into shutdown.

8) Pump Control

Lead/Lag Toggle Button

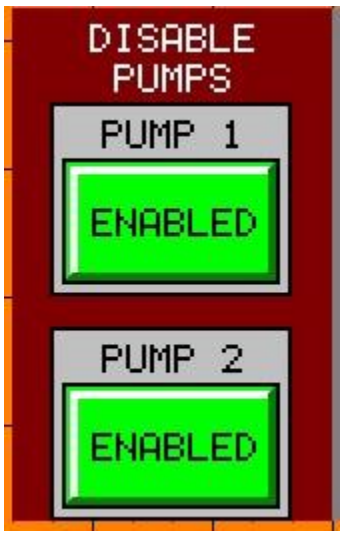
Under pump controls you'll find the Lead/Lag toggle button. This is a standard pushbutton. Pressing it will change the lead pump to lag and lag pump to lead. This effectively switches which pump is on for the remainder of the lead/lag 7-day schedule

Pump Failure Reset



Earlier in the manual I mentioned the possibility of a pump failure. In this case, the system goes into lead pump failure mode and energizes the lagging pump. The lagging pump will continue to be solely responsible for pushing the water until the lead pump is fixed. When in Lead Pump Failure, this Pump Reset button will appear on both the Main Screen and the Pump Control Screen. The leading trouble pump will not try to re-energize until this Pump Reset button is pressed. In the event that both pumps fail, power will be provided to both pumps, as this could be an issue with the Flow Switch. After pressing the *Pump Reset Button*, if there is still an issue and the flow switch doesn't close after 9 seconds, the pump failure mode will activate again and the Pump Reset button will reappear.

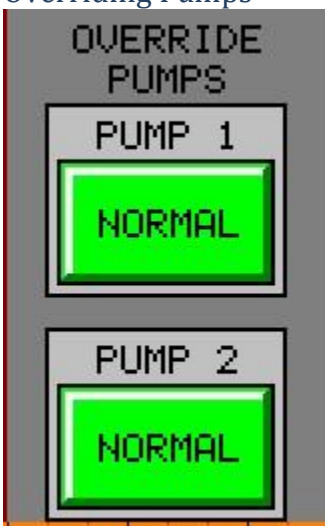
Disabling Pumps



Disabling a pump that is malfunctioning will, in turn, energize the other pump and avoid triggering an alarm when the program tries to energize the faulty one and fails to flow water. The program would switch the pump command automatically, if the pump weren't disabled, but an alarm would sound as the program would determine this pump failure not to be expected.

Disabling either pump will produce a warning message on the Main Menu.

Overriding Pumps



Indication that the pumps are working come from a flow switch. The flow switch closes when water is flowing in the system from a pump. It is possible for the flow switch to get damaged or malfunction. The program determines that the pumps aren't working if it doesn't receive this feedback from the flow switch. The Override feature should be utilized under these circumstances to force a pump to run.

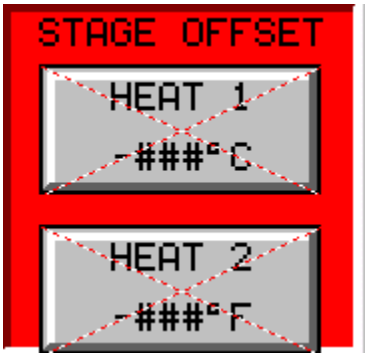
The Override feature works independently of any Lead/Lag, Alarm Lockout, or reverse-interlocking fail-safe that is normally incorporated in the program. This can be thought of as a simple HAND switch. It is possible to have both pumps on at the same time. This should be taken note of if it is not intended.

The Override feature should NOT be used on a regular basis for the reasons stated above

Having either pump Overridden will trigger a warning on the Main Menu.

9) High Temp Loop

Stage Offset



The Boiler Set points over the red backdrop will control when the boilers come on and turn off based around the *Boiler Reset Curve*. The Stage Offset determines how far from the boiler set point the loop temperature can fall before the boiler turns on and how long the boilers stay firing even after the boiler set point has been reached. For example, if the reset curve is requesting a set point of 100 degrees Fahrenheit and the Stage 1 Offset is 3 degrees, the boiler will fire up when the loop temperature reaches 97 degrees (100 – 3) and will stay firing until the loop reaches 103 degrees (100 + 3). This works the same way for Stage 2 Offset, in a stage 2 operation both boilers fire to achieve the Reset Curve temperature plus the Stage 2 Offset. NOTE: For proper operation, the Stage 2 Offset parameter needs to be greater than Stage 1 Offset parameter. Ex. Stage 1 Offset = 3, Stage 2 Offset = 5.

The purpose of these offsets is to prevent the boilers from frequently firing due to a small drop in boiler loop temperature.

Temperature Override

The boilers are controlled by a *Reset Curve* and has a failsafe that can be manually overridden when the Outside Air Sensor has a fault.

To activate, set the desired High Temp Loop Temperature and press the enable button. The system will run automatically based off of the Outside Air Temperature when the Target Override is not enabled.

Setting ON-Delay for the System Stages

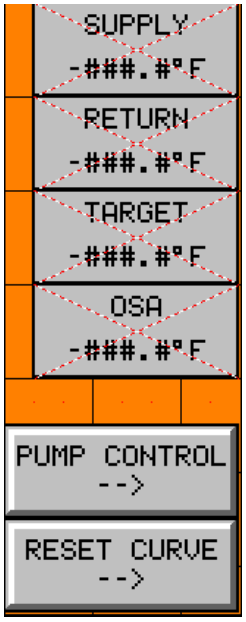
Both Heating stages have an ON-Delay timer that counts down before a stage is initiated. The default for these timers is 4 seconds. Ex. If the Heat 1 stage set point is 100 degrees F the loop temperature must be under that heat set point temperature for 4 seconds before the Heat Stage 1 will energize.

The purpose of this is because the temperature of the water will tend to fluctuate up and down. Without the utilisation of an ON-Delay, the stage coil would energize and de-energize a couple times a second along with this water temperature fluctuation. This is not good for the health and longevity of the equipment.

High Temp Loop High Alarm

If the return water rises above the High Temp set point the High Temp Alarm will sound. This alarm will disable the Heat Stages of the system.

High Temp Loop Target Temperature Gauge



The Target Temperature is the ideal temperature for the loop. The Target Temperature for the loop is calculated based on the Reset Curve and is displayed on the right side of the screen. Read below for instructions on setting up the Reset Curve.

High Temp Pump Control

For instructions on High Temp Pump Control read the *Heat Pump Control* instructions above as their functions are the same.

Reset Curve Screen

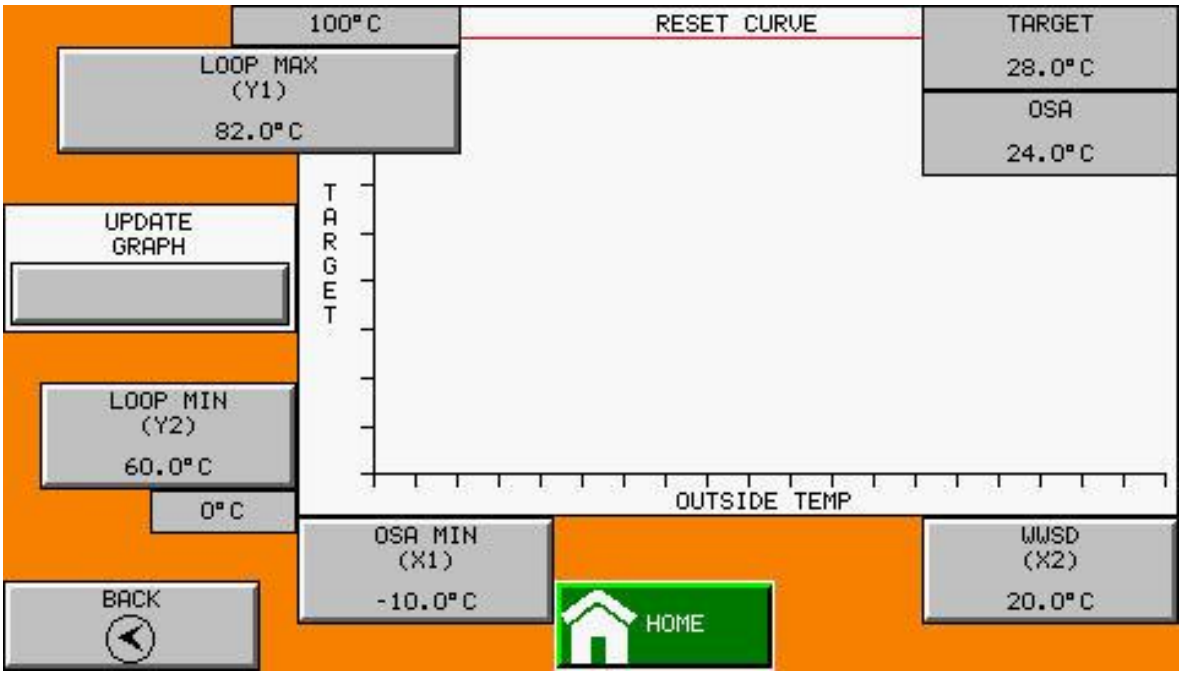
Here is where the parameters for the Boiler Reset Curve can be made. To edit them, press the grey button under the parameter you would like to edit. A Layout of the descriptions of each parameter are below:

OSA MIN – This is the Outside Temperature reading that the program will associate with setting the highest Boiler Temperature Set point.

BOILER MAX – This is the maximum boiler temperature set point the program is allowed to set and will be issued upon an Outside Temperature reading that is equal to or less than the OSA MIN setting.

OSA MAX – This is the Outside Air Temperature reading that will make the program set the boiler temperature set point equal to the BOILER MIN parameter.

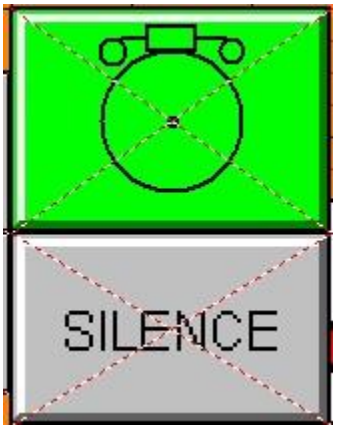
BOILER MIN – This is the minimum boiler temperature set point the program is allowed to request and will be equal to the boiler temperature set point when the Outside Air Temperature reading is greater or equal to the OSA MAX.



10) Alarm Notification

Alarm Notification

Alarm Buttons

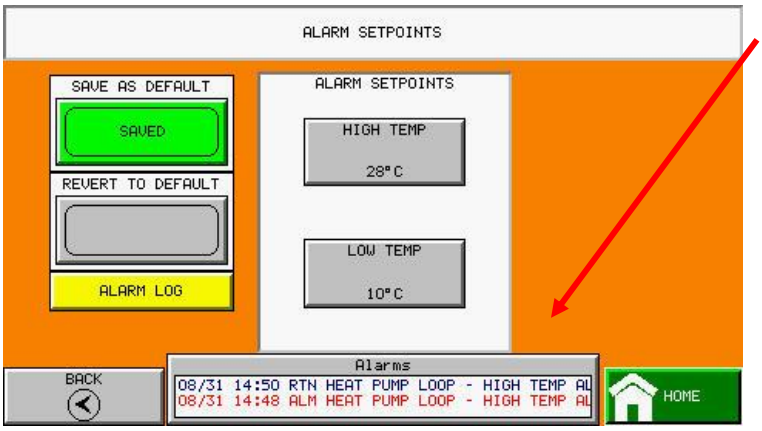


These buttons will appear on the screen in the event of an alarm. There are a few possible alarms that could occur, including High temp alarm, low temp alarm, pump failure, etc. Pressing the silence button will turn off the visual and audible buzzer for a pre-determined amount of time. The buzzer will come back on after this silence period if the problem is not fixed in that time. The alarm bell button will change colours to indicate the status of the alarm call. Green means there are no alarms and these buttons won't be displayed. Yellow means there are alarms that have been acknowledged but are still active. Red means there are currently one or more alarms that are active and have not been acknowledged.

Pressing on this alarm bell button will bring up an alarm summary log. This alarm log displays all active alarms including what the alarm is, their status (ALM – Alarm, ACK – acknowledged, RTN – Return to normal) and a timestamp.

In addition to these features, a red text field will appear at the top of each screen in the event of an alarm to warn the user as to what the alarm is.

If your system is equipped with a BUZZER the buzzer will sound during an alarm condition.



On the Alarm Setpoints screen, press the Historic Alarms panel to view all alarms that have been present since the last time the historic list has been manually cleared. All Alarm activity (Acknowledged, Active Alarm, Return To Normal) will be logged to this list.

11) Remote Monitoring

If there is remote monitoring required we can connect the flex panel to the out side world in many different ways.

a) We can provide simple alarm contacts that alert your security system in the event of a problem.
b) We can connect the controller to a LAN network and send emails out
c) We can connect an remote computer locally in the building or remotely anywhere in the world.
d) The control system HMI can be made available to IPADS, PC's, Smartphones ect…

Please contact Gabriel Industries for more information.

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