AutoGen

Generator System Controller

eFlo 2.0 Model

eFlo 1.5 Model

eValve Model

TOUCH SCREEN OPERATIONS MANUAL

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Introduction

AutoGen represents the next advancement in generator controls utilizing sophisticated flow loop algorithms to perform demand-based control on endothermic gas generators. AutoGen is designed to fully automate generator control including temperature, dew point, air-gas flow and automatic turndown.

For optimal metallurgical results, precise control of key process variable types is required. These variables include flow, dew point, gas-to-air ratio (before the mixture is cracked into endothermic gas), and endothermic gas temperature. The header pressure of the generator outlet provides an indication of the furnace's demand for endothermic gas. A pressure sensor at the generator outlet measures the outlet header pressure; AutoGen will increase the air blower speed when more gas is needed and decrease the speed when less gas is needed.

AutoGen is designed with two Flow Meters that are critical in precisely controlling the mixture of gas and air. One is the primary gas Flow Meter which handles the mixture of air and gas (also called *coarse*); the other is the trim Flow Meter, which allows smaller quantities of air or gas to be added to the mixture when needed to maintain the proper gas-to-air ratio. The primary gas Flow Meter is said to control *coarse adjustment,* while the trim Flow Meter handles *fine adjustment.*

AutoGen is based on SSi's Matrix controller, giving it exceptional scalability and range of functionality. An advanced segment-based programmer provides recipe control. The control

interface is a 12.1" color touch screen (with the option to use SSi Configurator for PC-based control). AutoGen provides built-in data logging, alarm management, and maintenance scheduling.

More detailed information on endothermic generator control as a general topic can be found on SSi's website, www.supersystems.com, under **Documentation -> Technical Papers**.

Theory of Operation

AutoGen is a demand-based system. It will make only the gas required (limited by the actual turndown of the system) to feed the equipment.

A pressure sensor is connected on the outlet of the generator's cooler. This measures and controls the system to 20" of pressure (typical endothermic delivery pressure to equipment). A VFD speeds up or slows down the blower to meet the demand:

- If the pressure drops (e.g. a valve opening allowing more endothermic flow), the blower will speed up to make more gas.
- If the pressure increases (e.g. a furnace is no longer taking gas), the blower will slow down to make less gas.

The Air Flow is a direct function of blower speed; The faster it spins, the greater the air flow.

Keeping pressure stabilized is key. An unstabilized system will never be able to control air/gas ratio and dewpoint.

- Pressure may fluctuate 0.2" above or below setpoint (Typical- 20") - this is an acceptable range.
- Fluctuations of 0.5" or more are a problem - if this occurs, PIDs may need to be adjusted.

Pressure alarms and air flow alarms are built in to monitor the pressure, air flow, and signals and will alert the user of any issues. Major issues (Air Sensor Out of Range, Coarse Gas Sensor out of Range, or Ratio Greater than 4.0 for too long) will shut down the system.

A Coarse Valve (natural gas) is used to maintain an air/gas ratio to get the endothermic dewpoint within a few degrees of setpoint. The idea ratio is 2.7:1, but this can vary as low as 2:1 and as high as 4:1 depending on many different factors. The air flow signal is wired into the Coarse Gas meter, and both flow rates are sent to the AutoGen controller via communications. The AutoGen controller sends the coarse gas meter an air/gas ratio setpoint (in this example, 2.7). With the air flow wired into the coarse gas meter, the meter knows the actual air flow. It then calculates air flow / ratio to determine the coarse gas flow setpoint, and drives up or down to meet this new setpoint. The calculation is fast, adjusting 20-30 times a second.

The coarse valve lights will always be flashing/driving open and closed, and the actual air/gas ratio will always be moving. The air flow is not constant, so the meter is always calculating and adjusting to maintain the needed ratio.

It is vital that the actual ratio remains near the setpoint ratio. If the actual ratio fluctuates rapidly (e.g. from 1 to 9 to 4 to 1 to 6 to 0 and so no) then this is a major issue.

- First, make sure pressure is stable.
- If the pressure is fairly stable but the coarse ratio is still moving excessively, verify inlet gas pressure to the flowmeter is stable.
- If inlet gas pressure is stable, adjustments may need to be made to the coarse meter gain (this is set during startup and should not need to be adjusted UNLESS there are major system changes that would have necessitated this).

Coarse ratio control is Priority #2. Flow alarm and ratio alarms are built in to alert on any issues. Major issues (transmitter issues, ratio too high or too low, etc…) will shut down the system.

A trim valve (natural gas) is used to dial in the actual dewpoint to meet the setpoint. This movement is very slow, and the amount of gas flow is very low.

- As the dewpoint %output increases (calling for more trim natural gas), the actual dewpoint will drive down.
- As the dewpoint %output decreases (calling for less trim natural gas), the actual dewpoint will drive up.

Because of variances in day to day operation (temperature, humidity, filters, catalyst, etc.), the trim valve will open and close (increase and decrease flow) as needed to control and maintain the dewpoint. If the dewpoint is uncontrollable, step back and verify that the pressure is stable and the coarse ratio is under control. Dewpoint control alarms are built in and will alert if the actual dewpoint deviates from the setpoint for too long.

Due to differences in control over time (age of catalyst, filters, etc…) the air/gas ratio that the system was characterized at during startup will not be the same in a year's time. This is typical, much like adjusting the older regulator/mixer to get dewpoint dialed back in. However, the AutoGen has smart features that will automatically "bump" the air/gas up or down to achieve this.

If the trim/dewpoint % output is high or low for too long (near 0% or 100% for 30 minutes), the AutoGen uses an algorithm to shift the air/gas ratio setpoint up or down to get the trim/dewpoint %output back near 50% and get the actual dewpoint controlling again near setpoint. This algorithm is based upon on the difference between the actual and setpoint dewpoints and a few other smart features. This "bump" feature will make several small bumps in the ratio to get the dewpoint back near where it needs to be. Too large of a bump can actually drive the dewpoint the opposite direction. (NOTE that prior to the bump feature automatically adjusting the ratio up or down, the system will announce that the dewpoint % output is too high or too low for too long, and you may also get dewpoint deviation alarms.)

The air/gas ratio to achieve dewpoint is not the same from one flowrate to the next. Therefore, during startup SSi will "characterize" the generator to determine the air/gas ratio required with trim control at a fixed 50% output to achieve the desired dewpoint. This will be tested at multiple flow rates throughout the generator's capacity (max flow to min flow). SSi will then

populate the data and enter it into the AutoGen controller. The AutoGen then populates a curve that it calculates to adjust the coarse ratio at any given flow rate.

In a perfect scenario, the AutoGen is capable of a turndown of 6:1. This means with a generator maximum capacity of 6000 SCFH, the maximum is 6000 SCFH and the minimum is 6000/6 = 1000 SCFH of endothermic gas. In reality, unstable supply gas pressure, catalyst issues, endothermic cooler issues, dirty pipes, dirty fire check, and other issues can and will prevent the system from turning down to the minimum capacity. This actual turndown is tested during the characterization; a minimum pressure %output is applied the VFD/Pressure control loop to ensure that the system does not attempt to make gas lower than its actual turndown. In this case, the pressure will start to rise (not an issue) and the Vent Regulator will vent off gas to maintain its minimum flow. (Note if attempts are made to run the generator below minimum turndown, there are NO GUARANTEES that the AutoGen will control properly or make good gas.)

Important Safety Requirements

WARNING!

AutoGen is NOT guaranteed to provide gas shutoff, nor is it designed to do so. For reliable gas shutoff, incorporate a valve that provides positive gas shutoff. Ensure that all gas flow equipment is in compliance with National Fire Protection Agency (NFPA) requirements, including those found in NFPA 86. Failure to follow these requirements could result in flammable gas leaks into the unit.

Ensure that the air and gas mixture ratio settings are within the specifications provided in this manual. Exceeding specified values could result in hazardous conditions.

Ensure that proper ventilation and/or breathing protection (for example, an industrial respirator or oxygen supply) are used when in the presence of endothermic gas. Failure to do so could result in serious physical injury or death.

Specifications

Control Power	110 VAC or 220 VAC
Communications	Modbus TCP, Modbus RS485
Gas Type	Natural Gas, Propane, LNG, LPG
Minimum Gas Pressure (Pre-Mix)	0.5 psig
Maximum Gas Pressure (Pre-Mix)	5 psig
Turndown Ratio	6:1
Maximum Operating Temperature	122 °F (50 °C)
Endothermic Gas Capacity (Maximum)	700 – 13,500 scfh 19.82 – 382.32 m^3/h

Setup

Piping Setup

Refer to Appendix 2: Piping Diagram on page 92.

Electrical Setup

Please reference electrical prints for details.

Ethernet Connections

The Ethernet connection has three distinct uses. First, should the Operator Interface fail, the Ethernet connection allows a laptop to be connected via a crossover cable to the AutoGen controller unit using a web browser. This connection can act as a LIMITED FUNCTION "operator interface" until the Operator Interface can be repaired or replaced. The laptop needs to be operating a Windows XP or higher with Internet Explorer. The default IP address is **192.168.0.201.** If you are experiencing problems please call (513) 772-0060 and talk with our computer communications personnel. Secondly, the Ethernet port can be used for communications to a SCADA software package. Call us at (513) 772-0060 if you are interested in this option. The third use for the Ethernet Port is the primary communications connection for the Configurator 2.0 Software.

Generator Startup and Operation

This section discusses general operation (including start-up, shut-down, and safety procedures) of the Generator. Original equipment (OEM) and customer/site specific practices shall supersede these recommendations. The below procedures are intended as a reference only and should be reviewed by facility Engineering & Safety prior to implementation. Original instrumentation & controls are beyond the scope of this manual; refer to manufacturer documentation.

Safety

All Generators must have a Firecheck valve that prevents combustion from returning back to the mixture system and natural gas supply. The integrity of the Firecheck valve should periodically be checked to ensure that it stops the flow of gas, shuts down the mixing system, and enables an alarm.

Additional safeties such as E-Stops which disable power to field devices can be used to quickly shut down the Generator while keeping Instrumentation power on. Main panel disconnects should only be used in situations where disconnecting power to the entire panel is the only safe solution. Supply gas hand valves may be used to permit or prohibit the flow of gas to combustion or reaction systems.

Startup (Preparing the Generator for Production)

Before heating the Generator, make sure that all obstructions (ladders, baskets, etc) have been cleared from the Generator. Make sure that a clear path has been made around the Generator.

From a powered off state, the Generator can be brought to an Idle state as follows:

1. Switch on the main disconnect
2. Reset any **E-Stops** and Confirm Main Power and Instrumentation Power are ON.
3. Reset the **Overtemp Controller** if required.
4. Open the **natural gas hand valves** located at the generator inlet and between the main Safety Shutoff Valve and Blocking Valve for the combustion system. Keep reaction hand valves closed until ready to make gas.
5. Locate and reset the **High** and **Low Gas Pressure Switches** if required.
6. Open the supply gas **hand valve** for the burnoff pilot, and ignite. Confirm the **Burnoff Pilot** is lit via indicator on the **AutoGen Touchscreen**.
7. If required, start and confirm the **Combustion Air Blower** is running.
8. With all safeties OK, open the main Safety Shutoff Valve.
9. From the Tube "X" Temp screen (Menu > Tube "X" Temp), set the Temperature SP to 0F. ("X" = tube number)
10. Open the **burner gas hand valves** and following OEM and documented procedures, light the main burner.
11. Once the burners are lit, adjust the **Temperature SP** to **1900F**. This can be performed by manually changing the Temperature SP, or pressing the "Start Heatup Ramp" HMI pushbutton that will slowly bring the generator to operating temperature.
12. Once at temperature, allow the generator to settle and maintain temperature for 1-2 hours to allow the refractory, retort, and catalyst to be fully saturated with heat.

13. The Generator is now ready to make gas.

Shut Down

Assuming the Generator is in an Idle state and not making gas, the Generator can be shut down as follows:

1. From the Tube "X" Temp screen, set the **Temperature SP** to 0F.
2. Close each tube **burner gas hand valves**.
3. Close the **Main Safety Shutoff Valve**.
4. If equipped, Stop the **Combustion Air Blower**.
5. Close the **supply gas hand valves**.
6. Close the **reaction gas hand valves**.
7. The Generator is now ready to remain in an Idle state; if required, power can be removed.

Start Making Gas

To start making gas:

1. Verify **hand valve** located before dewpoint analyzer is closed.
2. Open **natural gas hand valves** located before the AutoGen mixing system.
3. Verify the firecheck is open.
4. Verify gas outlet from the retort is coolers is directed to the Vent position.
    a. For a **3-Way Valve**: The 3-way Vent/Header valve is in the vent position.
    b. For a **Combination of Hand Valves**: The Hand Valve for the vent position is Open, and the Hand Valve for the Header position is closed.
5. Open required retort inlet **hand valves** located at the retort inlets.
6. Press and HOLD the **Mixture Pump Start** pushbutton until the **Mixture Pump Running** indicator is present on the **AutoGen Touchscreen**. Open the reaction system **Safety Shutoff Valve** for the Mixing System or Open the **Reaction Gas Blocking Valves** for the Tube(s) to make gas.
7. Confirm the screen is indicating a measurement of Air and Gas flow.
8. Confirm the Header Pressure is stabilizing at the required setpoint.
9. Place the **Dewpoint %Output** (Menu > Dewpoint) to **50%** and keep in Manual.
10. After making gas for 30 minutes, confirm the dewpoint with a portable gas analyzer.
    a. If within 15F of setpoint, open the **hand valve** located before the dewpoint analyzer, and place the Dewpoint Loop into **Automatic**.
    b. If outside of 15F of setpoint, wait an additional 30 minutes and recheck with the dewpoint analyzer.
        i. If within 15F of setpoint, open the **hand valve** located before the dewpoint analyzer, and place the Dewpoint Loop into **Automatic**.
        ii. If outside of 15F of setpoint, adjust the **Coarse Ratio** up (to increase dewpoint) or down (to decrease setpoint) in adjustments of .02 maximum and wait 20-30 minutes prior to taking another measurement until the dewpoint is within 15F of setpoint. Once within 15F of setpoint, open the **hand valve** located before the dewpoint analyzer, and place the Dewpoint Loop into **Automatic**.
        NOTE: A manual adjustment of .01 may result in a dewpoint change of 3-6F.
11. The Generator is now making gas in full automatic mode.

12. Direct the flow of Endothermic Gas to the Header Position.
    a. For a **3-Way Valve**: The **3-way Vent/Header** valve may be moved to the **Header** position.
    b. For a **Combination of Hand Valves**: Open the **Hand Valve** for the **Header** position, and close the **Hand Valve** for the **Vent** position.

Stop Making Gas

To stop making gas:

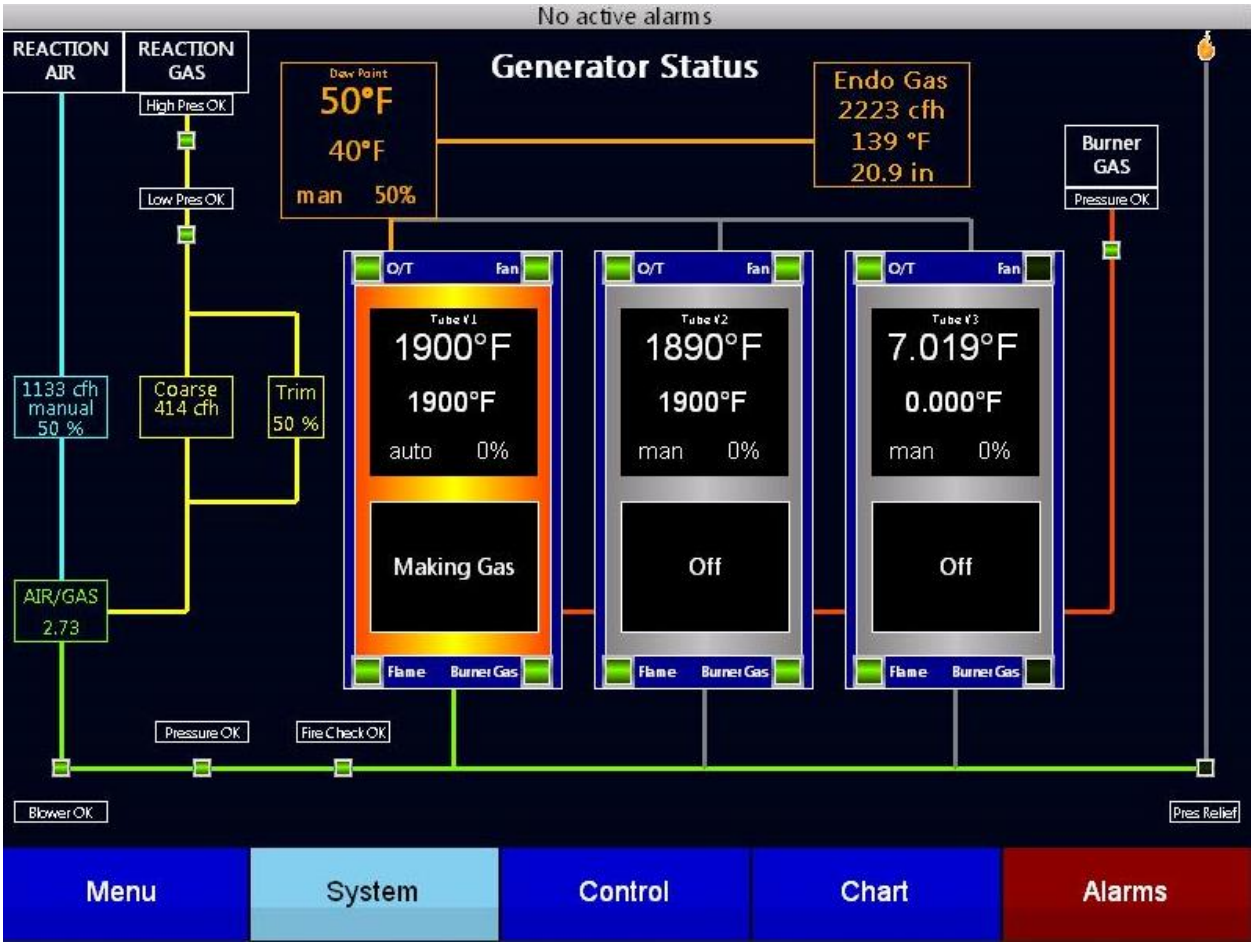
1. Direct the flow of Endothermic Gas to the Header Position.
    a. For a 3-Way Valve: Move the **3-way Vent/Header Valve** to the Vent position.
    b. For a Combination of Hand Valves: Open the **Hand Valve** for the **Vent** position, and close the **Hand Valve** for the **Header** position
2. Press the **Mixture Pump Stop** pushbutton and verify the green Mixture Pump Running light is off.
3. Close the **hand valve** located before the dewpoint analyzer.
4. The Generator has now stopped making gas.

Touch Screen Interface

AutoGen features a touch screen interface. The main options available are **Menu, System, Control, Chart,** and **Alarms**. These are the options on the screen when AutoGen first starts.

- **Menu:** Provides access to AutoGen menu options. The most commonly used options are provided at the highest levels of the screen interface. Additional options can be found under Configuration -> Matrix Menu. See page 14 for more on the high-level menu options; see page 47 for more on Matrix menu options.
- **System:** Provides an overview of the generator system. See page 39.
- **Control:** Displays critical control parameters. See page 40.
- **Chart:** Displays a trend chart of logged process data. See page 41.
- **Alarms:** Displays a report of alarms logged. See page 43.

When AutoGen is first started, the System screen will appear. It will look similar to the screen pictured below. Note the options shown at the bottom of the screen. The currently selected option is colored light blue (teal). Tapping on a different box will open the screen associated with that option.

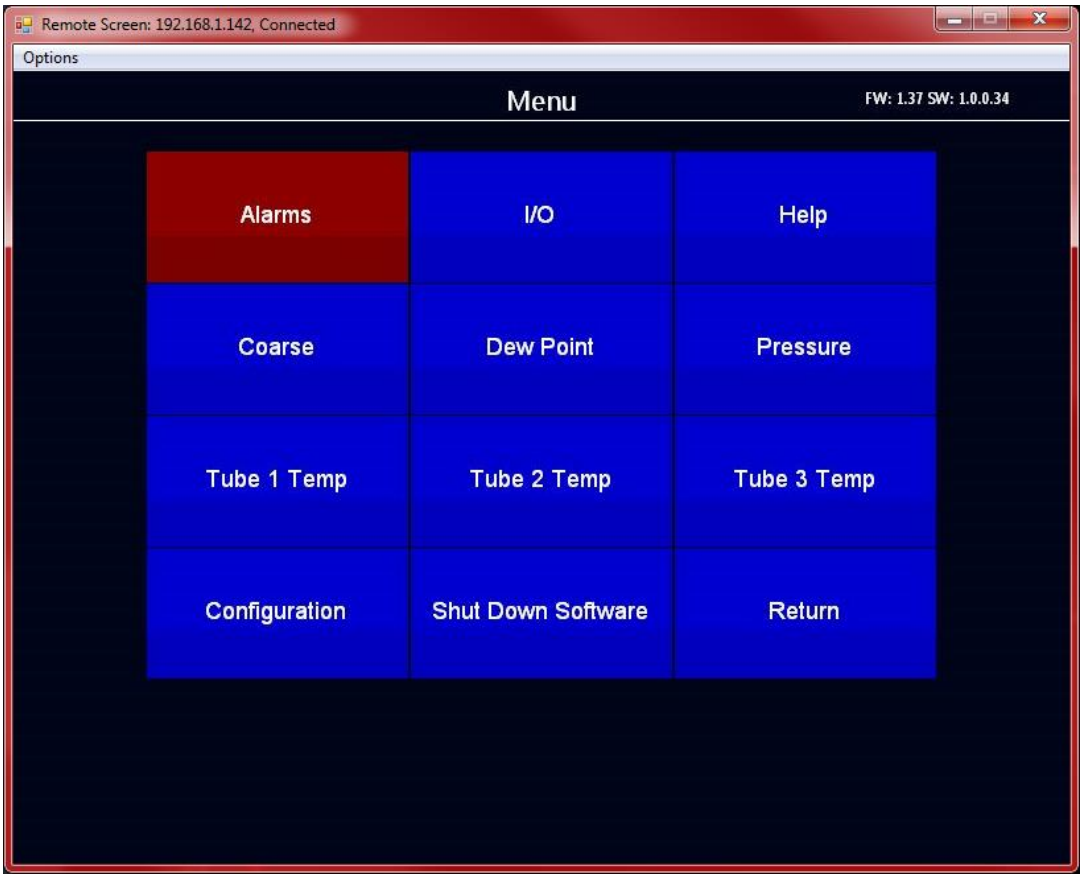


More information on the System Screen can be found in the System section on page 39.

The Menu option is the first option in the list. Tap on **Menu** to open it.

Menu

Tapping the **Menu** option opens the Menu screen.



The Menu screen presents a set of "tiled" options. These options, frequently used in generator control, are as follows:

- Alarms
- I/O
- Help
- Coarse
- Dewpoint
- Pressure
- Tube 1 Temp
- Tube 2 Temp (see note below)
- Tube 3 Temp (see note below)
- Configuration
- Shut Down Software
- Return

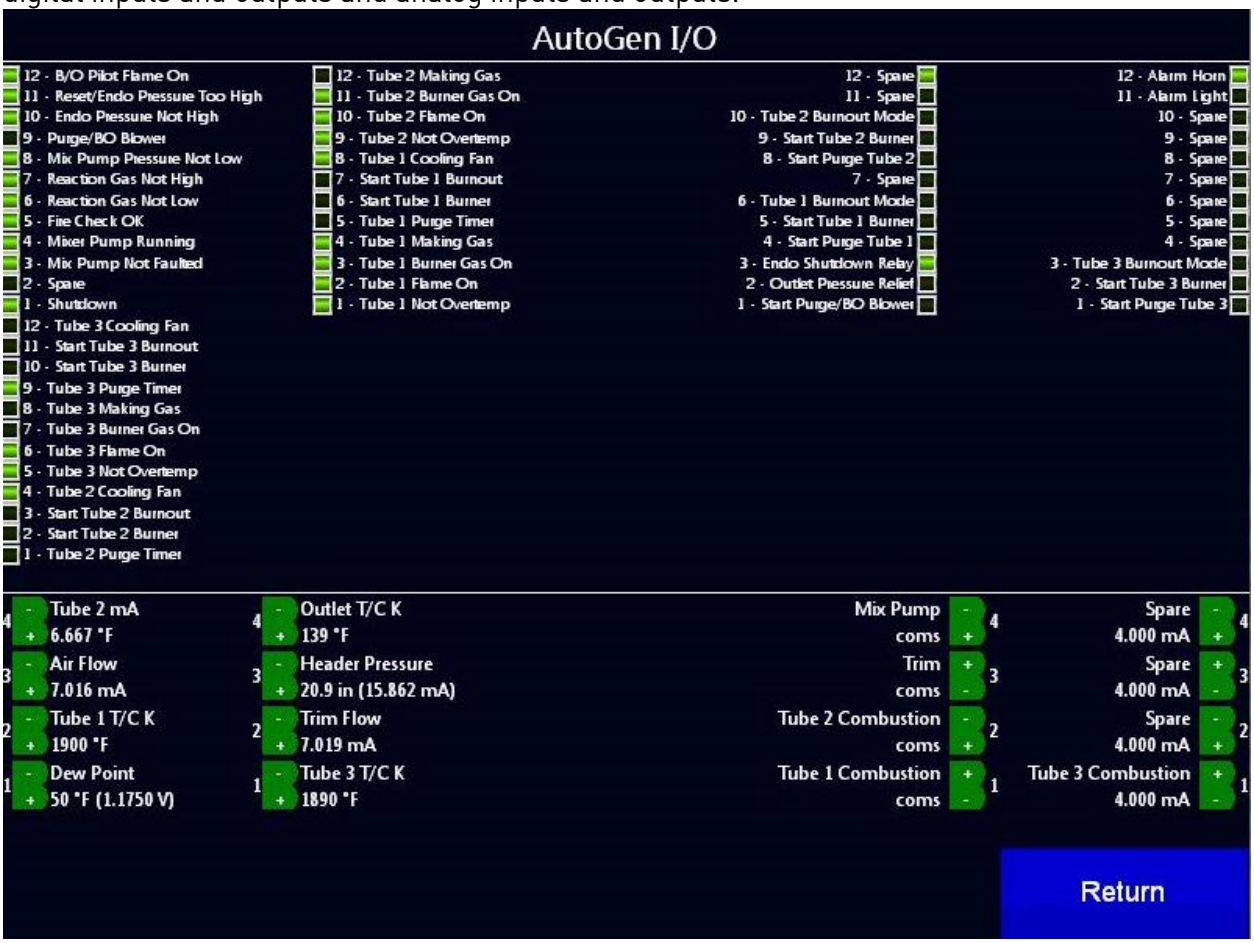
NOTE: The number of tubes may vary depending on your particular AutoGen setup. If needed, the number of tubes can be adjusted in Menu > Configuration > Device Setup.

Alarms

This option brings up the Alarms screen available from the main touch screen. See the primary Alarms section on page 43.

I/O

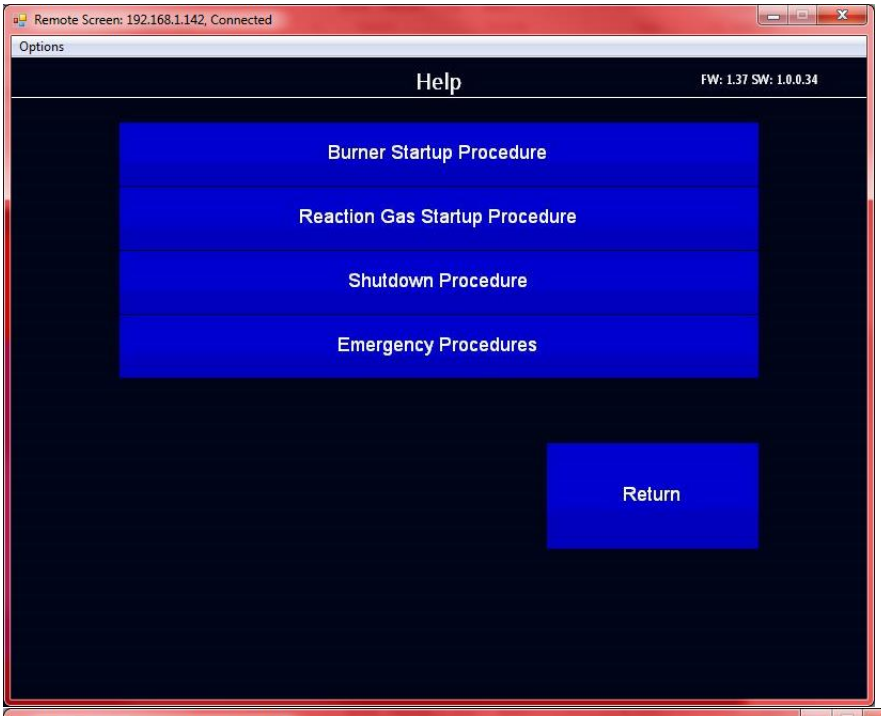
AutoGen features numerous input/output points. The I/O screen shows the status of all AutoGen digital inputs and outputs and analog inputs and outputs.

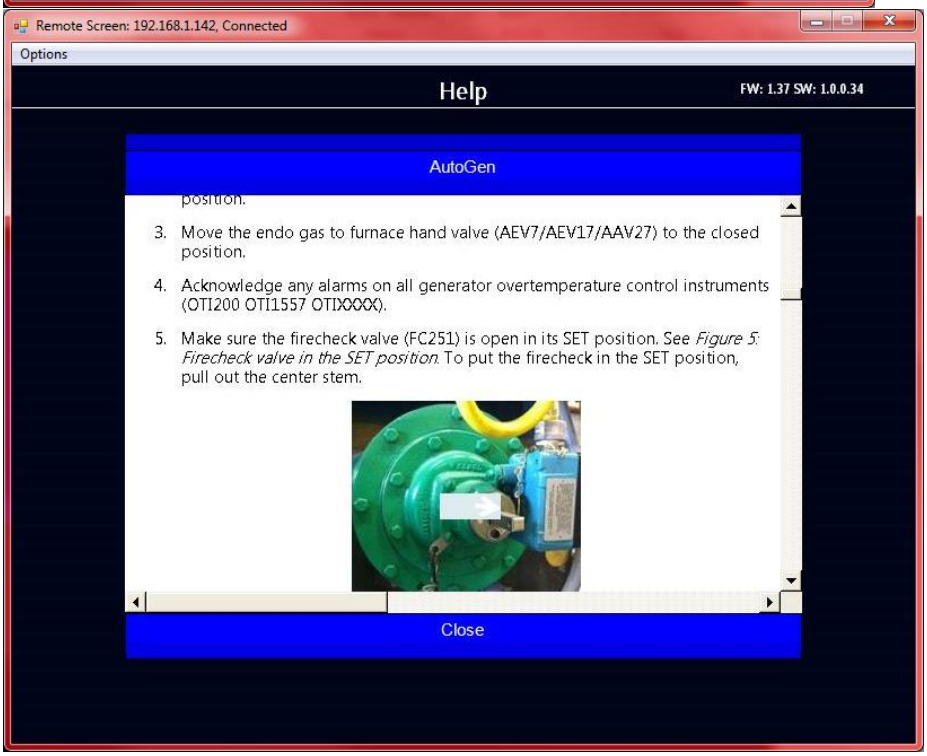


Analog I/O is shown on the bottom of the screen (below the horizontal line). Digital I/O is shown on the top (above the line). Inputs are shown on the left side of the screen, and outputs are shown on the right side. See the Digital I/O menu and Appendix 4 for more information on these options.

Help

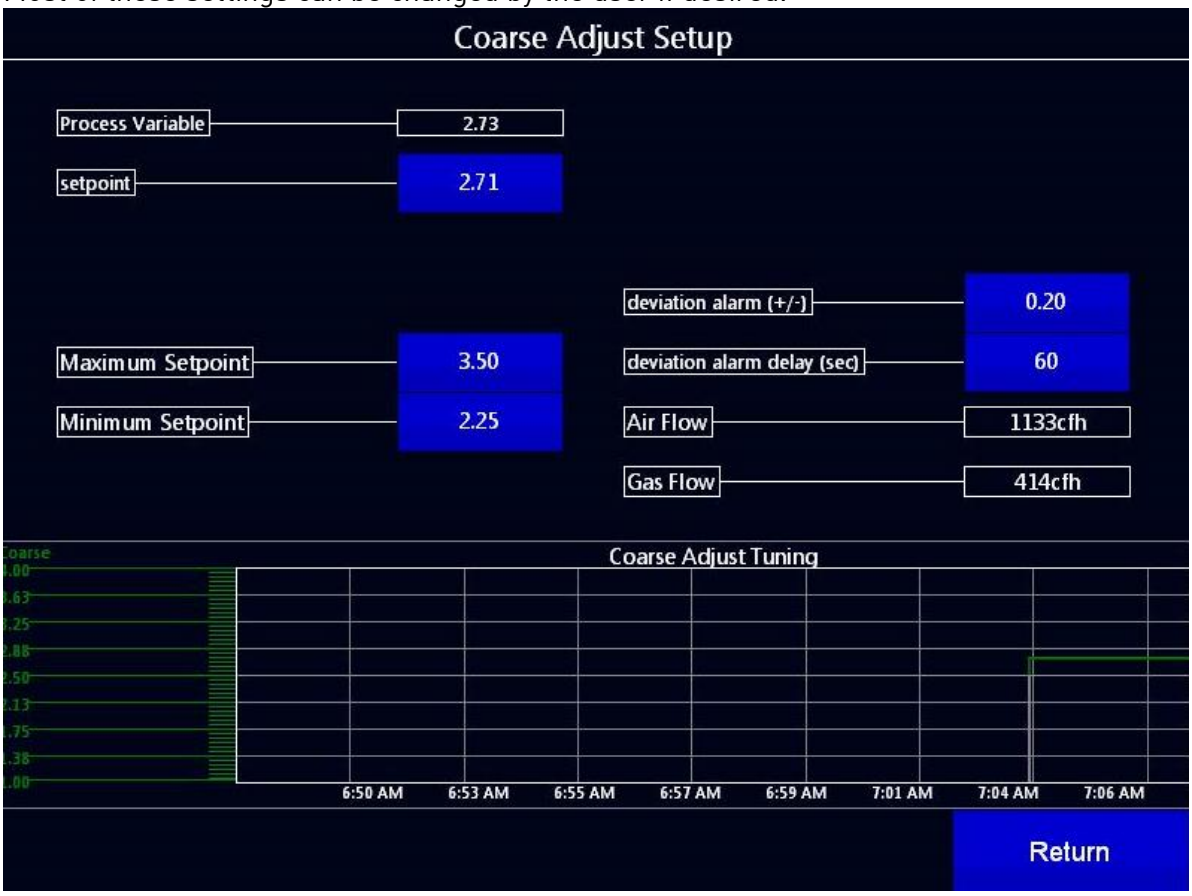
The Help Screen brings up help text for various procedures. Tap on a procedure to view the help text.





Coarse

The Coarse Adjust Setup, or Coarse, screen shows parameters related to coarse adjustment. Most of these settings can be changed by the user if desired.



Note that applicable units can be changed from the Device Setup menu. See page 27 for more information.

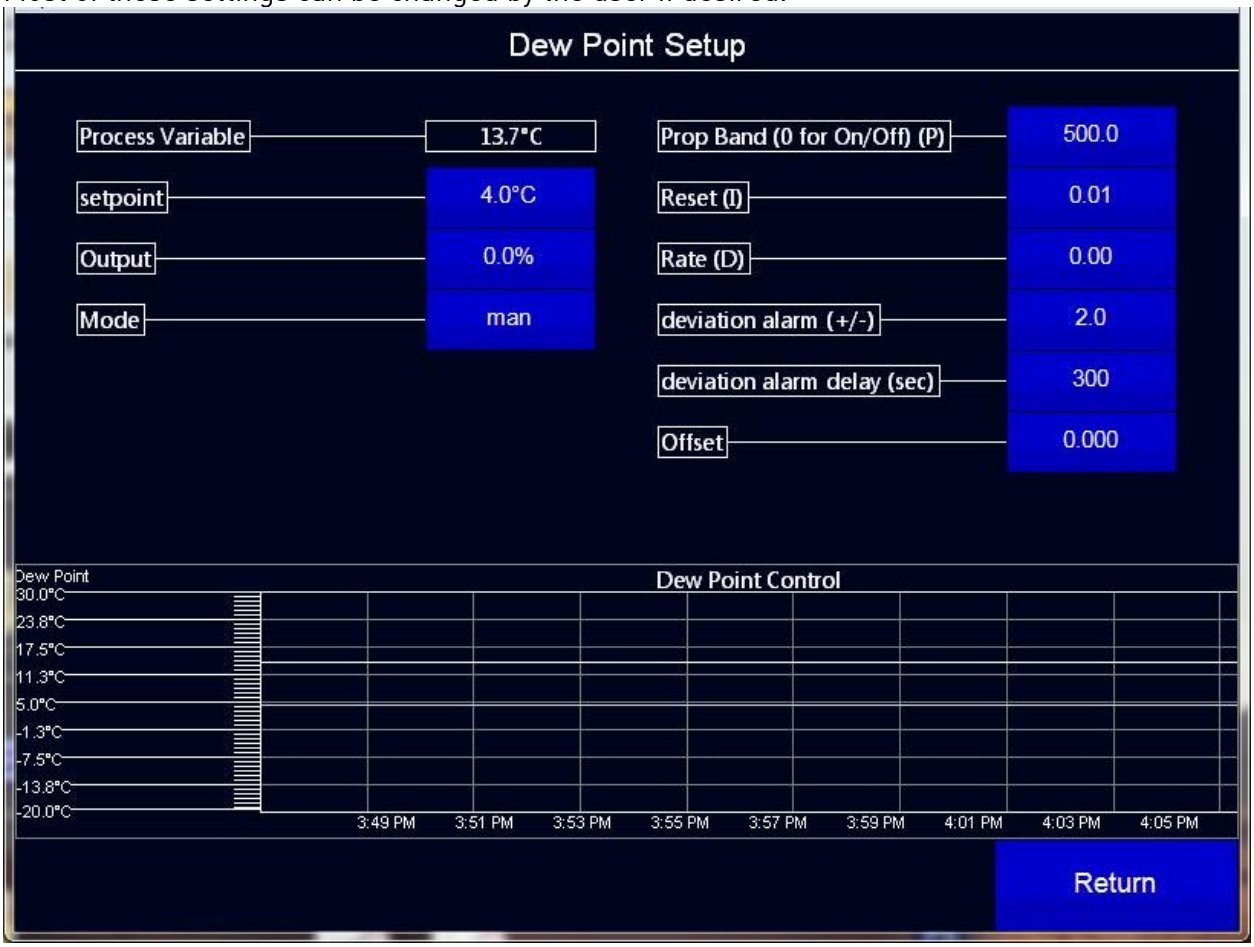
The following parameters can be viewed and/or controlled on this screen:

- Process Variable (view only): The current coarse value. This value cannot be changed from this screen.
- Setpoint: The coarse setpoint value.
- Maximum Setpoint: Allows the user to limit setpoint to a user-defined maximum value.
- Minimum Setpoint: Allows the user to limit setpoint to a user-defined minimum value.
- Deviation Alarm (+/-): A value that defines an alarm generated when the error (difference between Process Variable and Setpoint) is greater than the allowed deviation. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Deviation Alarm Delay (sec): A value that defines the number of seconds before a Deviation Alarm is generated. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Air Flow: The current air flow in the coarse mixture.
- Gas Flow: The current gas flow in the coarse mixture.

The Coarse Adjust Tuning chart shows changes in coarse values over time and can be used when tuning the coarse control loop.

Dewpoint

The Dewpoint Setup, or Dewpoint, screen shows parameters related to control of dew point. Most of these settings can be changed by the user if desired.



Note that applicable units can be changed from the Device Setup menu. See page 27 for more information.

The following parameters can be viewed and/or controlled on this screen:

- Process Variable. The current dewpoint value. This value cannot be changed from this screen.
- Setpoint: The dewpoint setpoint value.
- Output: The percent output.
- Mode: The control mode—either auto or manual. In auto mode, the output is controlled by the AutoGen controller automatically using setpoint, proportional band, reset, and rate settings.
- Proportional Band: Determines the response to the current error. The Proportional Band is the percent of the range of the process variable that will produce 100% output

and is the inverse of the proportional gain. A low Proportional Band value results in a larger change in output for a given error. Conversely, a high Proportional Band value results in a smaller change in output for a given error. If the Proportional Band is too small, control may oscillate or be otherwise unstable. If the Proportional Band is too large the control action may be too sluggish in response to changes within the system. **Note:** If the Proportional Band is set to 0.0, only on/off control is performed.

- Reset: Determines the influence of past errors. The Reset, or integral action (expressed in repeats per minute), sums the error between the process variable and setpoint over time and adds this accumulated output to the proportional output. A "proportional only" controller generally operates with steady-state error because some error is required to produce control output. The goal of integral action is to drive the steady-state error to zero and eliminate this droop.
- Rate: Adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing overshoot but is most often useful when trying to improve control on systems with significant and predicable lag.
- Deviation Alarm (+/-): A value that defines an alarm generated when the error (difference between Process Variable and Setpoint) is greater than the allowed deviation. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Deviation Alarm Delay (sec): A value that defines the number of seconds before a Deviation Alarm is generated. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Offset: A value that defines a sustained difference (or steady-state error) between Process Variable and Setpoint. For example, in the screenshot above, the Setpoint is 4°C and the Process Variable is 13.7° C. If this difference were to remain constant, it would represent an offset of 9.7°C.

The Dewpoint Control chart shows changes in dewpoint values over time and can be used when tuning the dewpoint control loop.

Pressure

The Pressure Setup, or Pressure, screen shows parameters related to control of pressure. Most of these settings can be changed by the user if desired.

Note that applicable units can be changed from the Device Setup menu. See page 27 for more information.

The following parameters can be viewed and/or controlled on this screen:

- Process Variable. The current pressure value. This value cannot be changed from this screen.
- Setpoint: The pressure setpoint value.
- Output: The percent output.
- Mode: The control mode—either auto or manual. In auto mode, the output is controlled by the AutoGen controller automatically using setpoint, proportional band, reset, and rate settings.
- Proportional Band: Determines the response to the current error. The Proportional Band is the percent of the range of the process variable that will produce 100% output and is the inverse of the proportional gain. A low Proportional Band value results in a larger change in output for a given error. Conversely, a high Proportional Band value results in a smaller change in output for a given error. If the Proportional Band is too small, control may oscillate or be otherwise unstable. If the Proportional Band is too

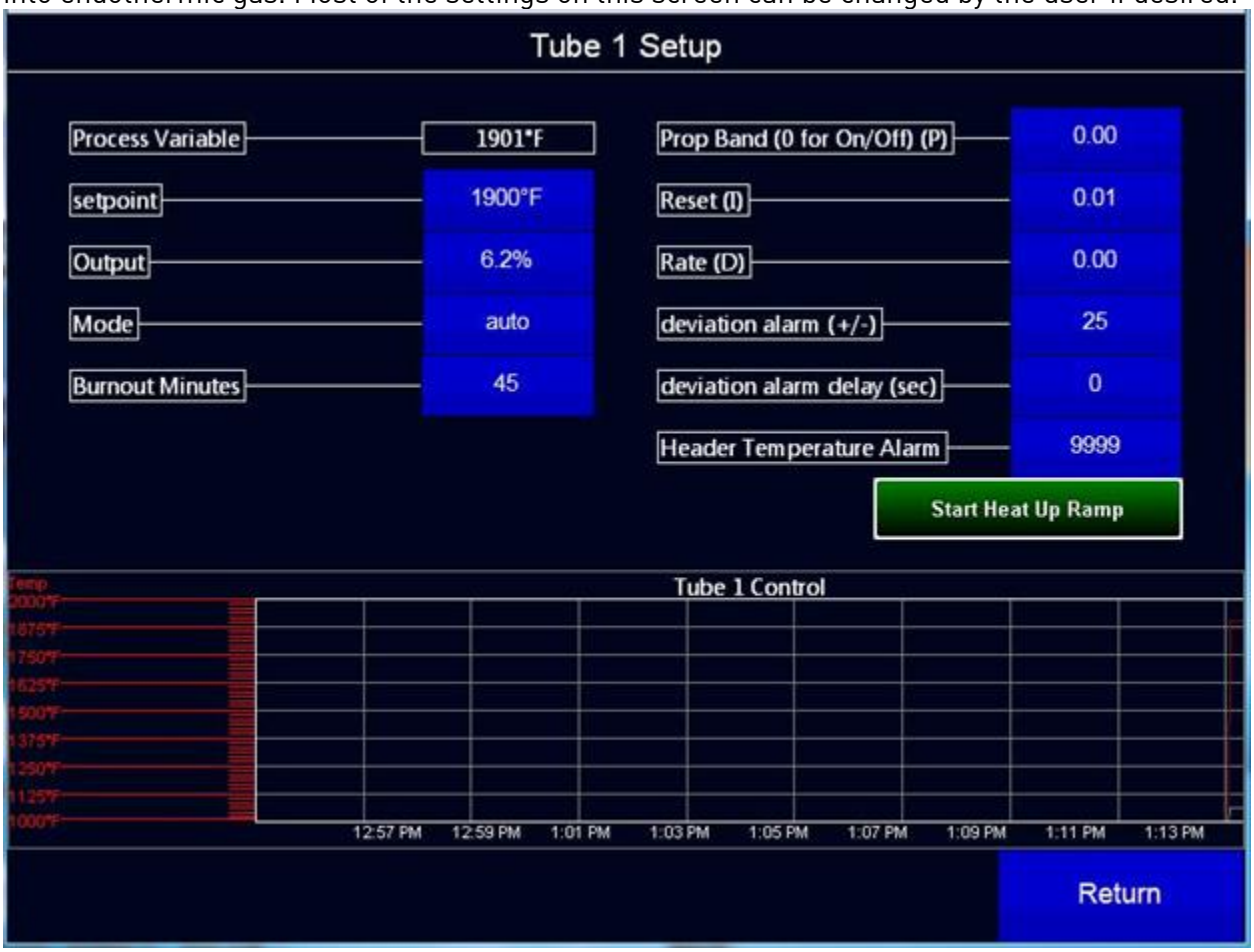
large the control action may be too sluggish in response to changes within the system. **Note:** If the Proportional Band is set to 0.0, only on/off control is performed.

- Reset: Determines the influence of past errors. The Reset, or integral action (expressed in repeats per minute), sums the error between the process variable and setpoint over time and adds this accumulated output to the proportional output. A "proportional only" controller generally operates with steady-state error because some error is required to produce control output. The goal of integral action is to drive the steady-state error to zero and eliminate this droop.
- Rate: Adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing overshoot but is most often useful when trying to improve control on systems with significant and predicable lag.
- Deviation Alarm (+/-): A value that defines an alarm generated when the error (difference between Process Variable and Setpoint) is greater than the allowed deviation. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Deviation Alarm Delay (sec): A value that defines the number of seconds before a Deviation Alarm is generated. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.

The Pressure Control chart shows changes in dewpoint values over time and can be used when tuning the dewpoint control loop.

Tube 1 Temp

The Tube 1 Temp (Tube 1 Setup) screen shows parameters related to conditions within tube #1, used for gas mixture. Each tube contains catalyst used in breaking down the air-gas mixture into endothermic gas. Most of the settings on this screen can be changed by the user if desired.



Note that applicable units can be changed from the Device Setup menu. See page 27 for more information.

The following parameters can be viewed and/or controlled on this screen:

- Process Variable. The current temperature. This value cannot be changed from this screen.
- Setpoint: The temperature setpoint value.
- Output: The percent output.
- Mode: The control mode—either auto or manual. In auto mode, the output is controlled by the AutoGen controller automatically using setpoint, proportional band, reset, and rate settings.
- Burnout Minutes: Allows the user to set the burnout time in minutes
- Proportional Band: Determines the response to the current error. The Proportional Band is the percent of the range of the process variable that will produce 100% output and is the inverse of the proportional gain. A low Proportional Band value results in a larger change in output for a given error. Conversely, a high Proportional Band value

results in a smaller change in output for a given error. If the Proportional Band is too small, control may oscillate or be otherwise unstable. If the Proportional Band is too large the control action may be too sluggish in response to changes within the system. **Note:** If the Proportional Band is set to 0.0, only on/off control is performed.

- Reset: Determines the influence of past errors. The Reset, or integral action (expressed in repeats per minute), sums the error between the process variable and setpoint over time and adds this accumulated output to the proportional output. A "proportional only" controller generally operates with steady-state error because some error is required to produce control output. The goal of integral action is to drive the steady-state error to zero and eliminate this droop.
- Rate: Adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing overshoot but is most often useful when trying to improve control on systems with significant and predicable lag.
- Deviation Alarm (+/-): A value that defines an alarm generated when the error (difference between Process Variable and Setpoint) is greater than the allowed deviation. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Deviation Alarm Delay (sec): A value that defines the number of seconds before a Deviation Alarm is generated. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Header Temperature Alarm: Allows the user to set the value at which a Header Temperature Alarm will be triggered.

User can also begin a Heat Up Ramp from the Tube 1 Setup menu.

The Tube 1 Control chart shows changes in dewpoint values over time and can be used when tuning the dewpoint control loop.

Tube 2 Temp

The Tube 2 Temp (Tube 2 Setup) screen shows parameters related to conditions within tube #2, used for gas mixture. Each tube contains catalyst used in breaking down the air-gas mixture into endothermic gas. Most of the settings on this screen can be changed by the user if desired.

Note that applicable units can be changed from the Device Setup menu. See page 27 for more information.

The following parameters can be viewed and/or controlled on this screen:

- Process Variable. The current temperature. This value cannot be changed from this screen.
- Setpoint: The temperature setpoint value.
- Output: The percent output.
- Mode: The control mode—either auto or manual. In auto mode, the output is controlled by the AutoGen controller automatically using setpoint, proportional band, reset, and rate settings.
- Burnout Minutes: Allows the user to set the burnout time in minutes

- Proportional Band: Determines the response to the current error. The Proportional Band is the percent of the range of the process variable that will produce 100% output and is the inverse of the proportional gain. A low Proportional Band value results in a larger change in output for a given error. Conversely, a high Proportional Band value results in a smaller change in output for a given error. If the Proportional Band is too small, control may oscillate or be otherwise unstable. If the Proportional Band is too large the control action may be too sluggish in response to changes within the system. **Note:** If the Proportional Band is set to 0.0, only on/off control is performed.
- Reset: Determines the influence of past errors. The Reset, or integral action (expressed in repeats per minute), sums the error between the process variable and setpoint over time and adds this accumulated output to the proportional output. A "proportional only" controller generally operates with steady-state error because some error is required to produce control output. The goal of integral action is to drive the steady-state error to zero and eliminate this droop.
- Rate: Adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing overshoot but is most often useful when trying to improve control on systems with significant and predicable lag.
- Deviation Alarm (+/-): A value that defines an alarm generated when the error (difference between Process Variable and Setpoint) is greater than the allowed deviation. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Deviation Alarm Delay (sec): A value that defines the number of seconds before a Deviation Alarm is generated. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Header Temperature Alarm: Allows the user to set the value at which a Header Temperature Alarm will be triggered.

The Tube 2 Control chart shows changes in dewpoint values over time and can be used when tuning the dewpoint control loop.

Tube 3 Temp

The Tube 3 Temp (Tube 3 Setup) screen shows parameters related to conditions within tube #3, used for gas mixture. Each tube contains catalyst used in breaking down the air-gas mixture into endothermic gas. Most of the settings on this screen can be changed by the user if desired.

Note that applicable units can be changed from the Device Setup menu. See page 27 for more information.

The following parameters can be viewed and/or controlled on this screen:

- Process Variable. The current temperature. This value cannot be changed from this screen.
- Setpoint: The temperature setpoint value.
- Output: The percent output.

- Mode: The control mode—either auto or manual. In auto mode, the output is controlled by the AutoGen controller automatically using setpoint, proportional band, reset, and rate settings.
- Burnout Minutes: Allows the user to set the burnout time in minutes
- Proportional Band: Determines the response to the current error. The Proportional Band is the percent of the range of the process variable that will produce 100% output and is the inverse of the proportional gain. A low Proportional Band value results in a larger change in output for a given error. Conversely, a high Proportional Band value results in a smaller change in output for a given error. If the Proportional Band is too small, control may oscillate or be otherwise unstable. If the Proportional Band is too large the control action may be too sluggish in response to changes within the system. **Note:** If the Proportional Band is set to 0.0, only on/off control is performed.
- Reset: Determines the influence of past errors. The Reset, or integral action (expressed in repeats per minute), sums the error between the process variable and setpoint over time and adds this accumulated output to the proportional output. A "proportional only" controller generally operates with steady-state error because some error is required to produce control output. The goal of integral action is to drive the steady-state error to zero and eliminate this droop.
- Rate: Adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing overshoot but is most often useful when trying to improve control on systems with significant and predicable lag.
- Deviation Alarm (+/-): A value that defines an alarm generated when the error (difference between Process Variable and Setpoint) is greater than the allowed deviation. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Deviation Alarm Delay (sec): A value that defines the number of seconds before a Deviation Alarm is generated. See an example of Deviation Alarm Usage in Appendix 1: Example of Deviation Alarm Usage on page 91.
- Header Temperature Alarm: Allows the user to set the value at which a Header Temperature Alarm will be triggered.

The Tube 3 Control chart shows changes in dewpoint values over time and can be used when tuning the dewpoint control loop.

Configuration

The Configuration screen provides access to several important functions within AutoGen:

- Data Transfer: Allows the user to send historical data via Email or FTP.
- Device Setup: Allows for the viewing and changing of options for the AutoGen controller, including measurement units, number of retorts, endo factor, and other options.
- Email Setup: Allows the user to configure settings for sending emails from the AutoGen system for defined alarms.
- Logic Program: Displays the progression of events programmed into the controller. This screen is not user-editable.
- Repair Database: Provides database repair options in a case where the database files on the touch screen are or may be damaged.
- Screen Communications: Changes communication options for the touch screen.
- Matrix Menu: Provides an extensive menu of options for the AutoGen controller. Many of these options are not present in the higher-level menus of AutoGen.
- Digital I/O: Allows to user to select and deselect the digital inputs and outputs that appear in the main I/O screen.
- Pressure Relief: Sets up pressure relief valve functionality. The pressure relief valve is used to vent header gas in the event the retort pressure gets too high.
- Generator Options: Provides an extensive list of advanced generator control options, including trim and coarse adjustment settings, gas valve full scale setting, various dewpoint settings, and more. Administrator level access is required to access these options.
- Return: Returns the user to the Main Menu.

These functions are described in greater detail in the sections below.

<u>Data Transfer:</u>

The Data Transfer screen allows the user to define FTP and email settings to transfer historical data from the AutoGen.

If using FTP, the user can set the FTP Server, Server Path, User, and Password for transferring data. If using Email, the user can set the target email address.

Once a transfer method is selected and the details entered, the remaining options allow the user to set how many months of data to send (or to send all data), the filename prefix, and how often to perform an auto transfer (in days, weeks, or months).

To save the settings without transferring data, tap OK. Data will not be sent until the user taps Send Data. Tap Cancel to forget the changes and return to the Configuration menu.

Logic Program

The Logic Program screen shows the progression of events programmed into the controller. Earliest events are shown first, with later events shown further down the list vertically. This screen is read-only; events cannot be modified from it.

Device Setup

This screen requires administrator access. The Device Setup menu allows you to change device settings including measurement units for temperature, flow, and pressure; the number of retorts and associated options; endo factor; and whether or not the burnoff pilot symbol is shown on the system screen. Revision data on the controller and the touch screen software are also shown.

- Temperature Units: The units used for temperature (°F or °C).
- Flow Units: The units used for flow (SCFH, CFH, or m^3/h). To enter a superscript, place a carat (^) before the character to be superscripted. For example, entering *m^3/h* will display m^3/h.
- Pressure Units: The units used for pressure (psig or mbar).
- Tubes: The number of tubes in the generator system. Possible values are 1, 2, or 3.
- Tube 1 Status: The status can be online or offline. If online, alarms are monitored. If offline, alarms are not monitored.
- Tube 2 Status: The status can be online or offline. If online, alarms are monitored. If offline, alarms are not monitored.
- Tube 3 Status: The status can be online or offline. If online, alarms are monitored. If offline, alarms are not monitored.

- Endo Factor: When air and gas are cracked to form endothermic gas, the volume of the resulting endothermic gas is greater than the combined volumes of air and gas. Endo Factor is the factor (multiplied value) used to estimate the volume of the endothermic gas. The nominal value is 1.43.

  The formula used with Endo Factor is as follows:

  *[Volume(air) + Volume(gas)] * Endo Factor = Estimated Volume(endothermic gas)*

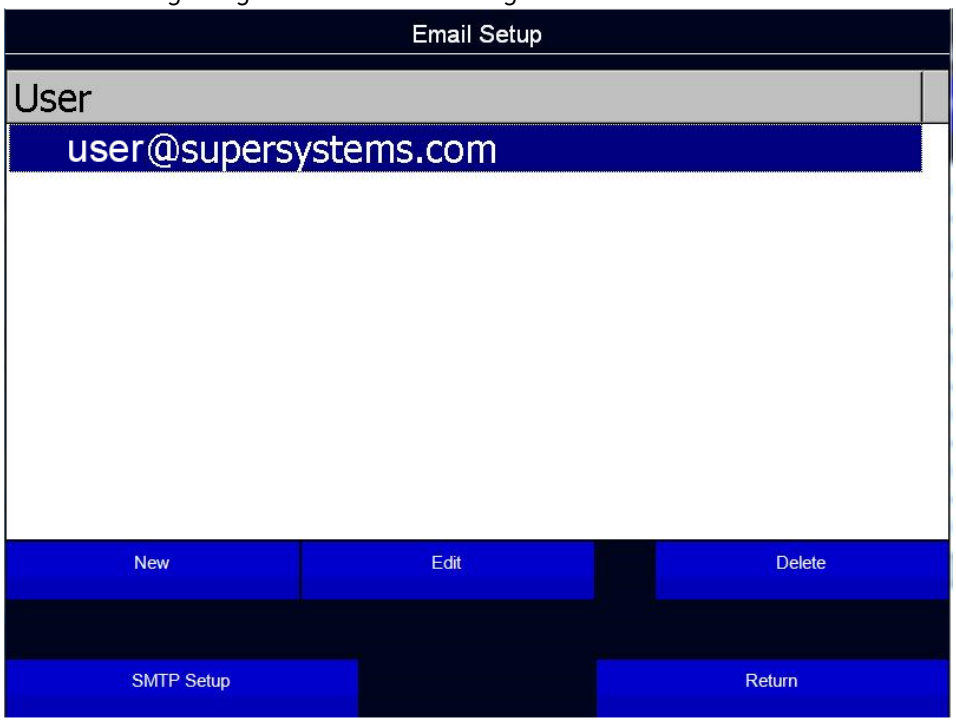
- Tube Capacity: the maximum endothermic gas flow per tube. The default is 4500; the maximum is 32767.
- Show B/O Pilot (checkbox): When this box is checked, the burnoff pilot icon is shown on the System screen. See page 39.
- AutoGen Revision (view only): The revision (version number) of the AutoGen controller.
- Touch screen Revision (view only): The revision (version number) of the AutoGen touch screen software.
- Standard AutoGen / AutoGen No Burner Startup (radio button): In Standard AutoGen mode, the burners will start automatically. In No Burner Starup mode, the operator starts the burners manually. During purge the temperature control output is set to 100% and goes back to automatic control when purge is complete.
- Dark Color Scheme (checkbox): When checked, a dark background color will be used on the touch screen. When not checked, a light background will be used.
- Inhibit Trim Display (checkbox): When checked, the trim flow is removed from the control screen when there is no trim feedback or if the user doesn't want the trim feedback displayed
- Legacy Valve Structure (checkbox): This setting must be checked for AutoGen firmware earlier than revision 1.22.

Email Setup

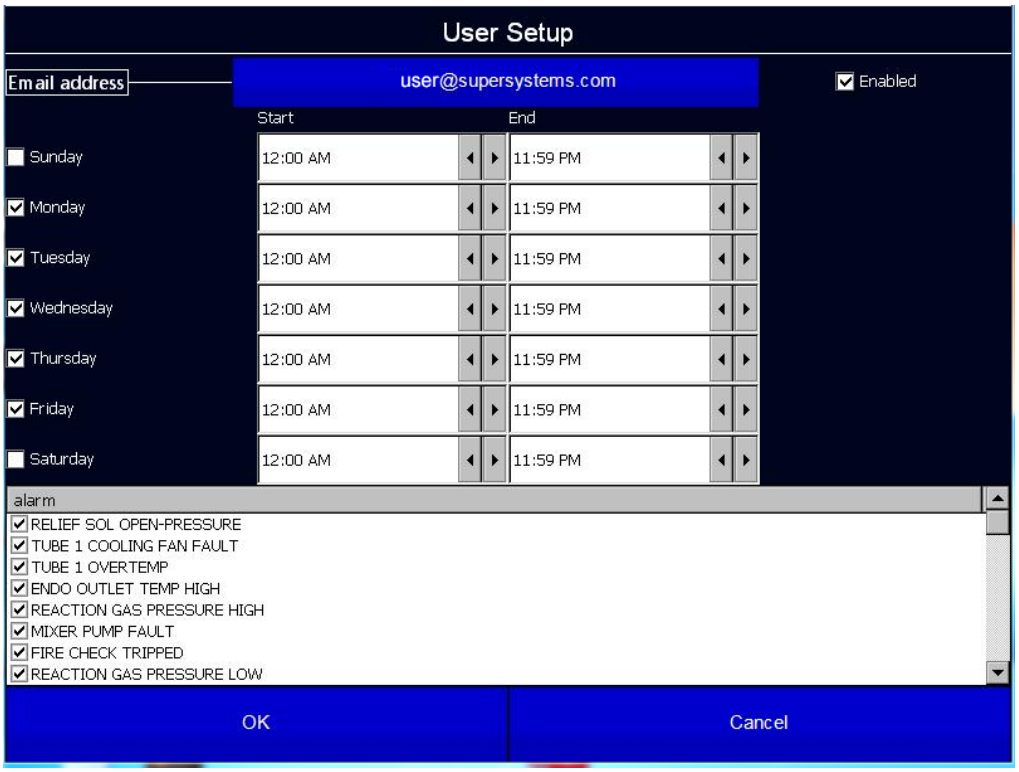
The Email Setup screen allows you to perform several interrelated tasks:

- Setting up users and email addresses for automated alarm notifications
- Setting up which alarms each user will be notified of
- Defining the times of day during which notifications are sent to each user

- Configuring email server settings.



To create a new user, tap the New button. To edit an existing user, select that user and tap Edit. To delete a user, tap on the user name The user screen will look similar to the screen below.

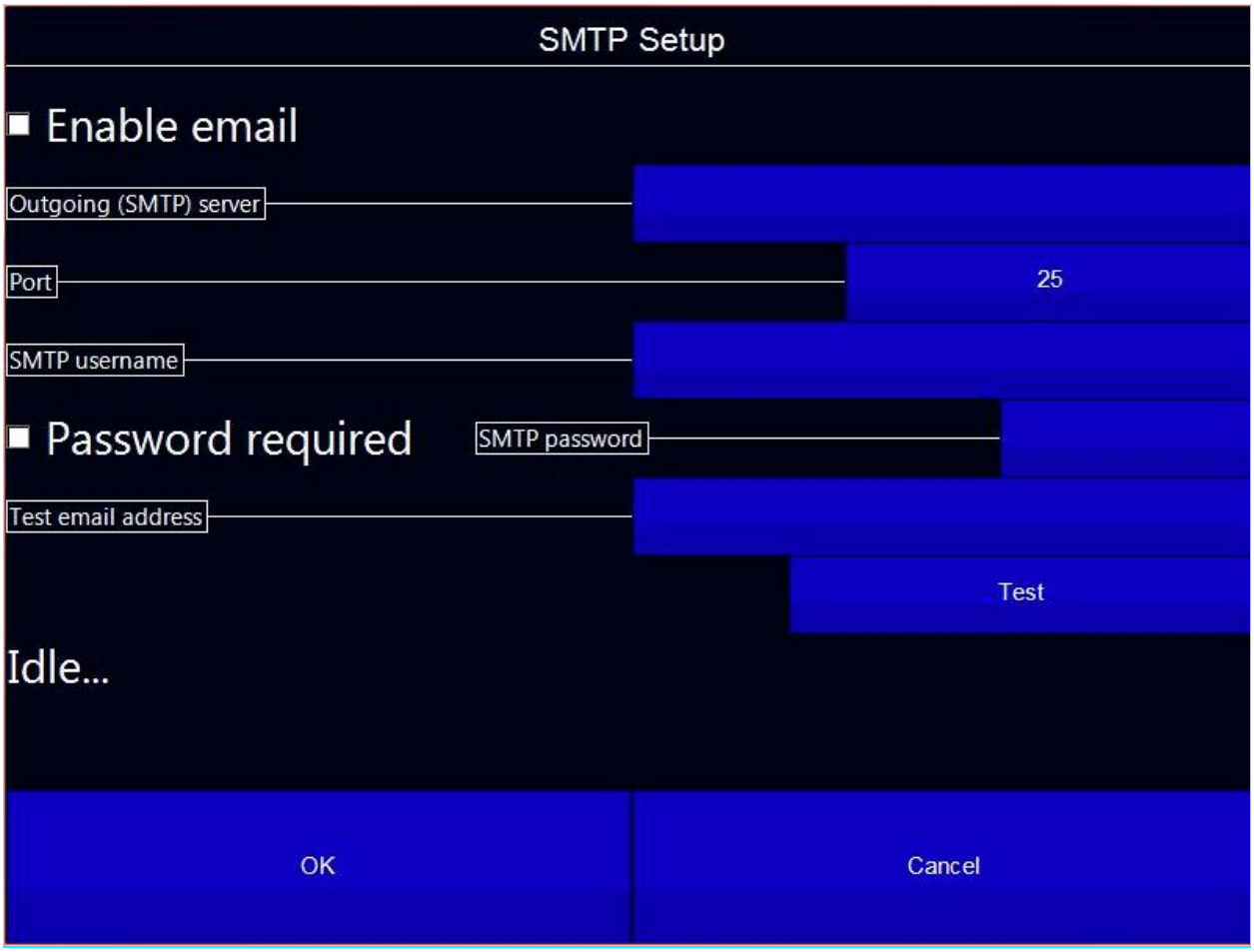


The Email Address field is used to add an email address to which emails will be sent when an alarm is generated; email must be correctly configured for this to work (see the SMTP Setup section below).The alarms for which emails will be sent are listed in the bottom "Alarm" section; each checked alarm is an alarm for which a notification will be sent.

In this screen, you will also set up the days of the week, and the times, during which alarm notifications will be emailed. A checkbox to the left of each day determines whether notifications will be sent on that day; if a day is checked, notifications will be sent that day when selected alarms are triggered. The Start and End times determine the time range during which notifications will be sent on each day.

The Enabled checkbox is used to identify whether the user is currently active in the AutoGen controller.

AutoGen will attempt to send emails to a defined email address when selected alarms are triggered. SMTP Setup allows you to configure email settings for this purpose.



- Enable email (checkbox): When this box is checked, email sending is enabled.
- Outgoing (SMTP) server: The server that AutoGen will use to send email with the SMTP protocol.

- Port: The port number on the server used to send email.
- SMTP username: The username on the SMTP server through which email will be sent.
- Password required (checkbox): When this box is checked, a password will be transmitted to the outgoing mail server. Many mail servers will not accept a username without a password.
- SMTP password: The email password on the mail server.
- Test email address: An email address to which a test email will be sent to determine whether outgoing mail server settings are entered correctly.
- Test button: When pressed, this button will begin the test email process and have an email sent to the test email address.

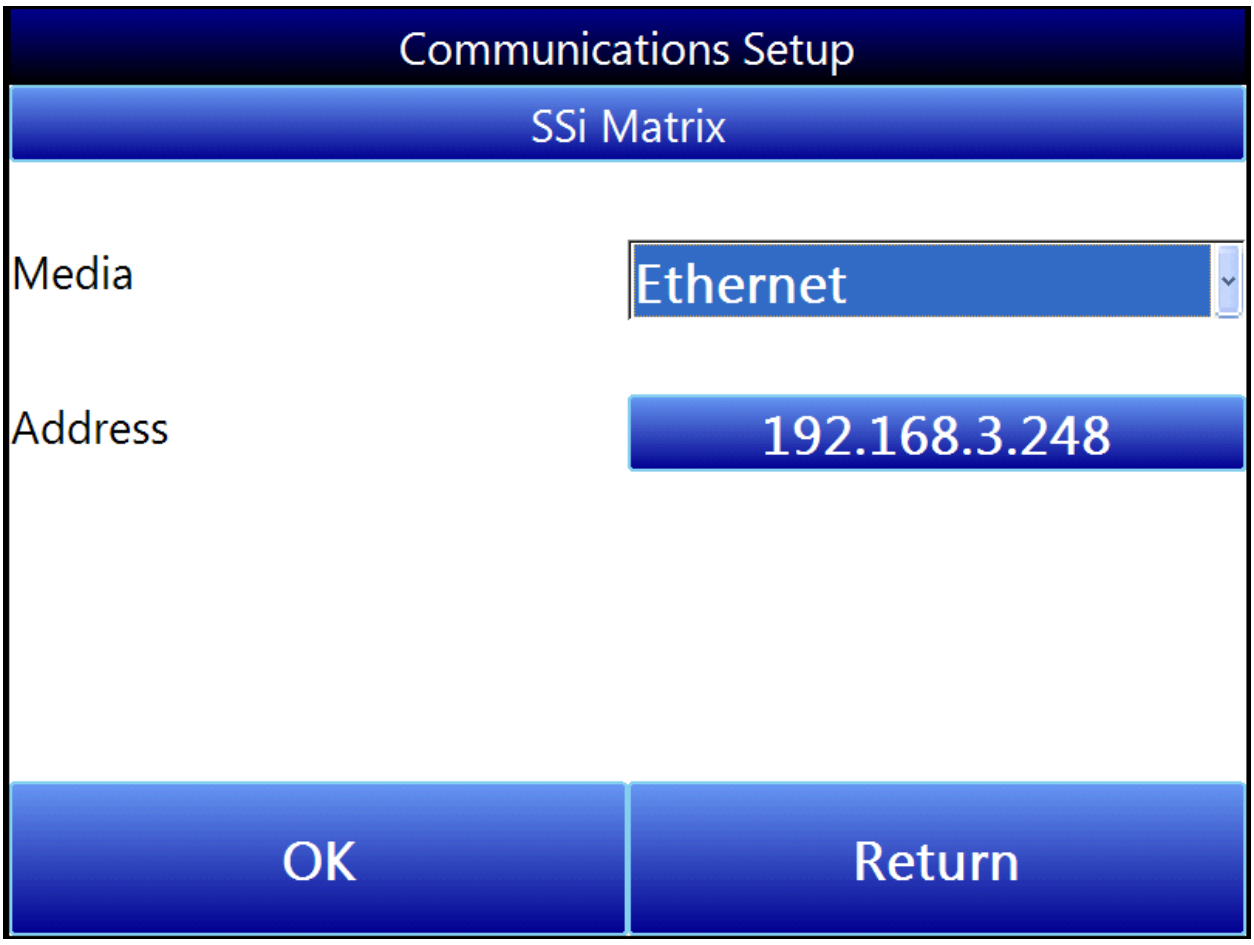
Note that each text field is limited to 31 characters.

Repair Database

Pressing this button will cause AutoGen to begin repair operations on the internal database. No prompts, messages, or new windows are displayed while the repair is in progress, and the screen may appear to "freeze." This is normal; control of the screen will be restored once the repair process is finished.

Screen Communications

The Screen Communications (Communications Setup) screen contains options for controlling communications between the touch screen and the AutoGen controller.



The Media option will be the type of connection the touch screen is using to connect to the controller. The options are:

- COM1
- COM2
- COM3
- COM4
- Ethernet

If COM1 through COM4 is selected, the user will have to set the Address and the Baud rate as well. If Ethernet is selected, then user will have to enter the IP address of the controller

The Address option is the slave address of the instrument for the COM port communications, or the Ethernet IP address for Ethernet communications. For the COM port communications, the address will range from 1 to 250. For Ethernet communications, the address must be supplied in a 999.999.999.999 format, or it will not be accepted.

The Baud option is the baud rate for the COM port communications. The options are:

- 1200
- 2400
- 4800
- 9600
- 14400
- 19200
- 28800
- 38400
- 57600
- 76800
- 115200

Matrix Menu

Please refer to the section "Matrix Menu (A Submenu of Menu -> Configuration)" on page 47 for details on the Matrix Menu options.

Digital I/O:

Please refer to Appendix 4 for the full list of Digital Inputs and Outputs available from this menu. If a checkbox is deselected in this menu, it will appear as "Spare" on the main I/O menu. However, most of the default settings should not be manually changed without first calling SSi at (513) 772-0060.

Pressure Relief

The AutoGen has a pressure relief configuration for the air and the gas flows. When flow drops below the Low Flow SP value for the number of seconds in the Low Flow Delay Timer, the flow is considered low. The logic programmer has a low flow signal that is activated after 10 seconds of low flow condition. When the low flow signal is active, an alarm is generated (Relief Solenoid Open - Flow). If there is any tube making gas and the mixer is not in its startup

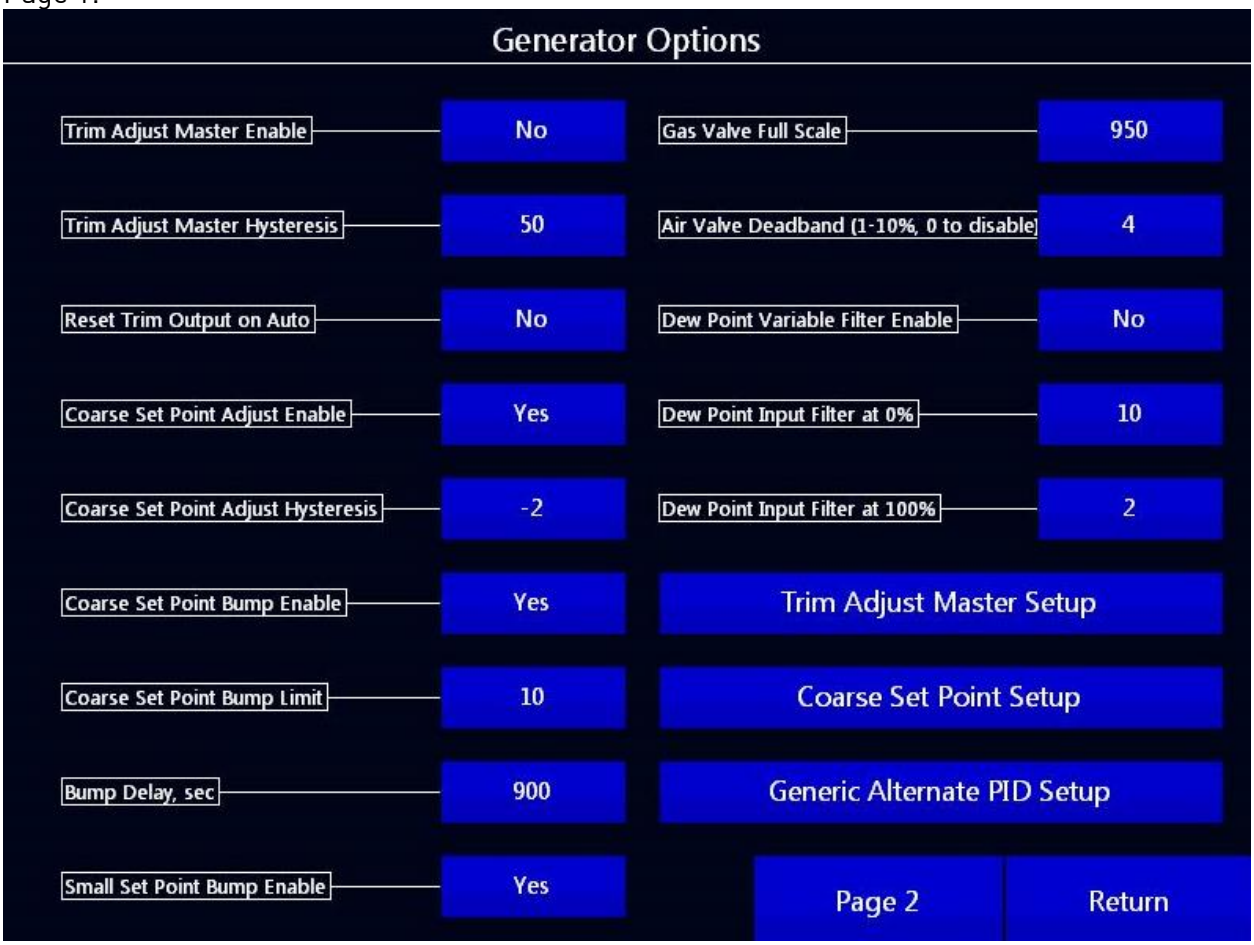
condition (manual output and 50% out—this should not be the case since there is a tube making gas) or the endo pressure state is okay (this is likely the case), then the outlet pressure relief output is activated.

The output remains activated and the alarm remains active until the flow rises above the normal flow SP value.

Generator Options

Generator options include trim adjust, coarse set point adjust, and other settings affecting generator gas control. Note the Page 1 / Page 2 button at the bottom of the screen; this button toggles between two different screens of options.

Page 1:



- Trim Adjust Master Enable/Hysteresis: Enables or disabled the Trim Adjust Master feature. Trim adjust instructs the AutoGen to apply a deadband (a value around which no change in output will occur to the coarse loop) and a trim loop delay timer. When there is a value in the trim delay timer, the trim loop will be placed into hold whenever the coarse loop is outside of deadband and the trim loop will not be put back into automatic control until the coarse loop has been in deadband for the specified delay time. Trim adjust allows for 10 different trim adjusts based on the gas flow of the system. Trim adjust master hysteresis places a hysteresis on the gas flow switch points.
- Reset Trim Output on Auto: This option will place the trim loop at 50% output when the trim loop is reinstated after being held due to the coarse loop being out of band.
- Coarse Set Point Adjust Enable/Hysteresis: This option enables or disables the Coarse Set Point Adjust feature. Coarse Set Point Adjust applies an offset to the base coarse set point based upon the endo flow calculated by the system. Hysteresis is applied when a Coarse Set Point switch point is encountered. There are two settings for this option that

interpolate between the nearest endo flow/offset points and provide a continuously updated coarse set point for control:
  - -1 : takes the calculated endo flow from the air and gas flows
  - -2 : takes the calculated endo flow from the air flow and coarse set point
- Coarse Set Point Setup: This table is the curve that the AutoGen will follow as flow demand changes.
  The generator and AutoGen is tested for the turndown range during startup and testing of the equipment. During this testing, points are taken along the turndown range to determine the curve to be filled out. Note that the curve created is not "point to point" or straight line. Rather, it creates smooth lines based upon the curve entered.

- **Flow:** This is the Flow Rate of Endothermic Gas.
- **Set Point Offset:** This is the offset from the Base Coarse Setpoint Point (±X.XX) for the Coarse Ratio required at the Reference Flow point.
- **Final Setpoint:** This is the Base Coarse Set Point with the Set Point Offset Applied.

Example: An 8000 SCFH generator is tested at points from maximum flow (8000 SCFH) to turndown, and data is captured to determine the Actual Ratio Required at a given Endothermic Flow Rate. This data is entered into a chart, as shown below.

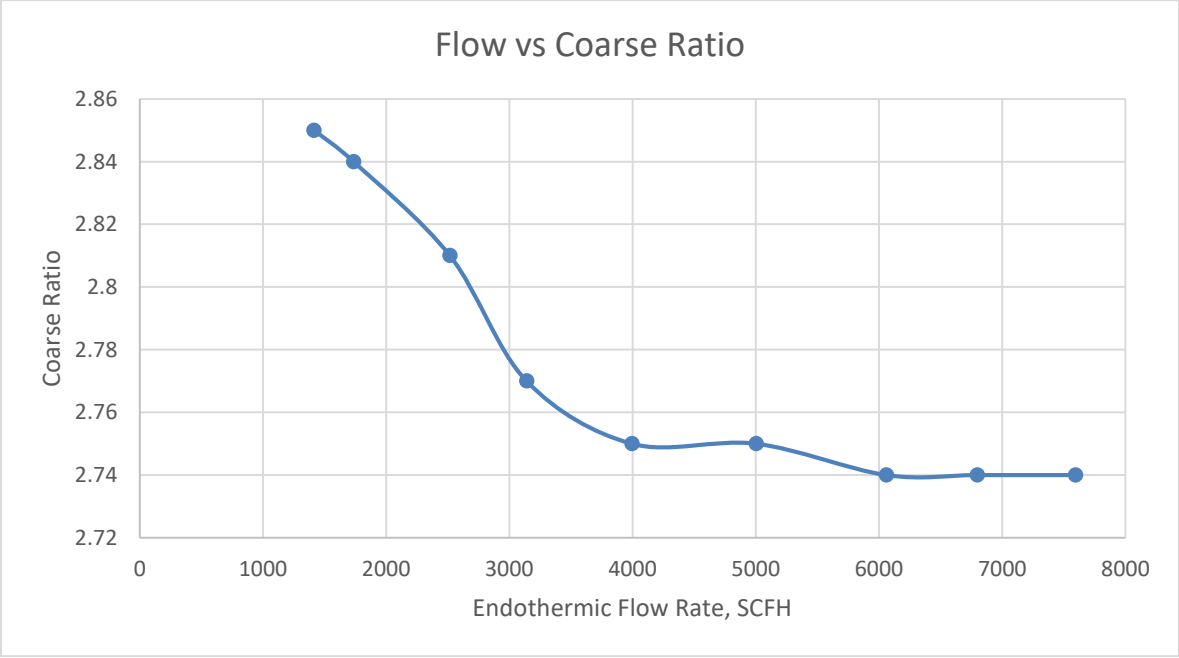
Flow (SCFH)	Ratio Required	Offset	Average	2.78
1415	2.85	0.07		
1735	2.84	0.06		
2518	2.81	0.03		
3140	2.77	-0.01		
3995	2.75	-0.03		
5004	2.75	-0.03		
6060	2.74	-0.04		
6798	2.74	-0.04		
7595	2.74	-0.04		

The Flow Rate and Ratio are entered into the two right columns. Then, an average is taken of the ratio which will now be below the Base Coarse Set Point.

From there, the difference is calculated to compute the offset required:

(Ratio Required) – (Base Coarse Set Point) = Offset

As can be seen, this curve is not linear, which is OK. AutoGen is able to interpret this and create and follow a smooth line curve between the points.



- Coarse Set Point Bump Enable: Turns Coarse Set Point Bump feature on or off. Coarse Set Point Bump will adjust the coarse ratio set point automatically if the trim output exceeds a predefined limit. The adjustment is based upon the valve 3 max flow provided

by the user. When Coarse Set Point Bump is activated, AutoGen will attempt to change the coarse set point so that the trim loop is close to 50% output.

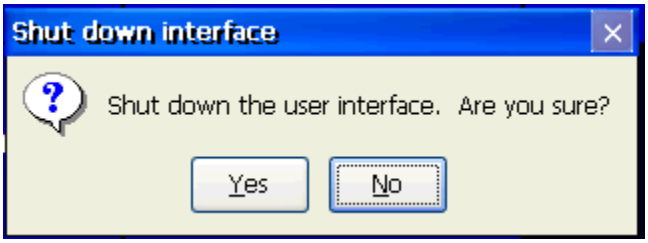
- Coarse Set Point Bump Limit: The limit that will force a coarse set point bump. The limit is applied to both ends of the control output so if the limit is 10% there would be a bump for both 8% and 93% (both fall within 10% of the max).
- Bump Delay: The amount of time, in seconds, before a bump is performed when Coarse Set Point Bump is enabled.
- Small Set Point Bump Enable: Makes a 0.01 coarse set point change if the dew point is within 2˚of set point but the trim output is beyond the bump limit after the bump limit timeout.
- Gas Valve Full Scale: This is the user-supplied full scale flow of the gas valve that AutoGen uses to predict the final coarse PID loop output when a large demand change is detected.
- Air Valve Deadband (1-10%, 0 to disable): This is used in conjunction with the coarse loop predictive adjustment feature. When AutoGen detects a large change in demand it will predict the final control output of the coarse loop until the air valve settles within the provided deadband.
- Dew Point Variable Filter Enable: Enables/disables the dew point input variable filter, which adjusts the filter time based upon the demand. The demand is determined by the Air VFD control loop output.
- Dew Point Input Filter at 0%: The input filter time, in seconds, when the Air PID loop is at 0%.
- Dew Point Input Filter at 100%: The input filter time, in seconds, when the Air PID loop is at 100%.
- Trim Adjust Master Setup: Opens setup options for Trim Adjust Master adjustments, allowing for changes based on total generator flow to provide better control at any level of flow. Settings include coarse deadbands and trim delays (in seconds) for entered flow values.
- Coarse Set Point Setup: Opens setup options for Coarse Set Point. A Base Coarse Set Point is set in this screen. Then, at entered flows, a Set Point Offset is applied, resulting in a Final Set Point at each particular flow.
- Generic Alternate PID setup: Edits for the generic alternate PIDs. Generic alternate PIDs have some things in common with PID switching. When a threshold is crossed a new set of PIDs are loaded and a bumpless transfer is executed to keep control smooth. What is different is in the setups. Generic PIDs allow you to define a switch variable and two PID loops on which to apply PID switching. In addition, you can have up to 10 PIDs in the generic scheme. AutoGen switches PIDs for the coarse (PID Loop A) and trim (PID Loop B) loops based on the endo flow of the system (source register). The hysteresis is applied when switching between PIDs to prevent chattering back and forth.

Page 2:

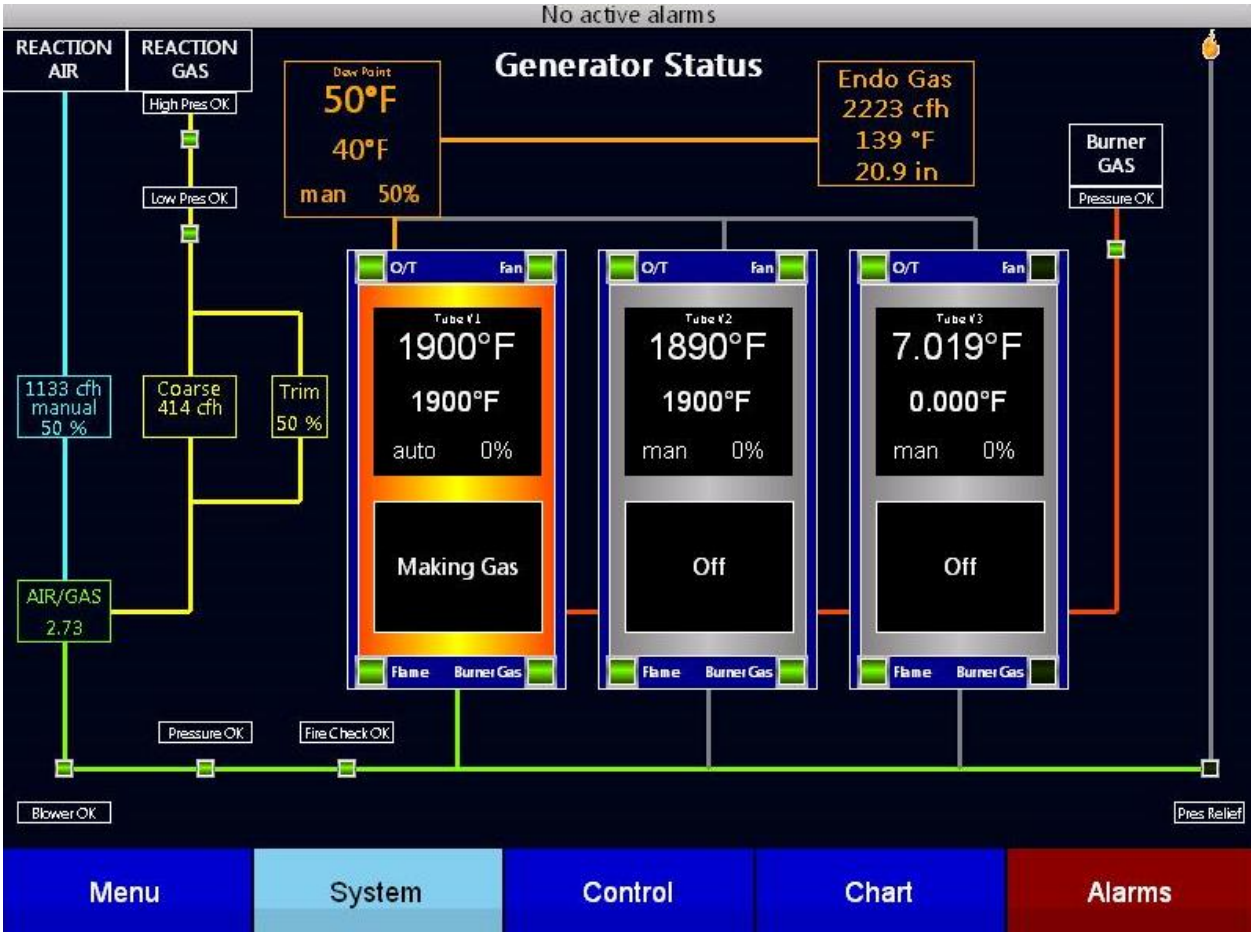
- Mix Hold Time, sec (10 - 300): Duration (in seconds) to keep the Mixer loop in hold when the hold feature is activated. The mix hold feature puts the mix loop into hold at 50% output when there are no tubes making gas).
- Coarse Hold % Output: The coarse output maintained by AutoGen during startup or if an issue is detected with flow feedback to the system. This value is set in conjunction with Pressure Hold % Output.
- Pressure Hold % Output: The pressure maintained by AutoGen during startup or if an issue is detected with pressure feedback to the system. This value is set in conjunction with Coarse Hold % Output.
- Low Flow Delay Timer: The amount of time (in seconds) AutoGen will wait before generating a low flow alarm.
- Generator Type: The type of generator: EZ or Retrofit.
- Digital Input 4: The selection for digital input #4 based on how the system is wired. Options are Mixer Pump Running and Burner Gas Low.
- Analog Input 6: The selection for analog signal input #6. Options are Trim Flow and Tube #3 T/C.
- Use Coarse Ratio SP Adjust Equation: When enabled, this feature uses a proprietary equation to adjust the coarse ratio setpoint based on the total demand of the system.

Shut Down Software
This option allows you to shut down the AutoGen screen and return to the operating system on the touch screen.

Important: Do not shut down the AutoGen screen unless you are preparing to turn off the touch screen completely or you are performing maintenance on the touch screen (for example, at the direction of Super Systems, Inc.).



System
The System screen shows important information related to generator processes and statuses.



The generator tubes are represented in the large rectangular boxes near the center of the screen. Current temperature, setpoint, control mode, and output percentage are shown in these

boxes. Indicators in each of the four corners of each box indicate the status of overtemp, fan, flame, and burner gas.

Other "large" boxes on the System screen represent different process components: reaction air, reaction gas, coarse, trim, burner gas, and endothermic (endo) gas. The flow of gases is shown with lines that connect different process components. Each line has a color indicating the type of gas:

- Blue: Air.
- Yellow: Natural Gas.
- Green: Air/Gas Mixture.
- Orange: Endo Gas.
- Red: Natural Gas used for the burner heating the tube.

The screen also features "small" rectangular boxes that represent the status of various safety interlocks within the system. For example, "High Pres OK" indicates that the system passes the high pressure check in the reaction gas line.

The small flame symbol in the upper right corner of the screen represents the burnoff flame (pilot light) used in case excess mix gas needs to be burned off. At the bottom right corner of the screen is a box representing the pressure relief valve.

Control

The Control screen shows the status of various control parameters.

Parameters related to coarse adjustment, dewpoint, and temperature are shown in separate panes along the top of the screen. Parameters related to flow are shown in the leftmost pane. Current alarms are shown in the middle pane (near the center of the screen) and are also

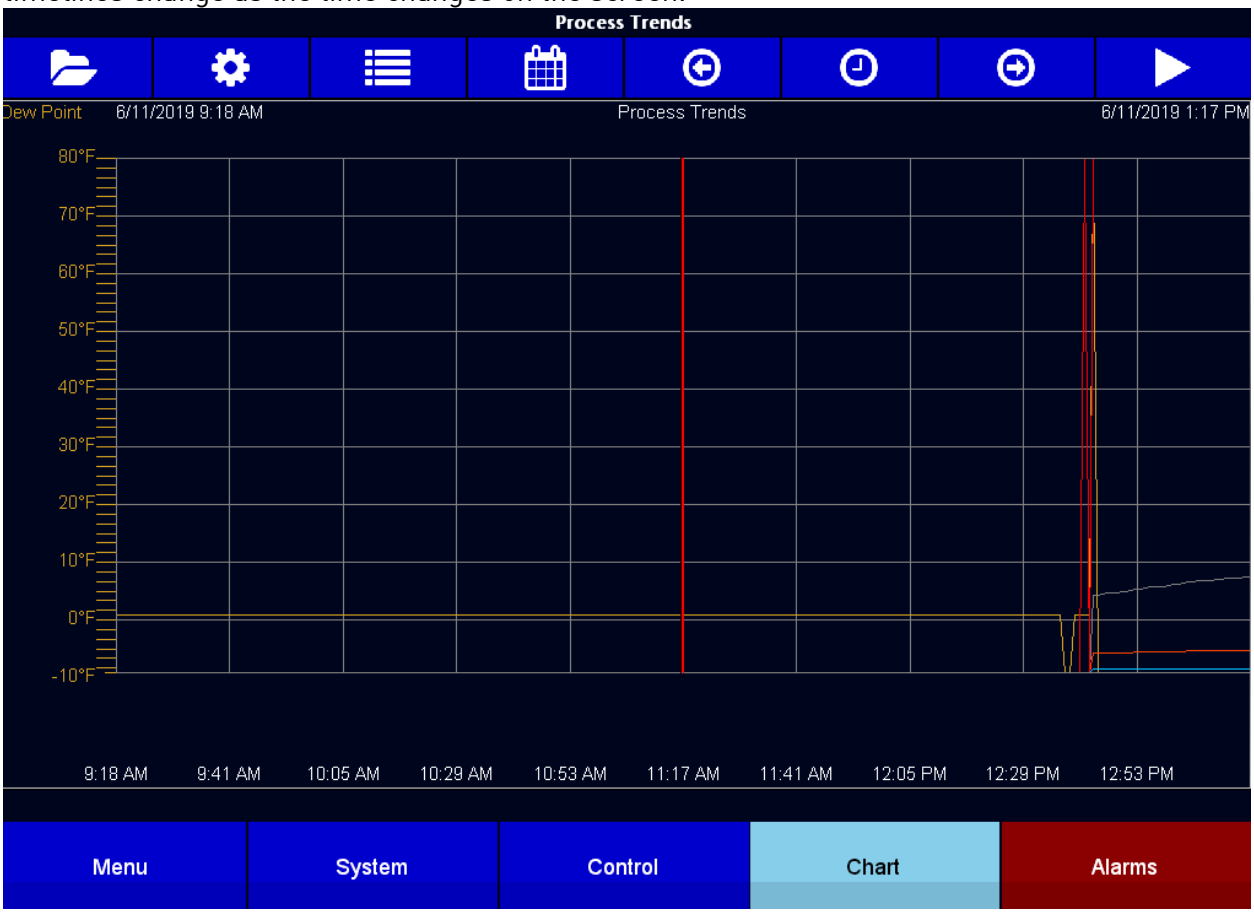
displayed in an alarm status bar that cycles through the names of active alarms at the top of the screen.

To change setpoints and other user-configurable parameters, refer to the Menu window, described in more detail beginning on page 14.

The bottom of the screen shows a trend chart of activity.

Chart

The Chart Display shows between 1 hour and 24 hours of process variable data on the screen and can be scrolled back to view all of the data stored on the touch screen. The vertical timelines change as the time changes on the screen.



The function buttons run along the top of the screen.

The folder button -  - will allow the user to open folders and trend chart files on the screen.

The Trend Lines button -  - will allow the user to select or de-select the trend lines on the trend chart to display. If the checkbox next to each trend line is checked, then that trend line will be displayed.

The Datagrid View button -  - will display a screen with the trend data in a grid format instead of with trend lines. The trend data is shown in 1-minute intervals. Clicking on the OK button on this screen will close the screen down and return to the Chart Display screen.

The Calendar button -  - will allow the user to select a date and time to view chart data.

The Back button -  - will move the chart's view backward in time by the specified chart interval.

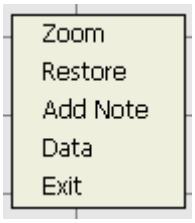
The chart interval button -  - will determine the number of hours displayed on the trend chart. The options are: 1 Hour, 2 Hours, 4 Hours, 8 Hours, 12 Hours, or 24 Hours.

The Forward button -  - will move the chart's view forward in time by the specified chart interval.

The Play button -  - will put the chart into real-time mode if it is not in real-time mode, or take the chart out of real-time mode if it is. When in real-time mode, the chart will automatically be updated once a minute.

Chart Sub Menu

There is a sub-menu available by putting a finger or a stylus anywhere on the chart and holding it there for a couple of seconds. The sub-menu will have the following options available: Zoom, Restore, Add Note, Data, and Exit.
The Zoom option will allow the user to zoom in on a particular part of the screen. Once this has been selected, the user can take a stylus or a finger and create a box around the desired data. Once the user releases the stylus or finger, a zoom is no longer possible, and the user will need to re-select the option from the sub-menu to zoom in again.



The Restore option will back out of any zoom options that have been performed and display the chart screen as it initially was.

The Add Note option allows the operator to enter a note on the chart, similar to writing on a paper chart. The note shows up when the chart is printed out using the utility software included with the instrumentation. Pressing the Add Note option displays a screen where the operator can enter the operator ID or initials and a note. The user has the option to enter a note using the

operator interface keyboard, where he or she will be able to type in the note; or the user can use the Signature mode, which will allow them to write a note using a stylus.

The Data option will show the trend data as a data grid instead of the trend lines on a chart.

This functionality is exactly the same as if the user pressed the Datagrid View button -  - from the chart screen.

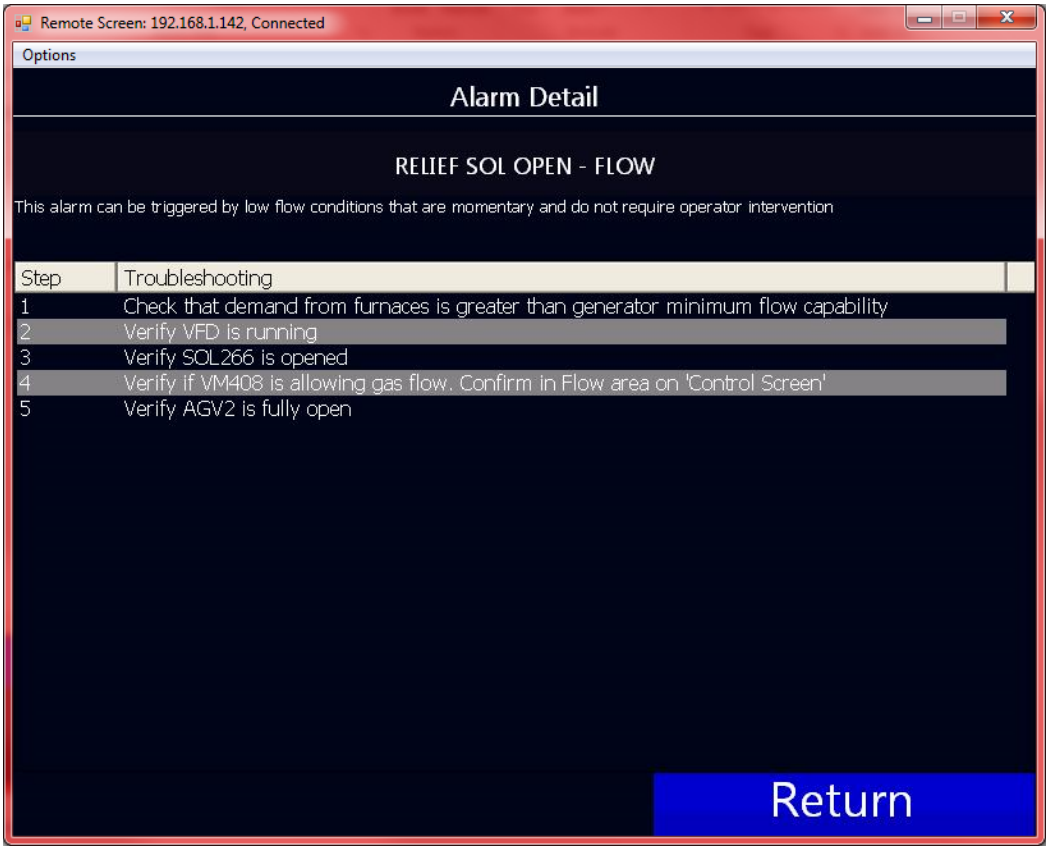
Exit will close out the sub-menu without selecting an item.

Alarms

The Alarms screen displays a list of active or past alarms.

The Active and Historical radio buttons can be selected depending on whether you want to view current alarms (Active) or past alarms (Historical). If Active is selected, active alarms will be shown in the Alarm list area. If Historical is selected, past alarms will be shown. Use the From and To date selectors to set up the start and end dates for historical alarm displays.

To acknowledge an active alarm, first tap on the alarm name, and then tap on the Ack button. For more details about an alarm, tap on the alarm name, and then tap "Detail" (Detail screen shown below). To silence an active alarm, tap on the alarm name, and then tap "Silence."



Critical System Alarms (Endo Shutdown Relay)

Critical alarms are determined to be crucial for safe operation of the generator. If any critical system alarm is detected it will release the endo shutdown relay. The endo shutdown relay is interlocked into the mixer circuit inside the generator control panel. The endo shutdown relay will shut down the mixer pump and the reaction gas supply in the event of an alarm.
There are five (5) critical system alarms programmed into the PLC. All critical alarms cause the mixer pump to shut down, the "shut down" alarm to display, and the alarm horn to sound. Note that "silencing" the alarm does not acknowledge or clear the alarm, it simply silences the horn.

NOTE: The "air sensor signal" alarm, "gas sensor signal" alarm or the "high ratio alarm" do not trigger individual alarms, but will display the "shutdown" alarm. The "low retort temperature" alarm and the "control TC signal alarm" will trigger individual alarms that specifically denote the respective condition.

Air Sensor Signal

An air flow signal within the proper range is vital to system operation. If the air flow transducer signal is lost, it will trigger a critical alarm.
Cause: This condition means that the air flow meter signal is lost. This is performed via communications between the Coarse Meter to the Matrix. Please contact Super Systems Inc. for assistance.
Reset: Correct the fault and restart the reaction gas system by following the proper procedures.

Gas Sensor Signal
A gas flow signal within the proper range is vital to system operation. If the gas flow transducer signal is lost, it will trigger a critical alarm.
Cause: This condition means that the air flow meter signal is lost. This is performed via communications between the Coarse Meter to the Matrix. Please contact Super Systems Inc. for assistance.
Reset: Correct the fault and restart the reaction gas system by following the proper procedures.

High Ratio Alarm (Coarse Ratio > 4)
If the air/gas ratio is over the high ratio alarm setpoint for a time period longer than the high ratio delay time, then the alarm is triggered.
Cause: This can occur when the gas supply is not adequate to maintain enough supply to the mixing system, or when the coarse ratio control valve is not responding. In either event, this is considered a critical system alarm which shuts down the mixing system before an unsafe situation can occur.
Reset: Correct the fault and restart the reaction gas system by following the proper procedures.

Low Retort Temperature
If the retort temperature is below the low temperature alarm setpoint (minimum setting is 1400°F (760°C)), then the generator is not at a sufficient temperature to create endothermic gas according to NFPA 86 guidelines. Insufficient temperature can cause raw gas and air to be introduced into a furnace downstream, which is hazardous. Therefore, a "low retort temperature" condition is a critical alarm that shuts down the mixing system.
Cause: Generator temperature is not within the controller limits. Check the burners for sufficient pressure. Check the control instrument for the correct temperature setting. Check to see that the temperature control valve is functioning. Check both the high gas and low gas pressure switches for proper settings and operation.
Reset: Correct the cause of the fault and restart the reaction gas system by following the proper procedures.

Control TC Signal Alarm (Thermocouple)
This alarm occurs when one of the generator temperature thermocouples becomes disconnected, or if an open loop is detected. When this alarm occurs, the mixing system is shut down.
Cause: When this alarm occurs, a thermocouple is not providing a signal to the overtemperature instrument or the overtemperature instrument itself is not functioning properly. Check the overtemperature instrument for an overtemperature alarm. Check the wiring to see if it has been disconnected. Test the thermocouple to confirm it is operational.
Reset: Correct the fault and restart the reaction gas system by following the proper procedures.

Non-Critical System Alarms
Non-critical alarms will provide warning to operators when the generator control is outside of recommended limits. Unlike a critical alarm, a non-critical alarm will not shut down the mixing system or the reaction gas supply. There are four (4) non-critical alarms programmed into the Matrix. Note that "silencing" the alarm horn does not acknowledge or clear the alarm condition; it simply silences the horn.

Ratio Deviation
A ratio deviation alarm occurs when the actual air/gas ratio has deviated from the ratio setpoint by an amount greater than the ratio deviation alarm setting.

Dew Point Deviation
A dew point deviation alarm occurs when the actual dew point has deviated from the dew point setpoint by an amount greater than the dew point deviation alarm setting.

Temperature Deviation
A temperature deviation alarm occurs when the actual temperature has deviated from the temperature setpoint by an amount greater than the temperature deviation alarm setting.

Outlet Overtemp
This alarm indicates that gas is not being cooled thoroughly after it exits the retort. If the temperature at the outlet reaches the setpoint, the "endo outlet temp high" alarm will occur. The alarm resets automatically if the temperature decreases below the setpoint. The default setpoint temperature is 300°F (149°C). To correct this alarm, find out what is causing the temperature to be too high. First, check whether the air filter is dirty. Then verify that the cooling blower is running. If no other causes are observed, the heat exchanger/cooler may be dirty, or the temperature sensor may be faulty.

Effluent Pilot Out (Burnoff Pilot Alarm)
Pilot flame monitoring of the effluent burnoff may be required at some sites, or supplied as a purchased option at other sites. If supplied, this alarm usually indicates that the pilot at the burnoff has gone out, or the pilot has not been sensed properly by the flame safety unit. Make sure that the pilot at the burnoff is lit and has a steady pilot flame. If the pilot appears to be functioning properly and this alarm persists, check that the flame rod is secure and mounted properly at the burnoff pilot. Also check wiring for problems.

A complete list of alarms can be found in **Appendix 8.**

Matrix Menu (A Submenu of Menu -> Configuration)

The Matrix Menu contains a list of options that provide access to advanced features of the AutoGen controller. Users of SSi's 9000 Series controllers will find the appearance of the menu familiar, although the options will be different in many cases. Options will be shown based on the access level of the logged in user: operator, supervisor, or administrator.

Following is the list of operator-level options (which are also accessible to supervisor- and administrator-level):

- Logs
- Board Status

Following is the list of options that, in addition to the above options, are available to supervisor-level users (and administrator-level users):

- PID
- Trend Chart Edit

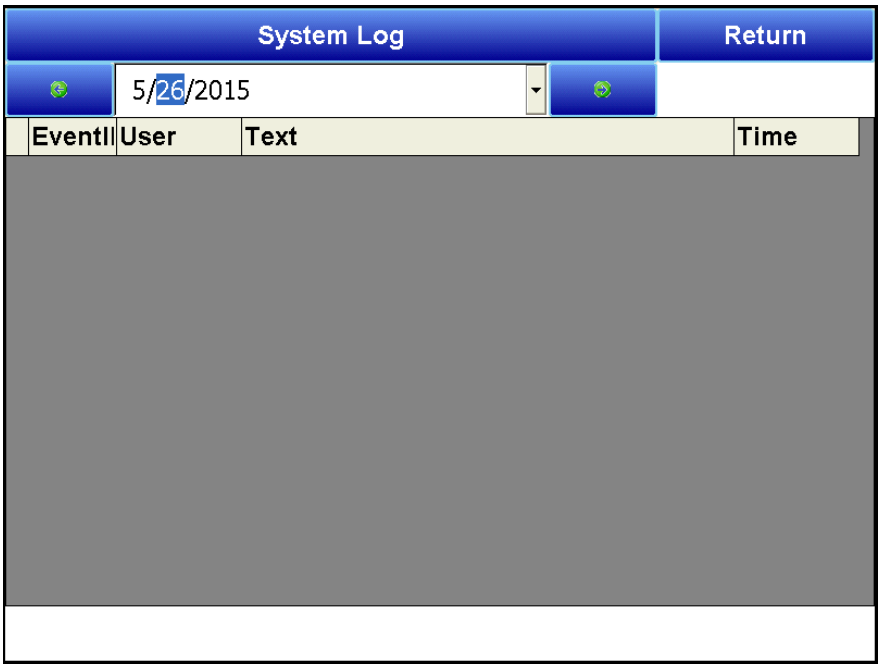
Finally, these options are available only to administrator-level users:

- Alarm Setup
- Alarm Group Setup
- Relay Assignments
- Furnace
- Communications
- Analog Input
- Analog Input Curve Entry
- Analog Output
- Alternate PID
- Calculated Values
- Calibration
- Valve Setup
- Security
- Configuration
- Diagnostics
- Logic Programmer
- PV Timers
- Task Scheduler
- Run Timers
- Generator Options
- Generic PID Switching
- Logic I/O Mapping

The above options are described in more detail below.

Logs

The Logs screen will allow the user to view three different types of logs – **System**, **Alarms**, and **Cycle**.



Clicking on the button that displays the log type (**System Log**, **Alarm Log**, or **Cycle Log**) will allow the user to select the type of log file to view.

The green directional arrows will display the previous items in the log or the next items in the log, if the log items are longer than one screen. The drop down list in between the directional arrows will allow the user to select the date of the log items to view.

The **Return** button will return the user to the menu screen.

Log Types

The System Log tracks the startup and shutdown activity of the touch screen as well as when communications to the controller are established.

The Alarm Log tracks all alarms—those that are internal to the controller and those that are generated by the PLC. This log tracks the alarm generated, its start time, and its end time. This log can be useful for helping build an alarm history.

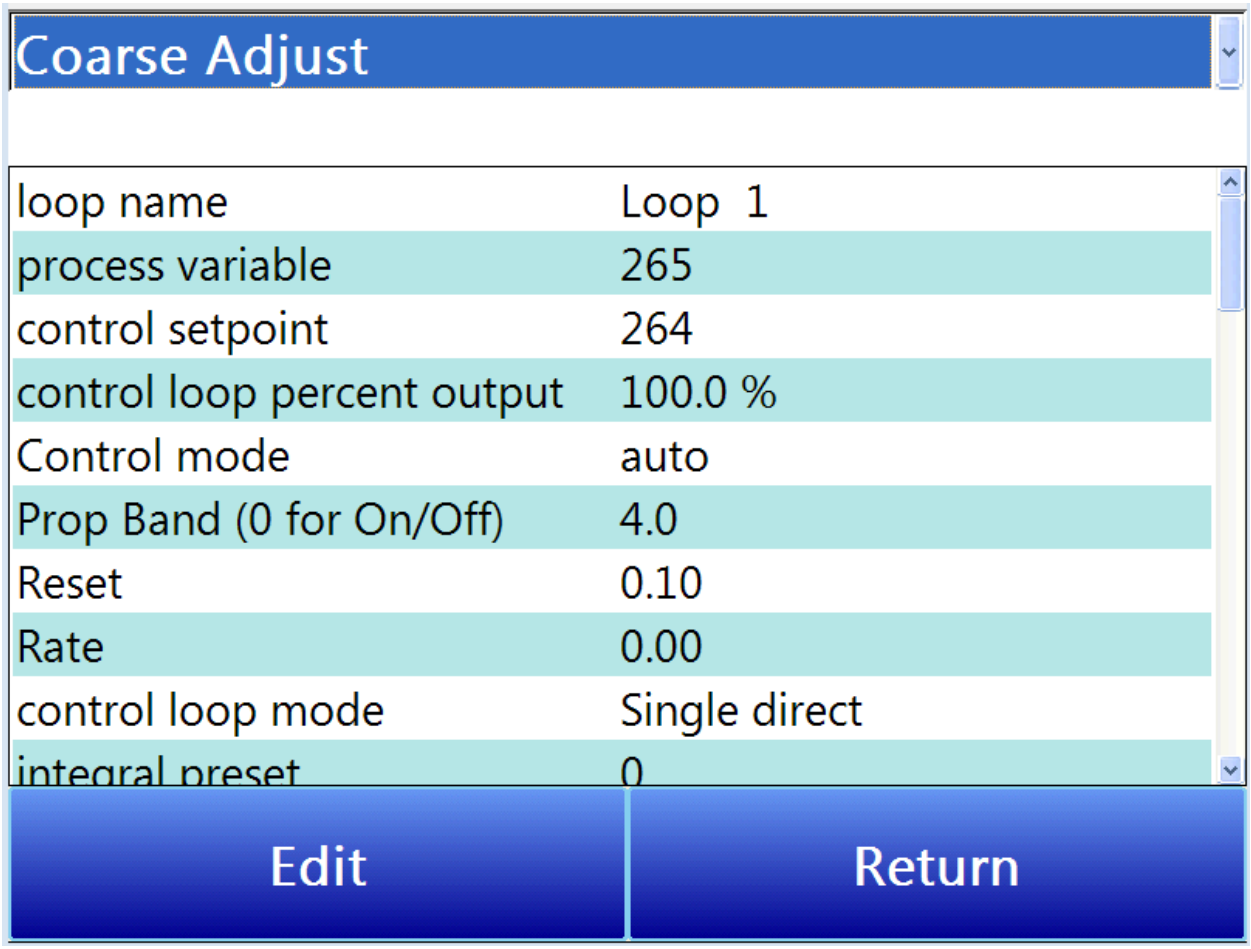
The Cycle Log keeps track of charged loads and completed recipes. Specifically, it displays the start time and date, completed time and date, and recipe number executed. A Utilization button can be pressed to open a page with information on utilization based a selected date and on the amount of time that the controller has run a recipe compared to the amount of time it has not run a recipe.

Board Status

This screen shows the current values of Analog Input and Analog Output signals coming from and going to their respective boards. Digital Input/Output statuses are shown; if signals are being sent and received as expected, "OK" will be shown for each Digital I/O. All analog and digital inputs and outputs can be seen individually on the I/O screen (see page 15).

PID

PID provides tuning parameters entered for each Process Variable loop. The loops that can be changed are Coarse Adjust, Trim, Mix Pump, Tube 1, Tube 2, Tube 3, Loop 7, Loop 8.



- Loop name: The name of the current control loop.
- Process variable: The current value of the process variable.
- Control setpoint: The setpoint to which AutoGen will control.
- Control loop percent output: The output percentage that the control loop is calling for. This will range from 0.0 to 100.0%.
- Control mode: The mode in which control will be operated: **automatic, manual, or hold**.
- Prop Band: Proportional Band determines the response to the current error. The Proportional Band is the percent of the range of the process variable that will produce

100% output and is the inverse of the proportional gain. A low Proportional Band value results in a larger change in output for a given error. Conversely, a high Proportional Band value results in a smaller change in output for a given error. If the Proportional Band is too small, control may oscillate or be otherwise unstable. If the Proportional Band is too large the control action may be too sluggish in response to changes within the system. Note: If the Proportional Band is set to 0.0, only on/off control is performed.

- Reset: Reset determines the influence of past errors. The Reset, or integral action (expressed in repeats per minute), sums the error between the process variable and setpoint over time and adds this accumulated output to the proportional output. A "proportional only" controller generally operates with steady-state error because some error is required to produce control output. The goal of integral action is to drive the steady-state error to zero and eliminate this droop.
- Rate: Rate adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing overshoot but is most often useful when trying to improve control on systems with significant and predicable lag. The range 0 – 327.67. NOTE: The rate is not typically used for carbon control.
- Control loop mode: This is the mode of the loop. The values are **Dual Reverse**, **Single Reverse**, **Dual Direct**, or **Single Direct**.
  Dual – This has two output relays which can increase and decrease to achieve the SP.
  Single – This has one relay which works in only one direction to achieve the SP.
  Direct - If the PV - SP equals a positive number and the output would bring the PV down toward setpoint, that is direct.
  Reverse – If the PV - SP equals a negative number and the output would bring the PV up toward setpoint, that is reverse

  Example: If a 12 mA output drives a 0 degree F temperature (PV) *UP* to a 1200 degree F temperature (SP), this would be *REVERSE*, and since this would take a *SINGLE* output from the controller, the Mode for the Temperature Loop is **Single Reverse**.

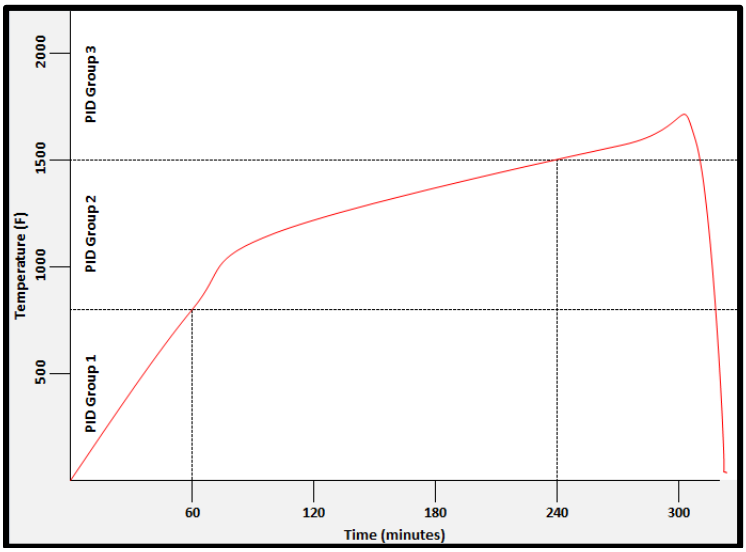
- Integral preset: This field provides an offset for the starting point for PID control, also referred to as "Load Line" or "Manual Reset". The range is **–100 to 100.**
- Cycle time: This field is typically set to the valve travel time multiplied by 1.5. The range is 0 – 500.
- PV source: The options for PV Source are as follows:
  Disabled
  Input 1 – 24
  Calculated Value 1 – 8
  Aux Input 1 – 40
  Valve 1 – 8
- Setpoint source: The options for Setpoint Source are as follows:
  Direct
  Aux Input 1 – 24
  Master SP 1 – 4
  Cascade loop 1 – 16 %out
  Valve 1 – 8

- Control setpoint offset: This value is added to the setpoint value to get the working setpoint for the PID control. This is useful in a multizone application where a zone may need a slightly higher or lower setpoint than the other zones. The base setpoint for all the zones can be from the same source' the offset is used to tweak the setpoint for a zone.
- Setpoint change limit: This is a smart time feature that allows Process Loop to use PB only without Reset until the Process Variable drops below the percent output set under this category.
  It is used to eliminate overshoot.
  The Output percentage selected under this category *must* be above the normal operating output percentage of the furnace at heat.
  The options are: OFF, 80%, 70%, 60%, 50%, 40%, 30%, or 20%.
  Example: If the furnace runs at 40% output at heat for the maximum load, the setpoint change limit should be set to 60%.
- Alarm enable: This enables (yes) or disables (no) the deviation alarm. The deviation alarm may be a band or deviation only with a + or - setpoint.
- Alarm type: The types are band and deviation. Band alarm works by looking at a value above and below setpoint. Deviation alarm works by looking at a value either above or below the setpoint value on which the alarm is based.
- Alarm setpoint: The amount by which the process variable can deviate from the control setpoint before a deviation alarm is generated.
- Smart: A smart alarm is an alarm that works with a Process Variable (PV), and, when enabled, it will not be active until the PV is within band of the setpoint. The alarm sounding - if active - will be disabled until within the SP band. When it is in band, the alarm will go active unless on delay time is set.
- Latching: Determines whether the alarm is latching (Yes) or not latching (No). Latching means that if the alarm state is active and the returns to the safe state, the alarm bit is not cleared. The alarm must be acknowledged by the operator.
- 0 SP inhibits alarm: This value will allow a 0 setpoint to block an alarm. The options are either No or Yes.
- Alarm delay: This value is the delay (in seconds) for the alarm if a deviation alarm is detected. The range is 0 to 10000.
- Percent output alarm low setpoint: This sets the low setpoint for a percent output alarm. If the PID loop is in auto and the calculated percent output is below this value, an alarm condition occurs. An actual alarm state is not declared until the alarm condition is maintained for the delay time.
- Percent output alarm high setpoint: This sets the high setpoint for a percent output alarm. If the PID loop is in auto and the calculated percent output is above this value, an alarm condition occurs. An actual alarm state is not declared until the alarm condition is maintained for the delay time.
- Control low limit: This is the low limit for the loop.
- Control high limit: This is the high limit for the loop.
- 0 SP stops control: If the Setpoint is zero, then all outputs are turned off. The option is either Yes or No.
- Ctrl shutdown inputs: Selects which input(s) will shut down control if their setpoint is exceeded. The setpoint and hysteresis for each input are set up in the Analog Inputs menu.

- PID auto switch: This is the PID auto switch field. The value can either be **Yes** or **No**.

  PID auto switch is a feature within the instrument that allows multiple PID Loops to be used for various temperature ranges. This feature can be extremely helpful when a single PID Loop is not accurate across a wide temperature range. The most common indication that PID auto switching may improve furnace ability is failure to pass Temperature Uniformity Surveys (TUS). In many examples, a certain PID Loop may prevent under- or over-shoot at normal operating temperatures; but produce unacceptable overshoot at lower temperature.

  This feature allows the user to utilize (up to) three distinct loops to obtain more accurate heating curves. In most applications, it is helpful to use the built-in Tuning Assistant feature to determine appropriate PID values. These values can be recorded and manually entered as described below. The chart below demonstrates this feature.



In the example above, proper use of the Tuning Assistant allows the user to find the following optimal PID settings for the following temperature ranges:

- 0-800F -> PID Group 1 (P = 1.0, I = 2.0, D = 3.0)
- 801-1500F -> PID Group 2 (P = 1.3, I = 2.3, D = 2.3)
- 1501F+ -> PID Group 3 (P = 1.6, I = 2.6, D = 3.6)

The following settings must be made via the touch screen:

Parameter	Value
PID Loop Setup -> Loop 1 -> PID Auto Switch	Yes
PID Loop Setup -> Loop 1 -> Switch Point PID 1-2	800
PID Loop Setup -> Loop 1 -> Switch Point PID 2-3	1500
Alternate PID Setup -> LP1 set 1 -> Prop Band	1.0
Alternate PID Setup -> LP1 set 1 -> Reset	2.0
Alternate PID Setup -> LP1 set 1 -> Rate	3.0
Alternate PID Setup -> LP1 set 2 -> Prop Band	1.3
Alternate PID Setup -> LP1 set 2 -> Reset	2.3
Alternate PID Setup -> LP1 set 2 -> Rate	3.3
Alternate PID Setup -> LP1 set 3 -> Prop Band	1.6
Alternate PID Setup -> LP1 set 3 -> Reset	2.6
Alternate PID Setup -> LP1 set 3 -> Rate	3.6

- PID 1 -> 2 switch point: This is the PID Switch Point field. This is used in conjunction with the PID Auto Switching feature. See the *PID Auto Switch* section for more information.
- PID 2 -> 3 switch point: This is the PID Switch Point field. This is used in conjunction with the PID Auto Switching feature. See the *PID Auto Switch* section for more information. The range is **–300** to **4000**.
- PID auto switch source: This setting determines which parameter the PID auto switch will be based on: **setpoint** or **process variable**.
- Setpoint lower limit: This is the lower limit of the setpoint.
- Setpoint upper limit: This is the upper limit for the setpoint.
- Setpoint zero (src 29 – 40) and Setpoint span (src 29 – 40): The setpoint zero and span are used with cascade control. Setpoint sources 29 to 40 are the percent outputs of PID loops 1 thru 12 respectively. The setpoint zero is the value in engineering units (same as PV) when the source loop percent output is zero. The setpoint span is the value in engineering units when the source loop percent output is 100%.
- PID output rate of change limit: This option causes the controller to limit the rate at which the output changes in the furnace. For example, if the output rate change limit is 5% per second, the controller will increase the output at a rate no greater than 5% each second until the output reaches the level needed to reach setpoint. This limit can be useful in cases where (for example) a heating element should not (for operational and safety reasons) heat up to a high output immediately. If the output needs to reach 100% to achieve setpoint, the rate of change limit will apply the output incrementally, rather than allowing the output to climb to 100% as soon as the heat is turned on.
- Overshoot control logic: Overshoot control logic is activated when a large setpoint change occurs. If the logic is active and a large setpoint occurs, it sets a working setpoint at an appropriate distance from the desired setpoint to prevent the PV from overshooting the desired final setpoint. When the PV reaches or crosses this working setpoint, then the logic exponentially ramps the working setpoint to the desired final setpoint. Possible values are **No** and **Yes**.
- Ramp detect logic: The Ramp Detect logic works in conjunction with the instrument recipe programmer. If the control loop is the temperature loop for the recipe programmer, and the OPCODE is a ramp, then the control loop does some special

checks. If the Overshoot Control Logic is active, then the final setpoint of the ramp is used to determine the working setpoint band. However, the ramp setpoint is used until the band is reached. Also, once the band is reached, if the ramp is faster than the overshoot logic exponential ramp, then the program is temporarily put on hold as needed to sync the two ramps. Possible values are **No** and **Yes**.

- Ramp overshoot level 1 and 2: When either of these options is turned on, if a ramp is detected in a step recipe in a temperature loop, the controller will take action to minimize overshoot. Level 2 targets overshoot more aggressively than Level 1.
- Overshoot control logic state: Overshoot control logic is activated when a large setpoint change occurs. If the logic is active and a large setpoint occurs, it sets a working setpoint at an appropriate distance from the desired setpoint to prevent the PV from overshooting the desired final setpoint. When the PV reaches or crosses this working setpoint, then the logic exponentially ramps the working setpoint to the desired final setpoint.
- Positive output accumulator: The Positive Output Accumulator is the sum of the positive outputs (given in percentages up to one decimal place) measured each second. Therefore, if the following outputs are recorded over five seconds:
-

Output (in %)	Second Passed
100.0	1
99.0	2
99.0	3
98.0	4
97.0	5

Then the value for the Positive Output Accumulator after five seconds will be (100.0 + 99.0 + 99.0 + 98.0 + 97.0) or 493.0.

To reset the Positive Output Accumulator, simply click **Edit** while the Positive Output Accumulator is highlighted and confirm the reset. This will cause the Positive Output Accumulator to be reset to zero and start accumulating values again from that point.

- Negative output accumulator: The Negative Output Accumulator is the sum of the negative outputs (given in percentages up to one decimal place) measured each second. The sum of the negative values is expressed as a positive value. This means that, if an output of -50% is recorded after one second, a value of 50 will be added to the Negative Output Accumulator. Similarly, if the following outputs are recorded over five seconds:

Output (in %)	Seconds Passed
-20.0	1
-20.0	2
-21.0	3
-21.0	4
-22.0	5

Then the value for the Negative Output Accumulator after five seconds will be (20.0 + 20.0 + 21.0 + 21.0 + 22.0) or 104.

To reset the Negative Output Accumulator, simply click **Edit** while the Negative Output Accumulator is highlighted and confirm the reset. This will cause the Negative Output Accumulator to be reset to zero and start accumulating values again from that point.

- Deadband: Deadband refers to a range within which no adjustments will be made. For example, if setpoint is 2.7, deadband is set to .03, and process variable reads 2.702, no adjustments will be made because this reading falls within the deadband range. Deadband is useful in extending the life of a valve by limiting the number of miniscule adjustments it is required to make. To set the Deadband value, tap **Deadband**, tap **Edit**, and enter the desired value.
- Deadband Mode: adjusts the proportional band component of the PID. Increasing the proportional band slows the control action of the PID, which can provide fast initial control with a gentler control near the set point. The user options are:
    - **Normal –** no adjustment to the control output within the defined deadband
    - **Proportional Band x2 –** control within the defined deadband with the Proportional Band component of the PID doubled.
    - **Proportional Band x4** - control within the defined deadband with the Proportional Band component of the PID multiplied by 4.

Trend Chart Edit

This menu option will allow the user to add, modify, or delete trend lines in a trend chart file, as well as the trend chart files themselves. The trend lines are the number of variables displayed on one screen. There is not a maximum for template selections, but the number of variables displayed on one screen must be a consideration in this process. The buttons across the top of the screen – **Open**, **New**, **Delete**, **Save**, and **Save As** – deal with the trend chart files themselves, not the individual trend lines.
Open will allow the user to select a trend chart file to open up to edit.
New will create a new trend chart file to begin adding trend lines to.
Delete will delete a specified trend chart file.
Save will save all changes to the current trend chart file that have been made.
Save As will allow the user to save the current trend chart file as a new file with a different name.

Once a new trench chart file has been created, or one has been opened, trend lines can be added, modified, or deleted. **Add** will add a new trend line to the file. **Edit** will allow the user to edit the information for a specific trend line. **Delete Line** will delete the specified line from the chart file.
Adding or editing a trend line will involve the following parameters:
Name – the name of the input, for example "Temp ACT" which would be the actual temperature of the input. It is a good idea to shorten the names so that they still make sense, but do not take up as much space.
Data – This will determine where the data is coming from. The user can click on the box to select from the list of data logged points in the controller. Some of the points have a name, such as "Temperature" or "Temperature SP", but others will just show the register in the

controller that has been logged. Note that certain parameters are already setup and logged. For anything needed beyond this, you will need to contact SSi at (513) 772-0060 to get the register information. This register will need to be added to the Datalogging Setup.

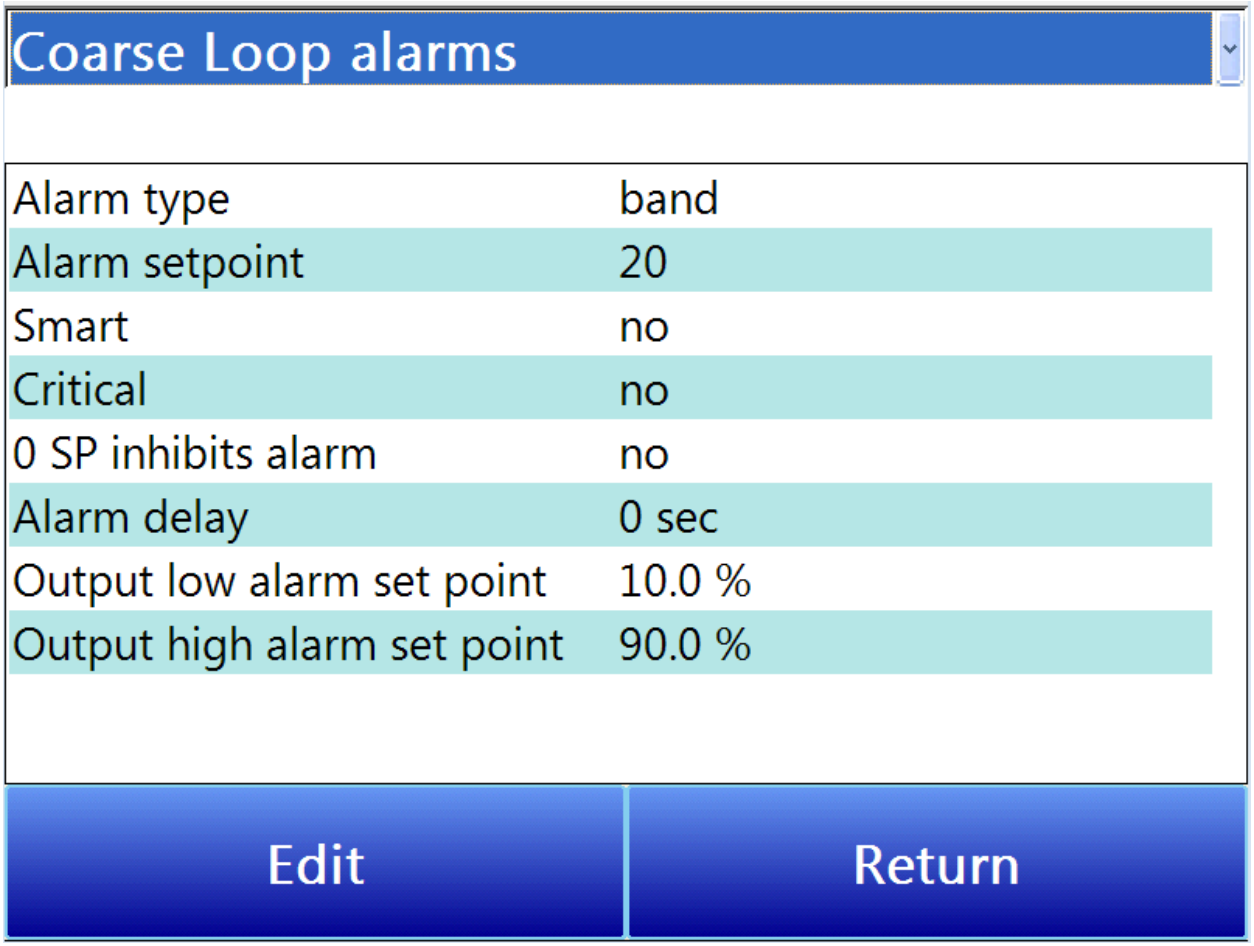
Min – the minimum displayed scale value on a chart.
Max – the maximum displayed scale value on a chart.
Expression – every input requires an expression to be calculated and displayed correctly. This is because the registers in the controller hold only integer values, so any value that requires a decimal point needs to be set up properly for the display. For example an expression for temperature would be x (1750 = 1750). For a value such as carbon or millivolts, the expression would be x * 0.01 (150 = 1.50) or x * 0.1 (805 = 80.5).
Format – the value displayed on the chart display of the operator interface. A short custom description can be added here. For example, to display one (1) decimal point, enter a value of "#0.0". For carbon values, enter a value of "#0.00" for 2 decimals. This would display a value like "0.81". Entering "#.00" would display a value of ".81". #0 or 0 will display integer values.
Color – The box next to the format box will allow the user to apply a color to the trend line to differentiate it from other trend lines on the chart.
Units – The type of units used for the trend.
Line Width – a numeric value for the thickness of the trend line. A 1 is a thin line; A higher value = thicker line width.
Sample – a number is entered here to test the expression and verify that formatting is correct.
Test – Press the test button to calculate the expression with the value entered in the sample parameter. For example with an expression of x*.1 and a value of 250 entered in the sample parameter will display a 25.0.
The **Set** button will save the values entered. The **Cancel** button will cancel the information and make no changes.

Alarm Setup

The controller can be configured to use a number of different alarms. The Alarm Setup menu allows you to change settings for the following types of alarms.

Coarse Loop alarms	Analog Input 2 alarms	Analog Input 19 alarms
Dew Point Trim alarms	Analog Input 3 alarms	Analog Input 20 alarms
Pressure alarms	Analog Input 4 alarms	Analog Input 21 alarms
Tube 1 alarms	Analog Input 5 alarms	Analog Input 22 alarms
Tube 2 alarms	Analog Input 6 alarms	Analog Input 23 alarms
Tube 3 alarms	Analog Input 7 alarms	Analog Input 24 alarms
PID 7 alarms	Analog Input 8 alarms	Calculate Value 1 alarms
PID 8 alarms	Analog Input 9 alarms	Calculate Value 2 alarms
PID 9 alarms	Analog Input 10 alarms	Calculate Value 3 alarms
PID 10 alarms	Analog Input 11 alarms	Calculate Value 4 alarms
PID 11 alarms	Analog Input 12 alarms	Calculate Value 5 alarms
PID 12 alarms	Analog Input 13 alarms	Calculate Value 6 alarms
PID 13 alarms	Analog Input 14 alarms	Calculate Value 7 alarms
PID 14 alarms	Analog Input 15 alarms	Calculate Value 8 alarms
PID 15 alarms	Analog Input 16 alarms	Generic Alarm 1
PID 16 alarms	Analog Input 17 alarms	Generic Alarm 2

Analog Input 1 alarms Analog Input 18 alarms Generic Alarm 3
Generic Alarm 4



Settings for Coarse Loop Alarms, Dew Point Trim alarms, Pressure alarms, Tube 1 – 3 and PID 7 – 16 alarms include the following.

- Alarm type: The types are **band** and **deviation**. Band alarm works by looking at a value above and below setpoint. Deviation alarm works by looking at a value either above or below the setpoint value on which the alarm is based.
- Alarm setpoint: The setpoint for the alarm.
- Smart: A smart alarm is an alarm that works with a Process Variable (PV), and, when enabled, it will not be active until the PV is within band of the setpoint. The alarm sounding - if active - will be disabled until within the SP band. When it is in band, the alarm will go active unless on delay time is set.
- Critical: Determines whether the alarm is critical (**Yes**) or not critical (**No**)
- 0 SP inhibits alarm: This value will allow a 0 setpoint to block an alarm. The options are either **No** or **Yes**.
- Alarm delay: This value is the delay for the alarm if a deviation alarm is detected. The range is 0 to 10000.

- Output low alarm setpoint: PID loop percent output low alarm setpoint. (DO NOT ADJUST THIS SETTING WITHOUT CONTACTING SSI)
- Output high alarm setpoint: PID loop percent output high alarm setpoint. (DO NOT ADJUST THIS SETTING WITHOUT CONTACTING SSI)

Settings for Analog Input 1 – 24 and Calculated Value 1 – 8 alarms include the following.

- High alarm setpoint: Upper limit setpoint for a high process alarm on an analog input or calculated value.
- High alarm hysteresis: Hysteresis value on the high alarm setpoint.
- Smart: A smart alarm is an alarm that works with a Process Variable (PV), and, when enabled, it will not be active until the PV is within band of the setpoint. The alarm sounding - if active - will be disabled until within the SP band. When it is in band, the alarm will go active unless on delay time is set.
- Critical: Determines whether the alarm is critical (**Yes**) or not critical (**No**)
- High alarm delay: Time in seconds that the high alarm must be active before it is annunciated.
- Low alarm setpoint: Lower limit setpoint for a low process alarm on an analog input or calculated value.
- Low alarm hysteresis: Hysteresis value on the low alarm setpoint.
- Smart: A smart alarm is an alarm that works with a Process Variable (PV), and, when enabled, it will not be active until the PV is within band of the setpoint. The alarm sounding - if active - will be disabled until within the SP band. When it is in band, the alarm will go active unless on delay time is set.
- Critical: Determines whether the alarm is critical (**Yes**) or not critical (**No**)
- Low alarm delay: Time in seconds that the low alarm must be active before it is annunciated.

Generic Alarm 1 – 4 have a Configure option.

<u>Alarm Group Setup</u>

The purpose of the alarm groups is to combine similar alarm sources into one action to make relay assignments easier. Each of the controller's PID loops, analog inputs, and calculated values can have more than one type of alarm (2 or 3). However, not everyone will need for any or all of those alarms to be active and action required. The alarm grouping provides a way to specify which alarms need to be recognized.

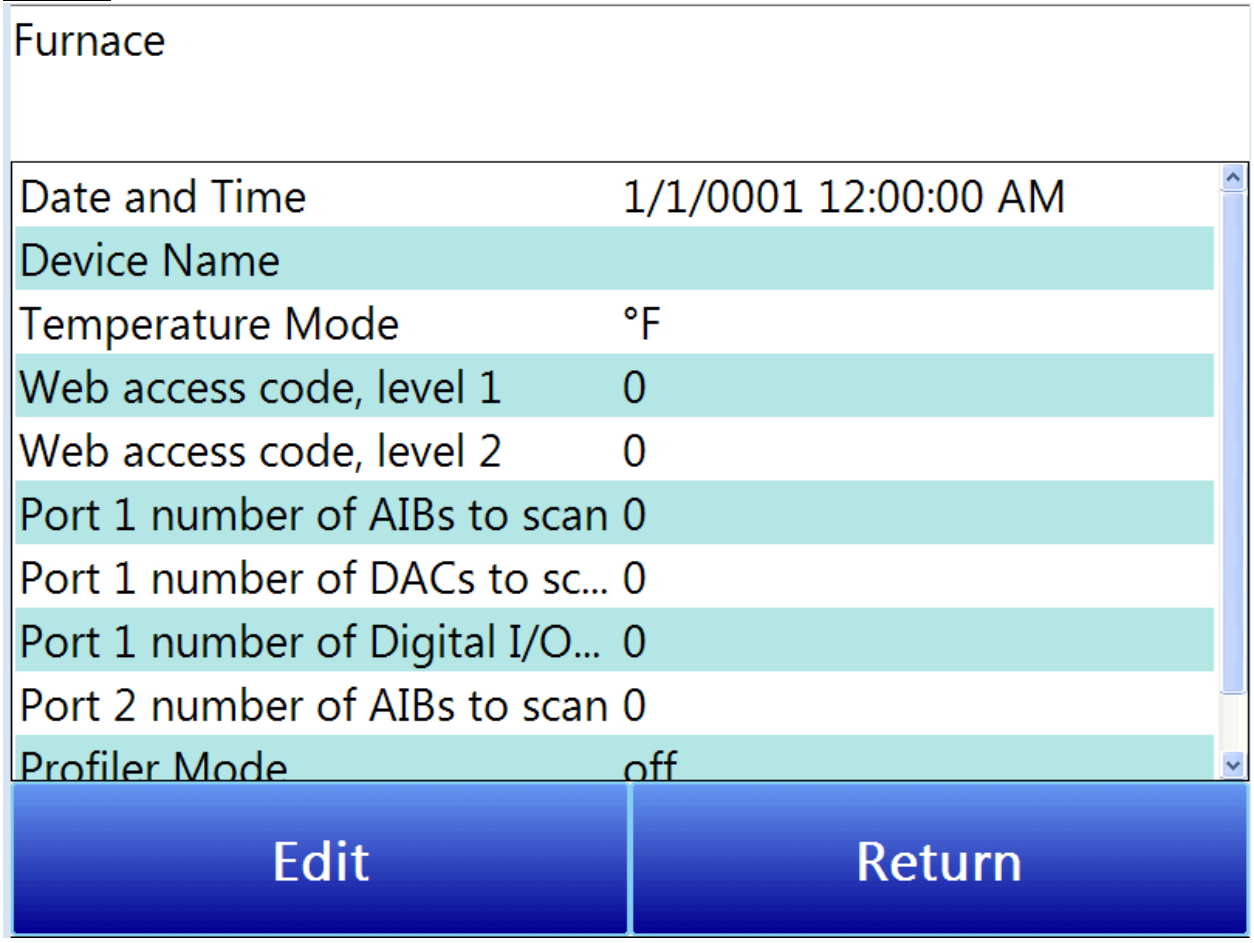
For example under Alarm Group setup the first three items are Control Loop Deviation Alarm Groups 1, 2, and 3. Each has the same possible setup of choosing any or all of the PID loops. Therefore, any combination of the deviation alarms for PID loops can be assigned to a group. If any alarm assigned to that group is in an alarm state, then the appropriate bit status is set.

<u>Relay Assignments</u>

Most of the relay assignments are set internally by the logic controller and should not be manually changed. Some relay assignments can be used when needed. These may include, for example, Digital Outputs 4, 5, 6, 7, 11, and 12. Check the "Spare" digital outputs on the I/O

screen to determine which relay assignments are available for use. The others should not be changed without first calling SSi at (513) 772-0060.

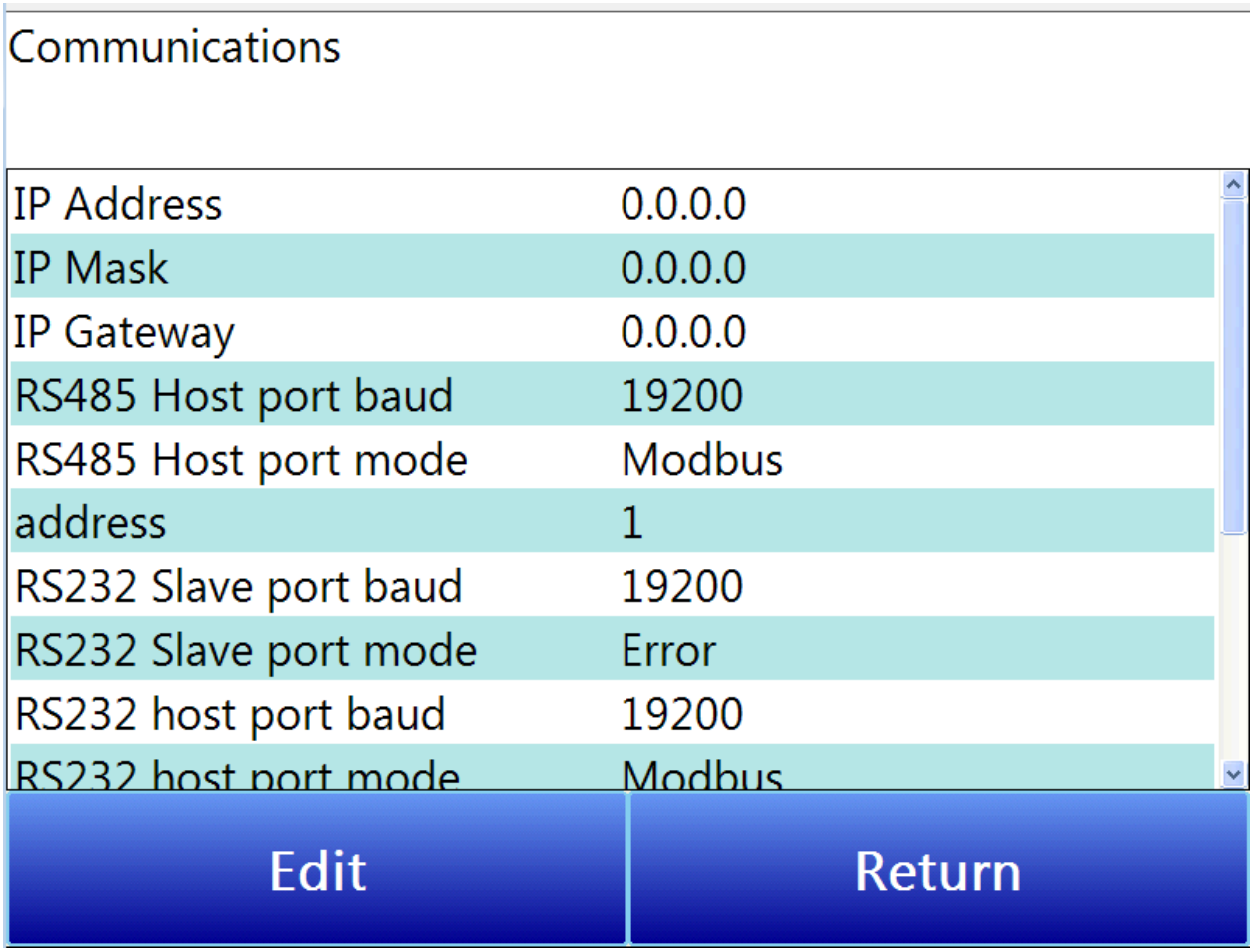
Furnace



- Date and Time: The date and time in the controller can be set here. The factory default is for the controller to sync to a web time server if it has access.
- Device Name: A unique name can be assigned to this controller; maximum of 19 characters
- Temperature Mode: Select between displaying temperatures in °C or °F.
- Port 1 number of AIBs to scan: This sets the maximum number of analog input boards to scan on the backplane.
- Port 1 number of DACs to scan: This sets the maximum number of analog output boards to scan on the backplane.
- Port 2 number of AIBs to scan: This sets the maximum number of analog output boards on a remote SR rack to scan.
- Profiler Mode: Enables the profiler feature. **DO NOT ENABLE THIS SETTING WITHOUT CONTACTING SSI.**
- PVT Type: The following can be selected: **not used**, **% Carbon**, **Dew point**, **Millivolts**, **Redundant Probe System**, and **Vacuum**. By default this is set to "not used." **DO NOT ADJUST THIS SETTING WITHOUT CONTACTING SSI.**

Communications

The Communications menu allows the user to view and configure all communication ports setup parameters for the device. These include IP address of the AutoGen controller, serial communications parameters, and PLC type (for systems using a PLC).



- IP Address: This will identify the IP address of the controller. Please consult your Systems Administrator before changing this value as it can affect communications to the controller, communications between the controller and the PLC, communications between the controller and other devices on the network, or to data collection systems. This is necessary if the Touchscreen will be communicating to the AutoGen over Ethernet communications. The IP address must be in the "xxx.xxx.xxx.xxx" format. NOTE: The IP address is not typically used for communications from the touch screen to the controller, but for communications between the controller to SuperDATA modules, PLCs, etc.
- IP Mask: This will identify the Subnet mask of the controller. The Subnet mask must be in the "xxx.xxx.xxx.xxx" format.

- IP Gateway: This will identify the IP gateway of the controller. The IP gateway must be in the "xxx.xxx.xxx.xxx" format.
- RS485 Host port baud: This will set the baud rate for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

1200	14400	57600	460800
2400	19200	76800	921600
4800	28800	115200	
9600	38400	230400	

- RS485 Host port mode: This will set the mode for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The options are **Modbus** and **Modbus master**.
- Address: This will set the address for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The range is **1** – **247**.
- RS232 Slave port baud: This will set the baud rate for slave port communications. The list of options is:

1200	14400	57600	460800
2400	19200	76800	921600
4800	28800	115200	
9600	38400	230400	

- RS232 Slave port mode: This will set the mode for slave port communications. The list of options is **Modbus master** and **Modbus slave**.
- RS232 host port baud: This will set the baud rate for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

1200	14400	57600	460800
2400	19200	76800	921600
4800	28800	115200	
9600	38400	230400	

- RS232 host port mode: This will set the mode rate for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The options are **Modbus**, **Cal Terminal**, and **Modbus master**.
- USB Slave port baud: This will set the baud rate for the USB host port. The list of options is:

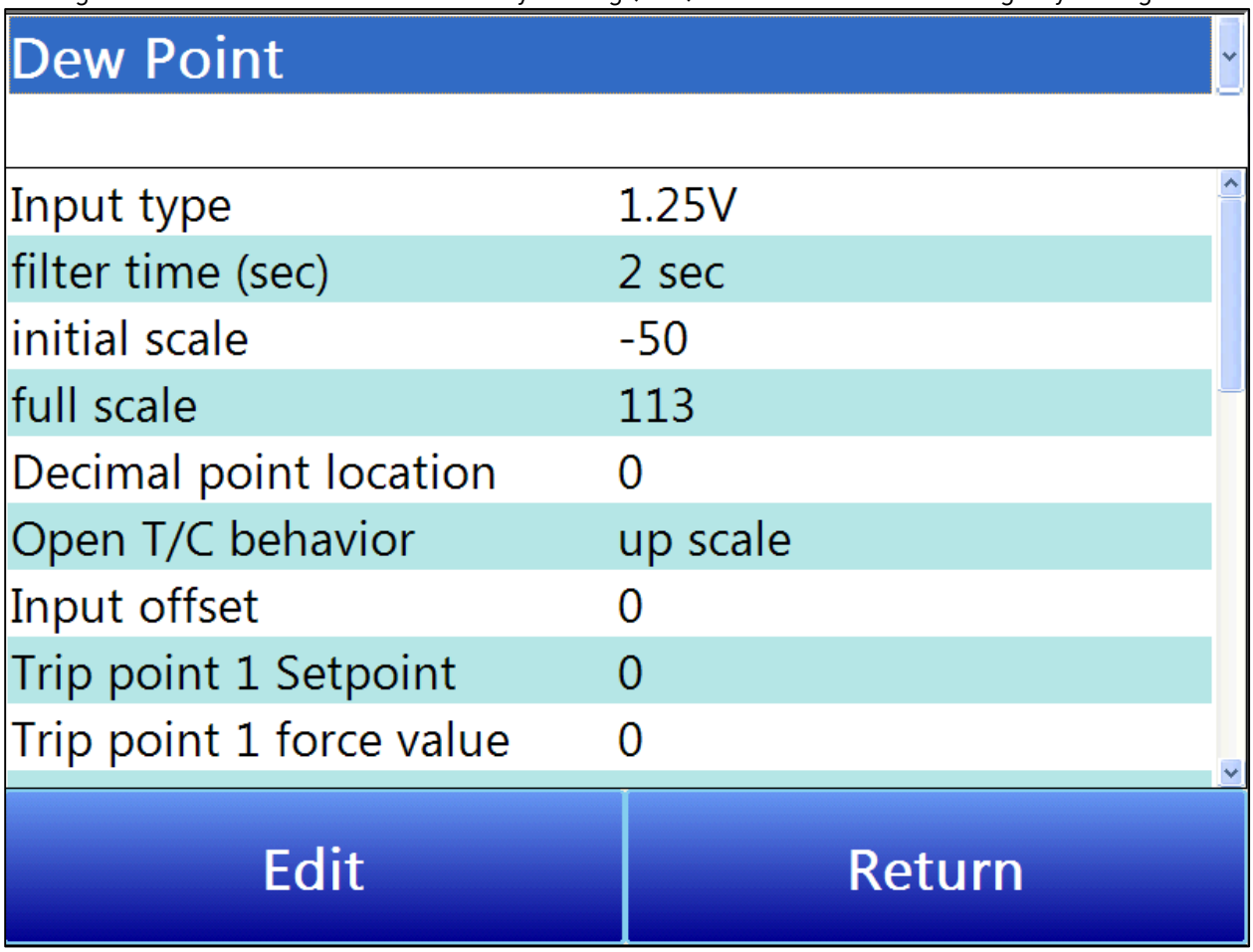
1200	14400	57600	460800
2400	19200	76800	921600
4800	28800	115200	
9600	38400	230400	

- USB Slave port mode: This will set the mode for the USB host port.
- Subprocessor slave baud: *Internal setting – should not be changed except at the direction of SSi.*
- Subprocessor slave mode: *Internal setting – should not be changed except at the direction of SSi.*
- PLC Type: The list of options is:

Micrologix Modbus	DF1 Slik
MCMmodule Modbus	Passive
DF1 PLC5	

Analog Input

The controller has 24 analog inputs. Each of the inputs comes with a factory default configuration dependent on the application. It can be modified prior to shipment to your facility or in the field by a technician or qualified/trained person with the proper security code. Before connecting your input source to the terminals, please verify that the input type is set up correctly. If the Input Type is not correct, do not connect the input source to the terminals, as damage can occur. Please consult SSi by calling (513) 772-0060 before making any changes.



The following inputs can be selected from the drop down menu at the top of the screen.

- Dew Point
- Tube #1 Temperature
- Air Flow
- Gas Flow
- Analog Input 5
- Trim Flow
- Header Pressure
- Outlet Temperature
- Analog Input 9 - 24

The following options can be selected for each input.

- Input type: The thermocouple type for most applications can be modified depending on your specific needs. *Note - some of the inputs DO NOT allow the user to modify the Input type*. To change the Input type, first select which input you want to change by selecting it in the pull-down at the top of the screen. The following is a list of the options:

T/C B	T/C T	20 mV
T/C C	T/C D	4-20mA (62 Ω), 10:1
T/C E	T/C G	4-20mA (124 Ω)
T/C J	T/C P	4-20mA (62 Ω)
T/C K	2.5V	625 mV
T/C N	1.25V	25V
T/C NNM	160 mV	12.5V
T/C R	80 mV	781.25mV
T/C S	40 mV	195.3125mV

- Filter time (sec): The filter time is a factory applied averaging tool used to help maintain steady control in high EMI environments. The filter time should not be adjusted without consulting SSI. Clicking on this value will display an input box from which the user can select a new value.
- Initial scale: This is the initial scale value. This could also be referred to as the starting value. For example, the initial value is the value when 0 volts is on the selected input; or on a 4-20 mA input, it would be the value at the selected input of 4 mA. Clicking on this value will display an input box from which the user can select a new value.
- Full scale: This is the full scale value. Clicking on this value will display an input box from which the user can select a new value.
- Decimal point location: This is the decimal point location value. This will affect the PV value and the location of the decimal when it is displayed. Clicking on this value will display an input box from which the user can select a new value.
- Open T/C behavior: This is the open TC value. The options are: **up scale**, **down scale**, **one trip point**, and **two trip points**.
- Input offset: The input offset value is algebraically added to the input value to adjust the input curve on read-out.

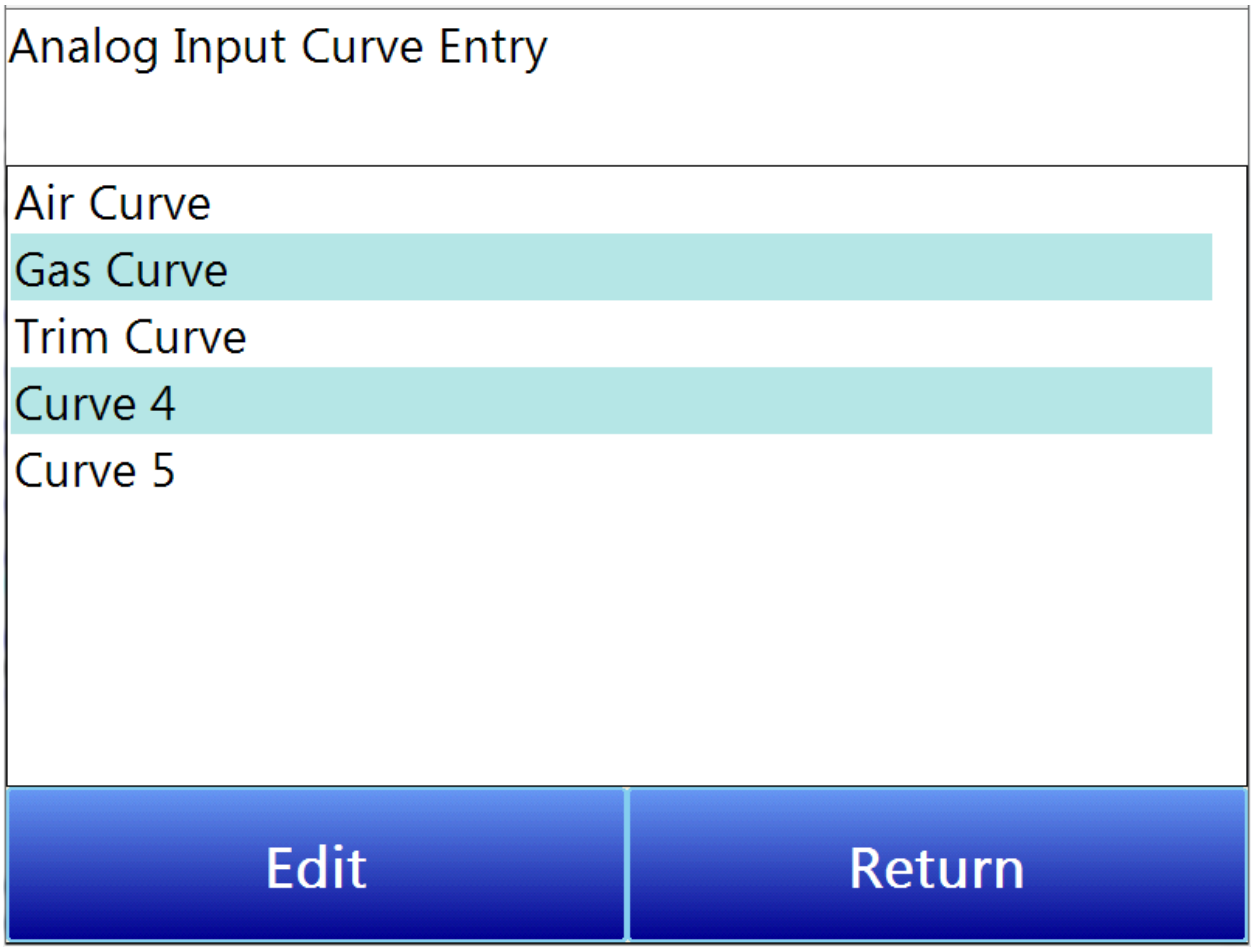
> **TRIP POINT EXPLANATION:** Setting a trip point will force the value that the controller uses for calculations to a certain value as assigned by the operator. Once the **Trip Point Setpoint** is reached, the controller will begin reading the value as the **Trip Point Force Value,** regardless of what the actual value is inside the furnace. The **Trip Point Direction** allows the operator to choose whether the controller will alter its reading when the trip point is either above or below the setpoint.

- Trip point 1 Setpoint: This is the trip point 1 setpoint value.
- Trip point 1 force value: This is the trip point 1 force value.
- Trip point 1 direction: This is the trip point 1 direction. The options are: **input above setpoint** or **input below setpoint**.
- Trip point 2 Setpoint: This is the trip point 2 setpoint value.
- Trip point 2 force value: This is the trip point 2 force value.

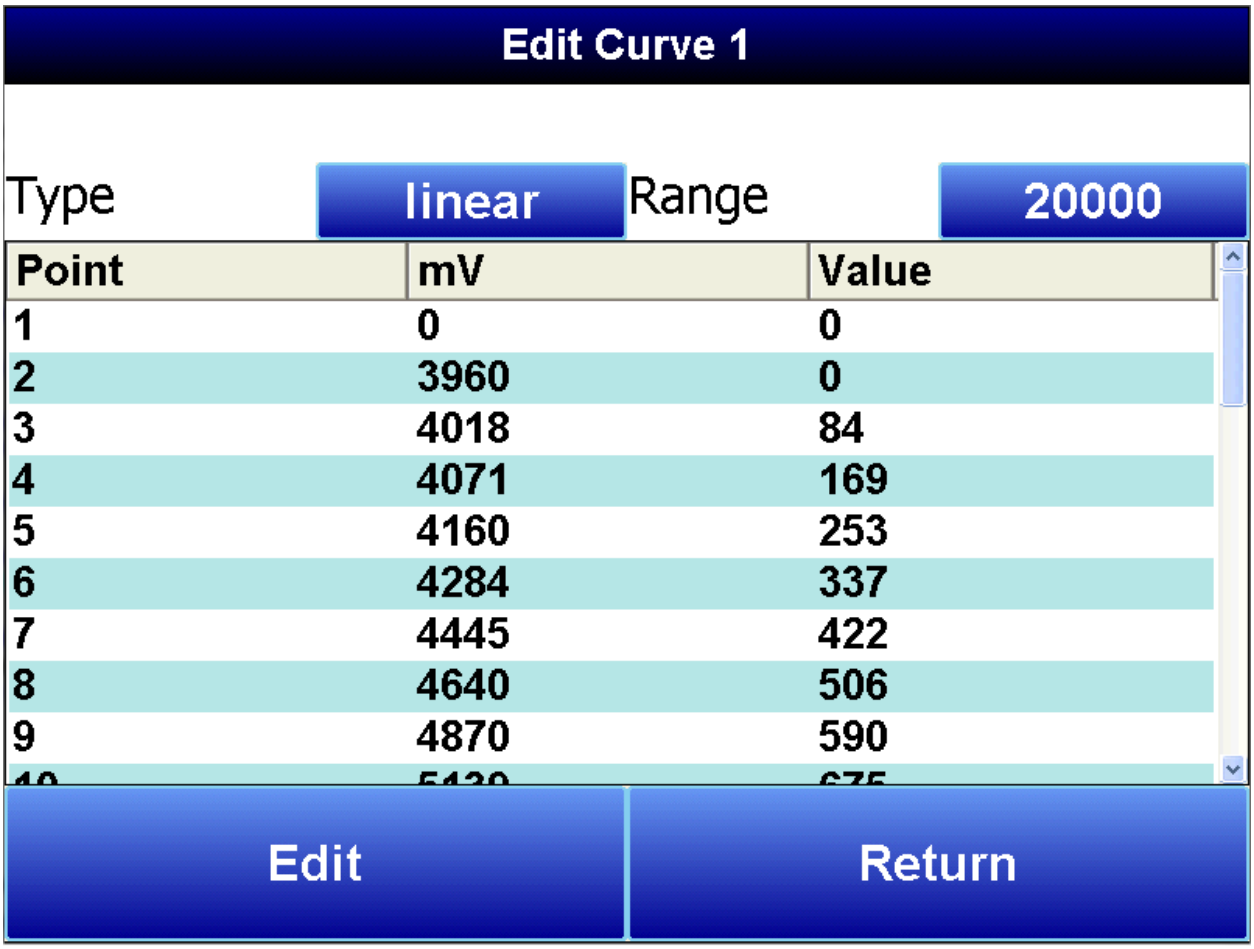
- Trip point 2 direction: This is the trip point 2 direction. The options are: **input above setpoint** or **input below setpoint**.
- High alarm setpoint: This is the setpoint for the high input limit.
- High alarm hysteresis: This is the hysteresis for the high input limit.
- High Alarm Smart: A smart alarm is an alarm that works with a Process Variable (PV), and, when enabled, it will not be active until the PV is within band of the setpoint. The alarm sounding - if active - will be disabled until within the SP band. When it is in band, the alarm will go active unless on delay time is set.
- High Alarm Critical: Determines whether the alarm is critical (**Yes**) or not critical (**No**)
- High alarm delay: The delay (in seconds) before the high alarm is generated.
- Low alarm setpoint: This is the setpoint for the low input limit.
- Low alarm hysteresis: This is the hysteresis for the low input limit.
- Low alarm Smart: A smart alarm is an alarm that works with a Process Variable (PV), and, when enabled, it will not be active until the PV is within band of the setpoint. The alarm sounding - if active - will be disabled until within the SP band. When it is in band, the alarm will go active unless on delay time is set.
- Low alarm Critical: Determines whether the alarm is critical (**Yes**) or not critical (**No**)
- Low alarm delay: The delay (in seconds) before the low alarm is generated.
- Hi limit alarm for control shutdown setpoint: This is the high setpoint used to shut down the PID loop if this input is selected in the PID Control shutdown inputs.
- Hi limit alarm for control shutdown hysteresis: This is the hysteresis applied to the corresponding setpoint (described above).
- T/C Correction Curve: This will allow the user to set the T/C correction curve. The options are **No** and **Yes.**

Analog Input Curve Entry

Most types of inputs are already setup with a curve built for each type of application. However, if an application calls for an input without a standard curve, the curve can be built using this option. Voltages can be paired with corresponding values to create a sensor curve based on a provided equation or data. This allows the controller to make appropriate readings from the sensor.



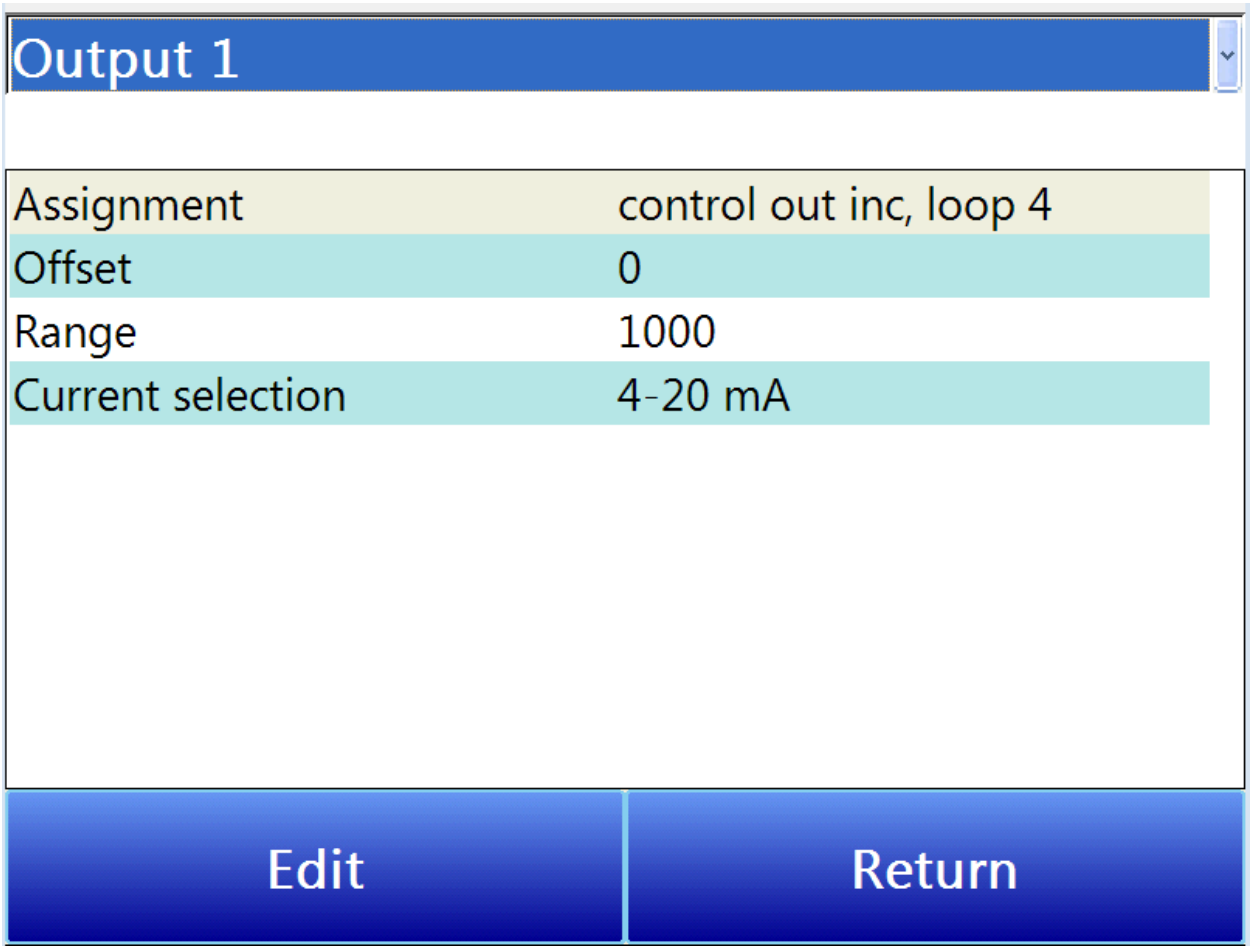
The first screen shows that five separate curves can be edited. Selecting one of Curve 1-5 and pressing Edit will display the screen where new curves can be assigned. The type can be toggled between Linear and None.



Thirty-two points can be assigned by selecting one of the points and pressing Edit. This allows the operator to change the Millivolts and the corresponding Value by clicking on each option. Pressing OK will save the point. Note that all 32 points do not need to be entered; however, the more points that are entered, the more precise the calculated value will be. Any values that are not entered should be set to values beyond (above or below) the ranges entered.

Analog Output

The controller has the option of up to 16 analog outputs. The outputs are ranged for a 4 – 20 milliamp signal or a 0 – 20 milliamp signal. Each output comes with a factory default configuration dependent on the application. Each output can be modified prior to shipment to your facility or in the field by a supervisor.



The following outputs can be selected from the drop down menu at the top of the screen.

- Tube #1 Heat
- Coarse Adjust
- Trim Adjust
- Mixer Pump VFD
- Analog Output 5 - 16

The following options can be selected for each output.

- Assignment: The analog output assignment can be modified depending on your system requirements. To change the Assignment, first select which analog output you want to change by selecting it in the pull-down menu at the top of the screen. The following is a list of the options:

No selection	*For all loops 1 – 16:*	**Calculated value 1 – 6**
	Control out inc, loop *x*	**Master set point 1 – 4**
	Control out dec, loop *x*	***RPS Select 1-8**
	Control out combo, loop *x*	**Flow Meter 1-8 setpoint**
	Process variable, loop *x*	**Flow Meter 1-8 Output**
	Set point, loop *x*	
	Input, loop *x*	

- Offset: This is the starting point, the Process Variable value at which you get 4 milliamps if the output is set up as 4-20mA (or 0 milliamps if output is set up as 0-20mA). Clicking on this value will display an input box from which the user can select a new value. The range is **–32768** to **32767**.
- Range: This is a Process Variable value between 4 and 20 milliamps (or 0 and 20 milliamps, depending on setup). Clicking on this value will display an input box from which the user can select a new value. The range is **–32768** to **32767**.
  Note: The range, although not displayed with a decimal point, contains a decimal point that is dependent on the process variable selected. For example, if the offset is 20 mV for 4 mA, and you want 100 mV to be 20 mA, then your range should be 80. If the process variable is temperature, then the range will be 80, since temperature PVs do not have a decimal. If the PV is % Carbon, then the range will need to include the two decimal points for % Carbon. So, a range of 80 will be entered as 8000.
- Current Selection: Provides the option of **4-20 mA** or **0-20 mA** control. Clicking on this value will display an input box with a drop-down list from which the user can select either of the two values listed above.

Offset and Range when assigned to a control loop
Inc : 0 = 4mA, 100 = 20mA
Dec : 0 = 4mA, -100 = 20mA

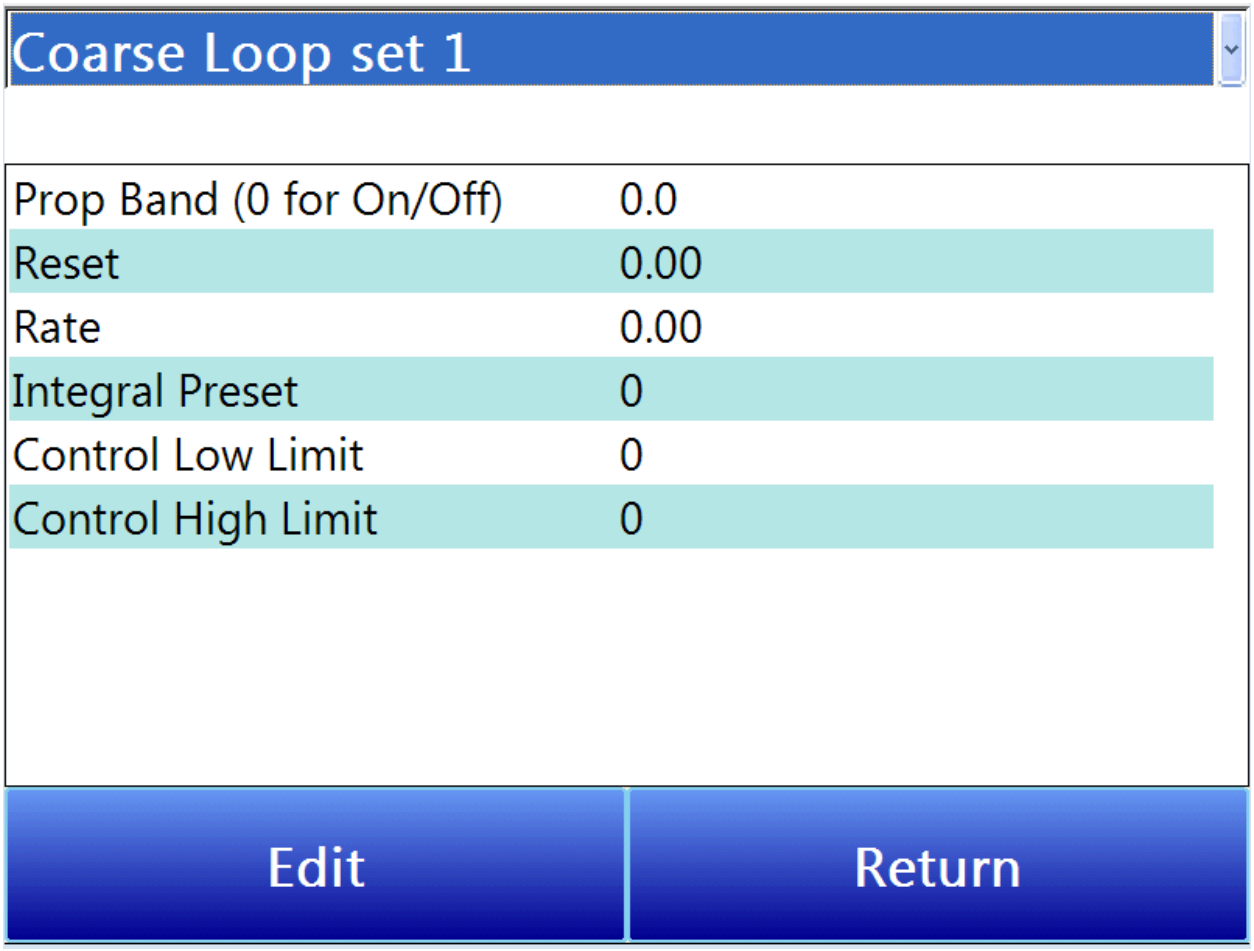
Example: if 4 – 20 mA = 800 mV - 1200 mV
Offset = 800 (starting point)
Range = 400

Alternate PID

IMPORTANT!

PID Auto Switching must be enabled in the PID Loop Setup menu before Alternate PID Setup settings will be applied.

The Alternate PID Setup menu option allows for additional sets of PID values to be configured. There is a choice of multiple alternate PID loops: **Coarse Loop set 1 – 3, Dew Point Trim set 1 – 3, Pressure set 1 – 3, Tube 1 set 1 – 3, Tube 2 set 1 – 3, Tube 3 set 1 – 3, Loop 7 set 1 – 3, Loop 8 set 1 – 3, Loop 9 set 1 – 3, Loop 10 set 1 – 3, Loop 11 set 1 – 3, Loop 12 set 1 – 3, Loop 13 set 1 – 3, Loop 14 set 1 – 3, Loop 15 set 1 – 3, Loop 16 set 1 – 3, PID 1 – 52.** The first 48 loops are for up to 3 alternate PID loops for each primary loop. The remaining loops can be used by Generic PID Switching.



Settings for each loop are as follows.

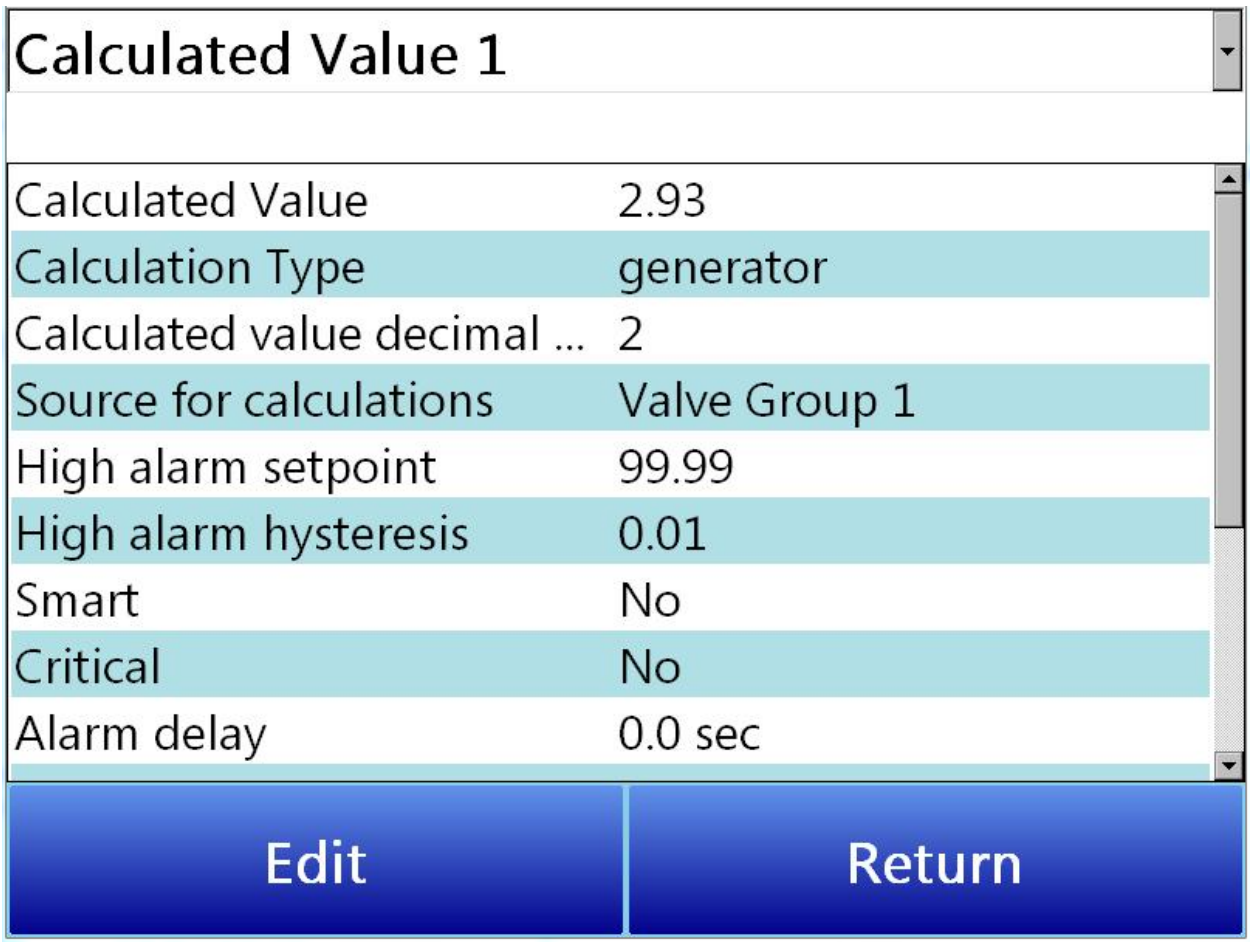
- Prop Band (0 for On/Off): Proportional Band determines the response to the current error. The Proportional Band is the percent of the range of the process variable that will produce 100% output and is the inverse of the proportional gain. A low Proportional Band value results in a larger change in output for a given error. Conversely, a high Proportional Band value results in a smaller change in output for a given error. If the Proportional Band is too small, control may oscillate or be otherwise unstable. If the Proportional Band is too large the control action may be too sluggish in response to changes within the system. Note: If the Proportional Band is set to 0.0, only on/off control is performed. The range is **–1.0** to **999.0**.
- Reset: Reset determines the influence of past errors. The Reset, or integral action (expressed in repeats per minute), sums the error between the process variable and setpoint over time and adds this accumulated output to the proportional output. A "proportional only" controller generally operates with steady-state error because some error is required to produce control output. The goal of integral action is to drive the steady-state error to zero and eliminate this droop. The range is **0.00** through **10.00**.
- Rate: Rate adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing

overshoot but is most often useful when trying to improve control on systems with significant and predicable lag. The range is 0.00 through 10.00. NOTE: The rate is not typically used for carbon control.

- Integral Preset: This is the integral preset value. This field provides an offset for the starting point for PID control, also referred to as "Load Line" or "Manual Reset". The range is **–100** to **100**.
- High Limit: This is the high limit value. The range is **–100** to **100**.
- Low Limit: This is the low limit value. The range is **–100** to **100**.

Calculated Values

The AutoGen Controller has 8 calculated value structures that can be individually set up to calculate different Process Variables.



Options for each calculated value (1 through 6) are as follows:

- Calculated Value: The result of the coarse air/gas ratio calculation.
- Calculation Type: This sets the type of calculation performed. The first calculated value structure in AutoGen is **generator**. Other options are **none, %C, Dew point, %O2, O2 offset log, DA,** and **K_N.**

- Calculated Value Decimal Point: The number of decimal places for display of the calculated value result. This is usually forced by the calculation type. For AutoGen the air/gas ratio has 2 decimal places.
- Source for Calculations: The source of the data used in the calculations. For AutoGen, this is **valve group 1**, which includes the flow meters for air, gas, and trim gas.
- High Alarm Setpoint: The calculated value at or above which the alarm becomes active.
- High Alarm Hysteresis: An amount subtracted from the High Alarm Setpoint to provide a deactivation level. The alarm will remain active until this deactivation level is reached. For example, assume the High Alarm Setpoint is 1300 and the High Alarm Hysteresis is 2. Assume the process has reached 1300, activating the alarm. In this condition, the alarm will deactivate when the process reaches 1298 or below.
- Smart: When Smart is set to **Yes**, the alarm condition must be in the "safe zone" to be armed. If, on startup, the calculated value is in an alarm condition, but the alarm is smart, then no alarm will occur.
- Critical: Critical also refers to latching. If this is set to **Yes**, then once the alarm has occurred, it will latch and stay in the alarm condition even if the calculated value return to the safe region. A critical alarm must be acknowledged to unlatch it.
- Alarm Delay: A value (in seconds) that determines the amount of time that the Calculated Value must be in the alarm state before the alarm is annunciated.
- Low Alarm Setpoint: The calculated value at or below which the alarm becomes active.
- Low Alarm Hysteresis: An amount added to the Low Alarm Setpoint to provide a deactivation level. The alarm will remain active until this deactivation level is reached. For example, assume the Low Alarm Setpoint is 1400 and the Low Alarm Hysteresis is 2. Assume the process has reached 1300, activating the alarm. In this condition, the alarm will deactivate when the process reaches 1302 or above.
- Smart: Smart: When Smart is set to **Yes**, the alarm condition must be in the "safe zone" to be armed. If, on startup, the calculated value is in an alarm condition, but the alarm is smart, then no alarm will occur.
- Critical: Critical also refers to latching. If this is set to **Yes**, then once the alarm has occurred, it will latch and stay in the alarm condition even if the calculated value return to the safe region. A critical alarm must be acknowledged to unlatch it.
- Alarm Delay: A value (in seconds) that determines the amount of time that the Calculated Value must be in the alarm state before the alarm is annunciated.
- Calculation Factor: The calculation factor is different for different calculation types. See the table below.

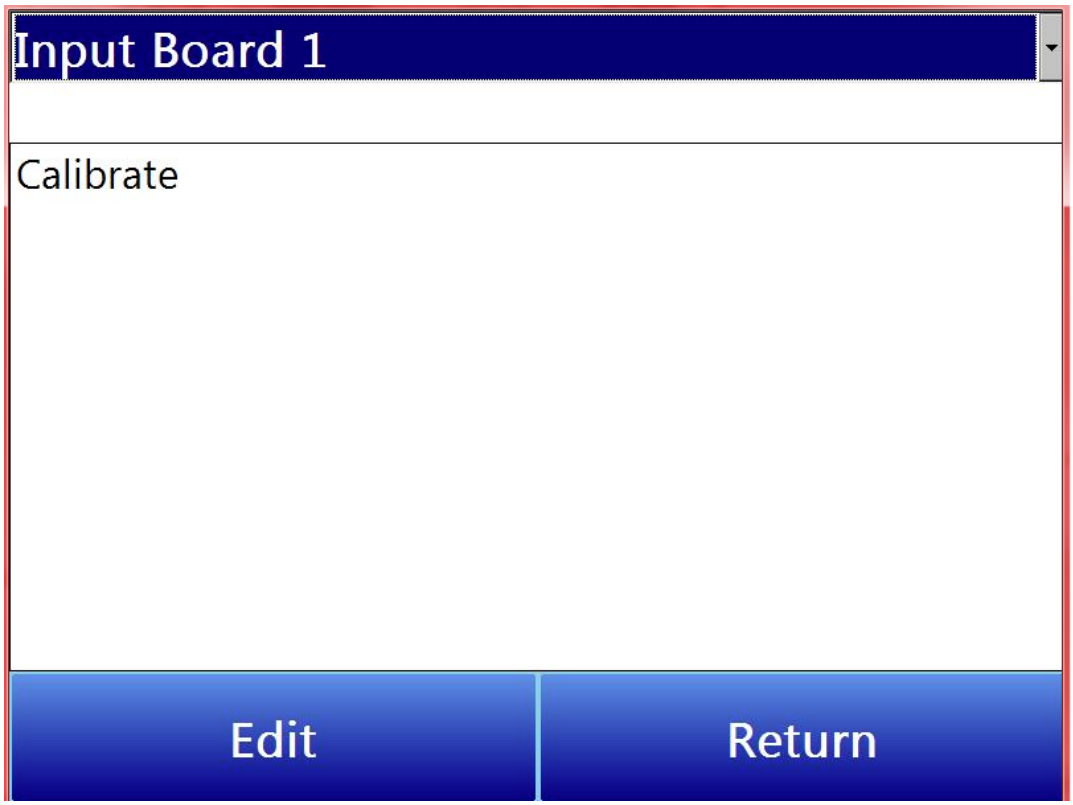
If the Calculation Type is:	Then the Calculation Factor can be entered as this value:
%C	% CO
Dew Point	% H2
Generator	Coarse Ratio Setpoint for Controlling the Air/Gas Ratio

Calibration

Analog Input Calibration

Analog Input Calibration provides you with options for performing a zero and span calibration of the analog inputs, as well as adjusting the analog input cold junction.

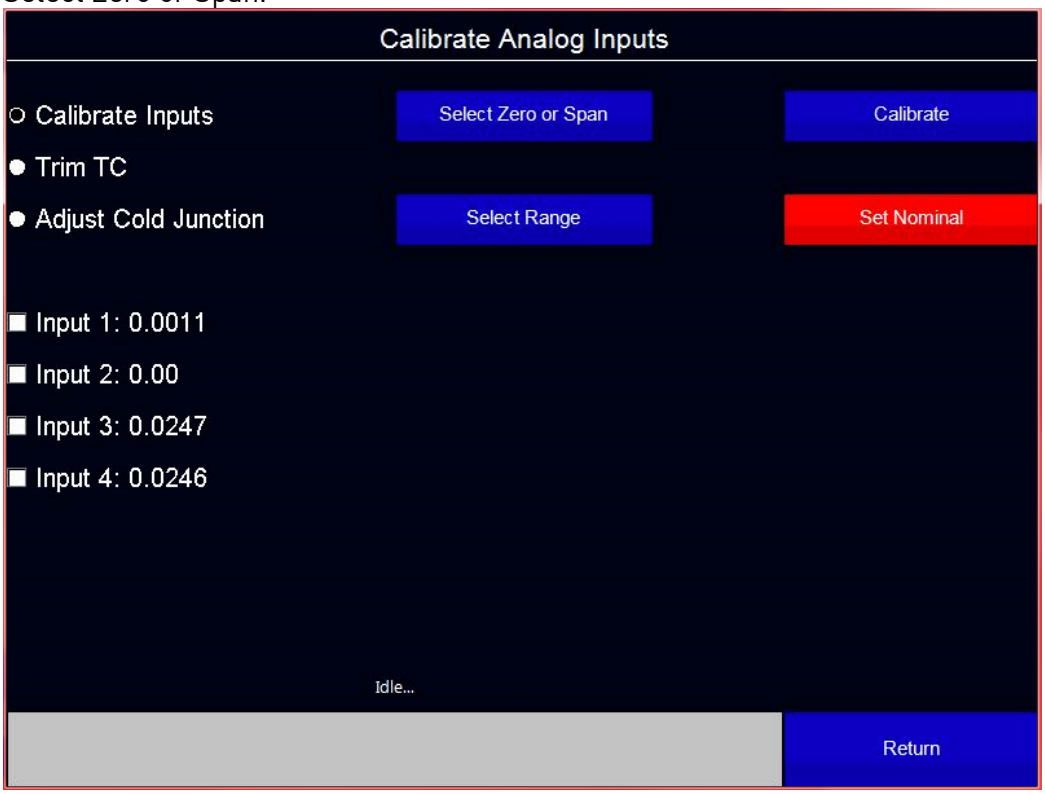
When this option is selected, a screen will appear in which you will select which input board calibration will be performed on. This screen is pictured below. Select the input board from the drop-down menu at the top of the screen. Tap Calibrate, and then tap Edit to continue.



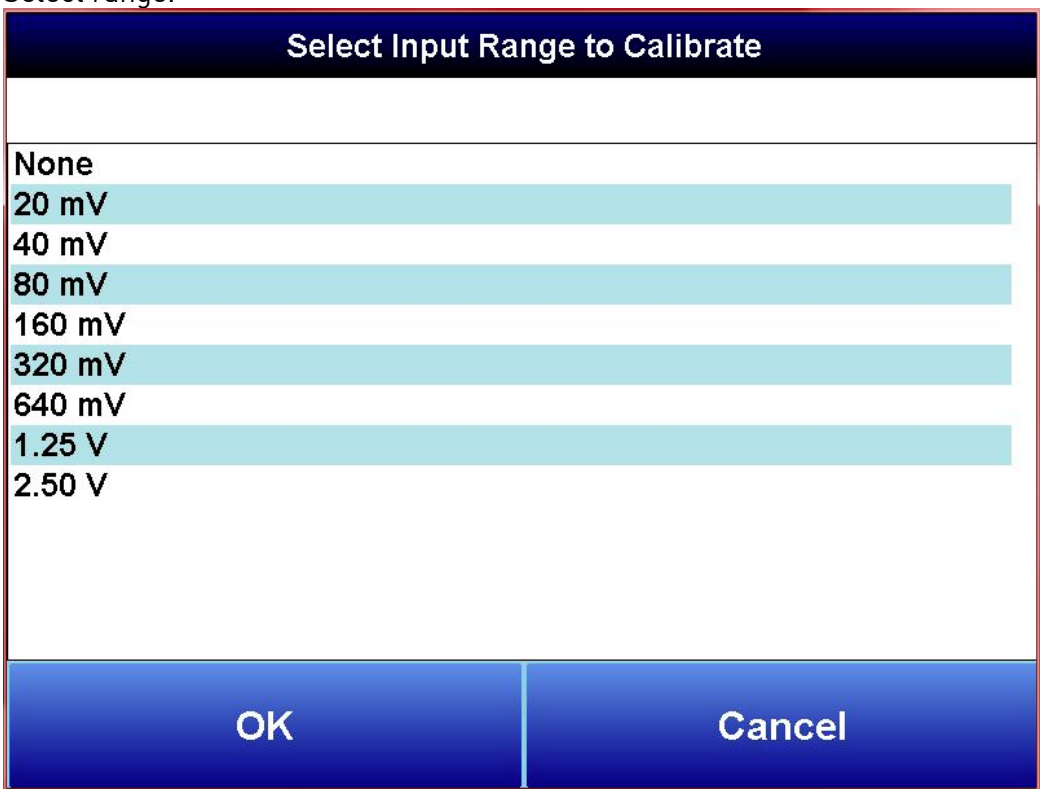
Analog Input Zero/Span Calibration (Calibrate Inputs)

These are the steps to follow when performing a zero or span calibration on the analog inputs.

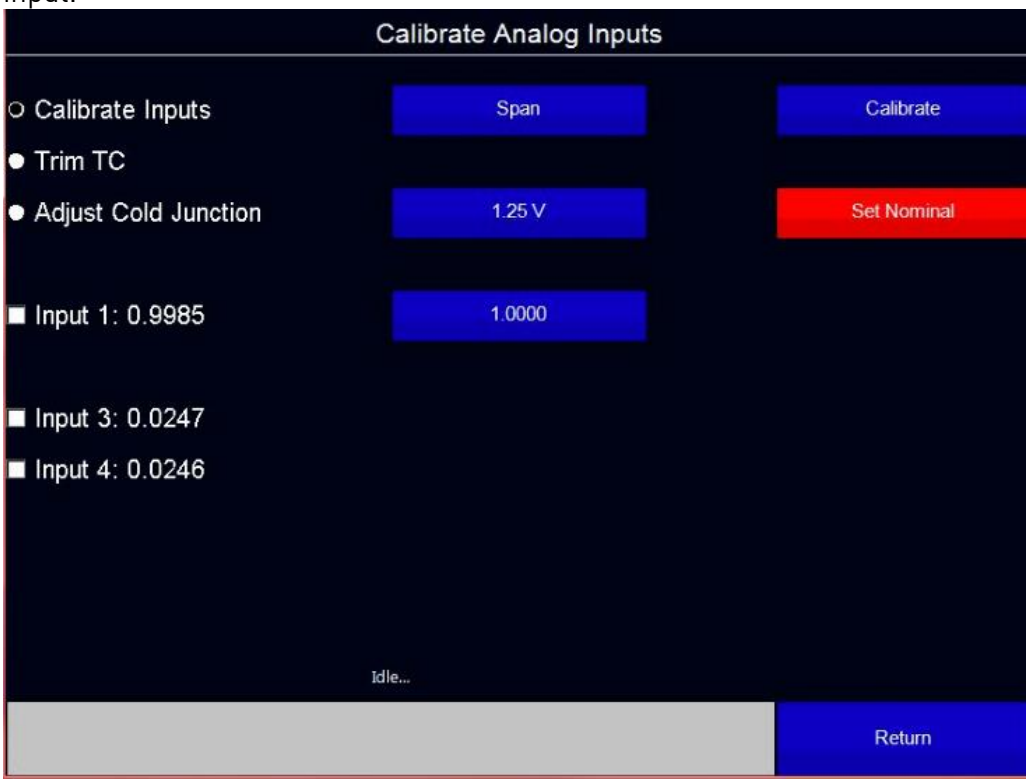
1. Select Zero or Span.



2. Select range.



3. Check the inputs that will be receiving the signal (the inputs will be filtered based on the input range selected in step two so that only relevant inputs can be calibrated).
   Note: The value to the right of the input label will update with the signal seen at the input.



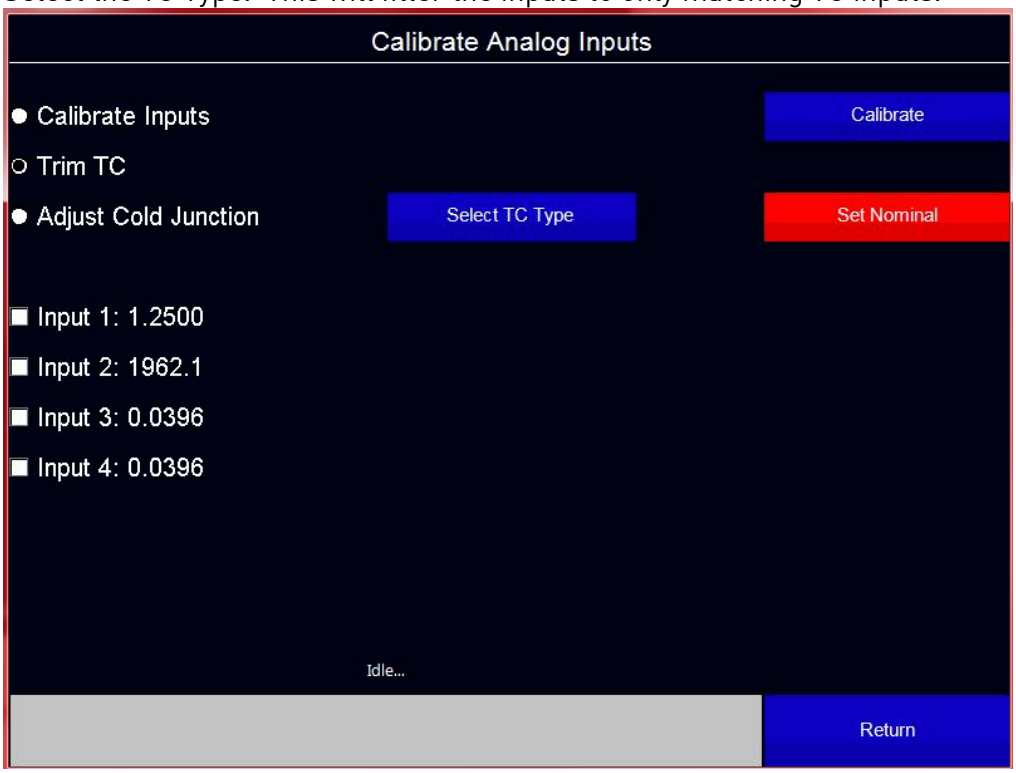
4. If Span calibration is selected an additional button will be below the range button. This is the suggested signal for the selected range. This value can be edited; however, this is not recommended.
5. Tap Calibrate.

Note: *Set Nominal* will restore the inputs to the factory settings.

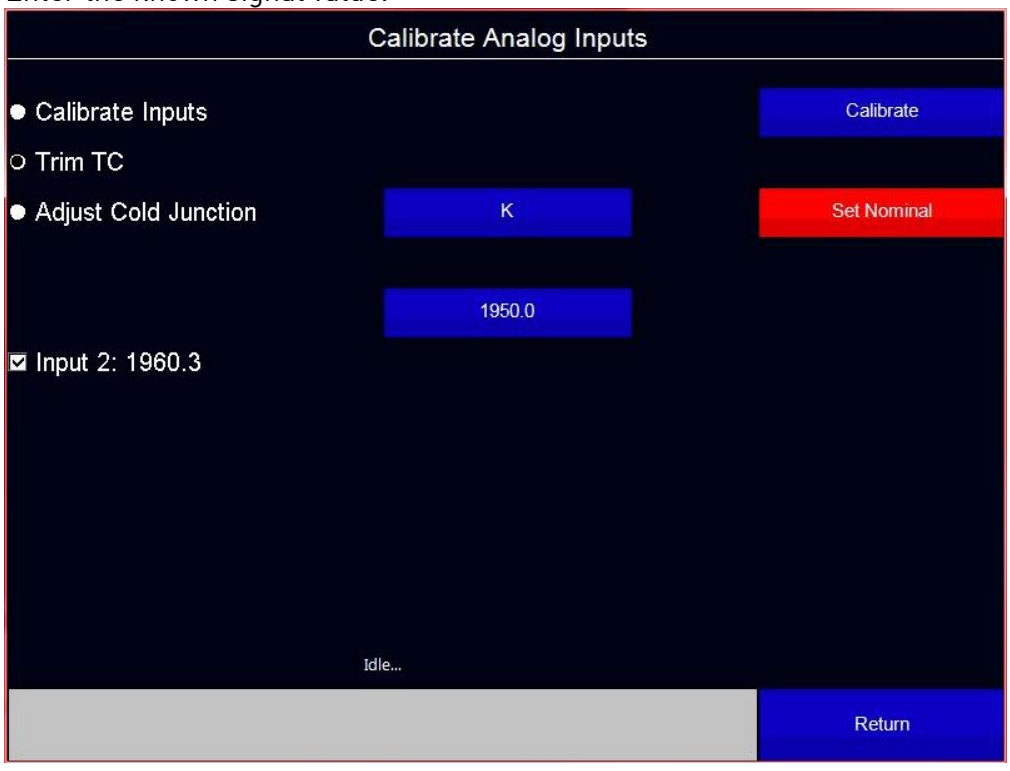
Analog Input Cold Junction Adjustment (Trim TC and Adjust Cold Junction)

Trim TC will automatically adjust the cold junction to make the displayed reading match the known source.

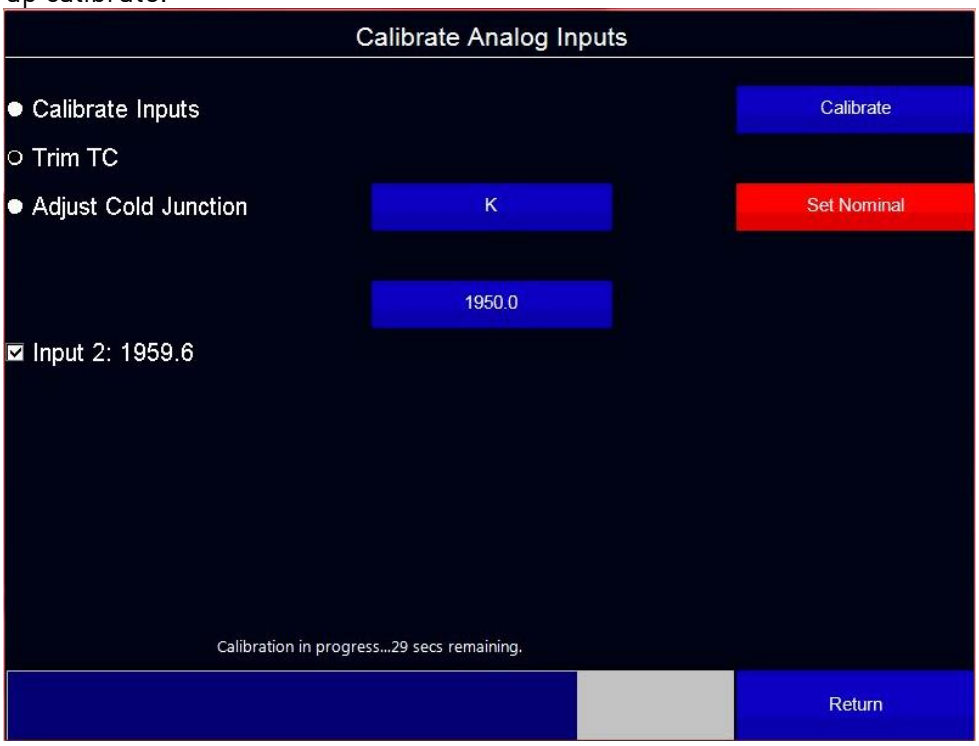
1. Select the TC Type. This will filter the inputs to only matching TC inputs.



2. Enter the known signal value.

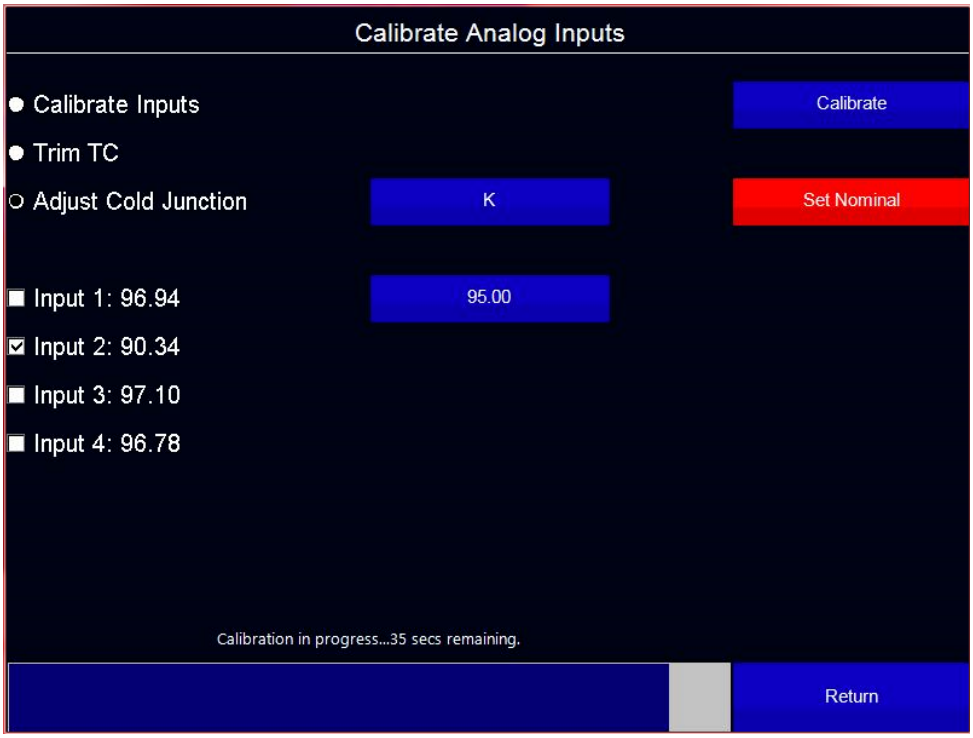


3. Tap calibrate.



Adjust Cold Junction allows the user to directly adjust the temperature of the cold junction at the terminals where the TC connects to the AutoGen.

1. Select the TC type.
2. Enter the measured Cold Junction temperature at the terminals.

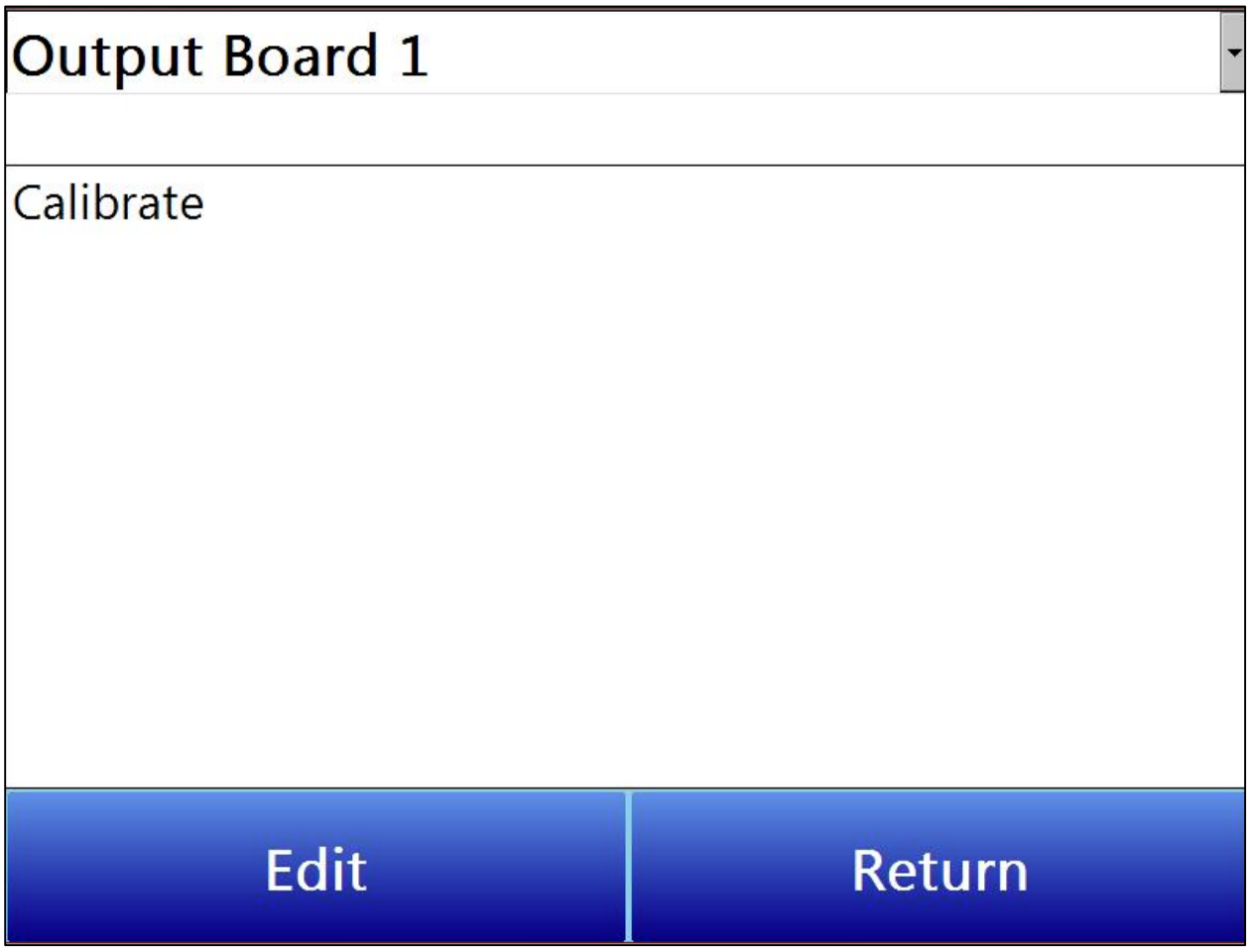


3. Tap Calibrate.

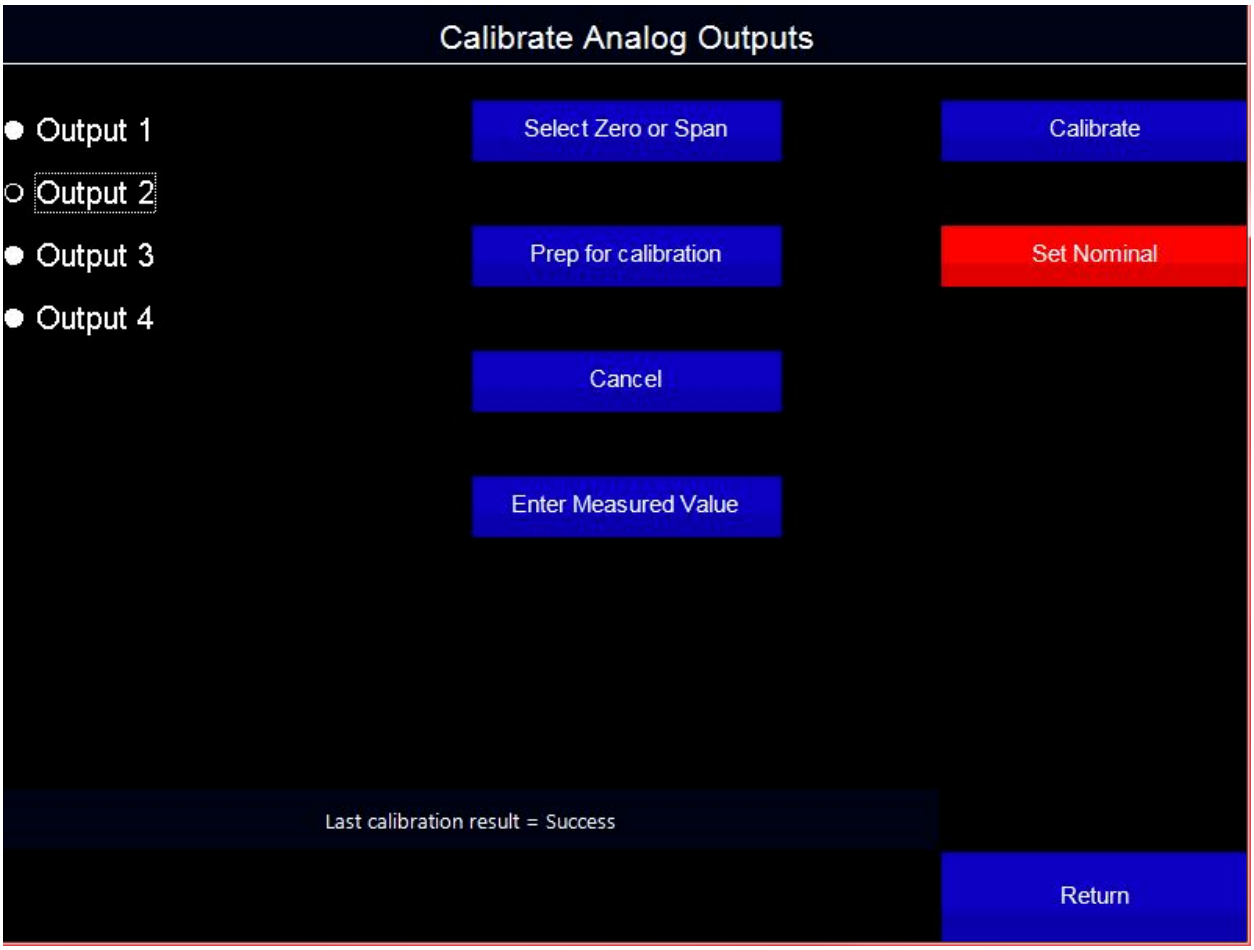
Analog Output Calibration

Analog Output Calibration provides you with options for performing a zero and span calibration of the analog outputs.

When this option is selected, a screen will appear in which you will select which board calibration will be performed on. This screen is pictured below. Select the board from the drop-down menu at the top of the screen. Tap Calibrate, and then tap Edit to continue.

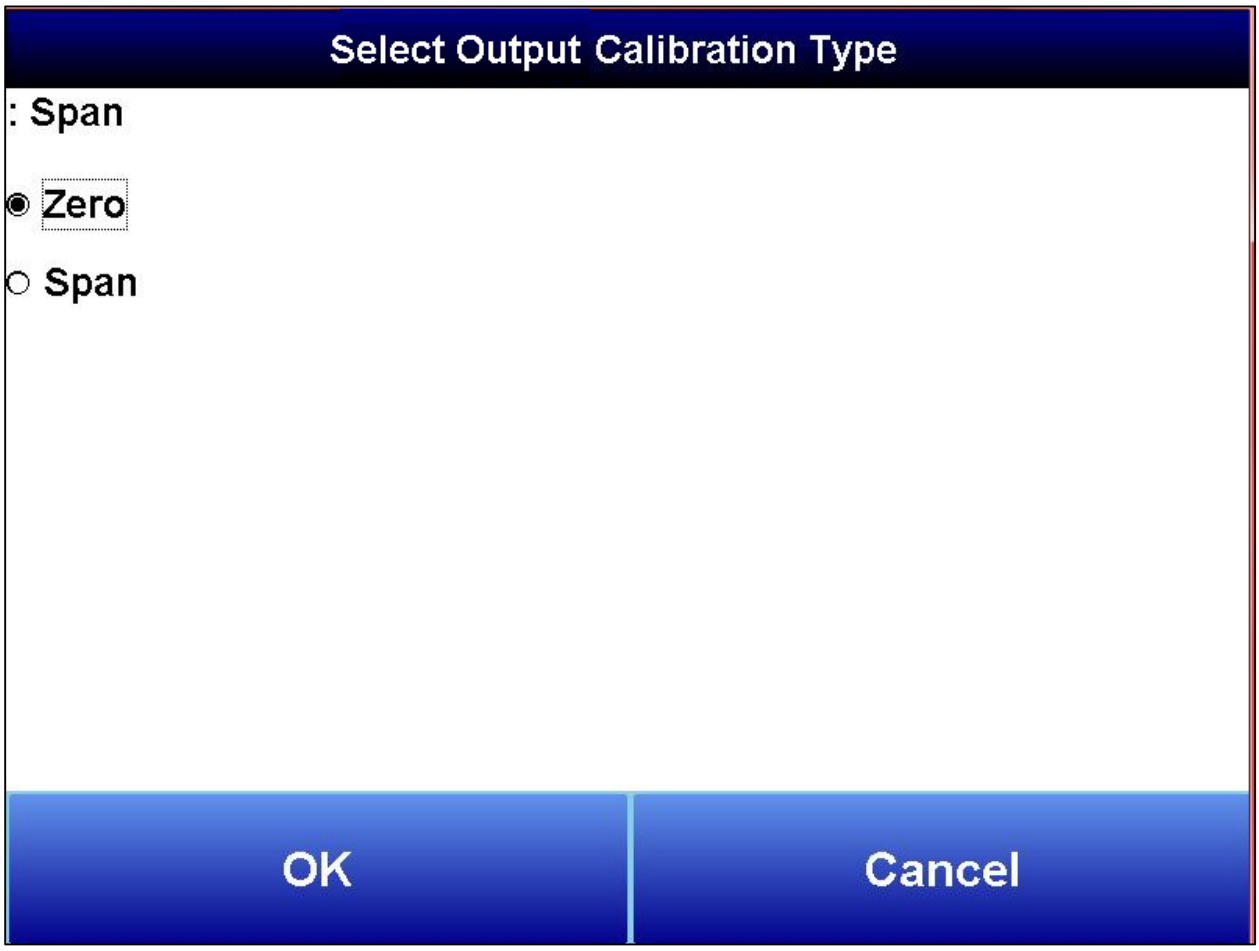


The Calibrate Analog Outputs screen will appear. This screen is shown below.



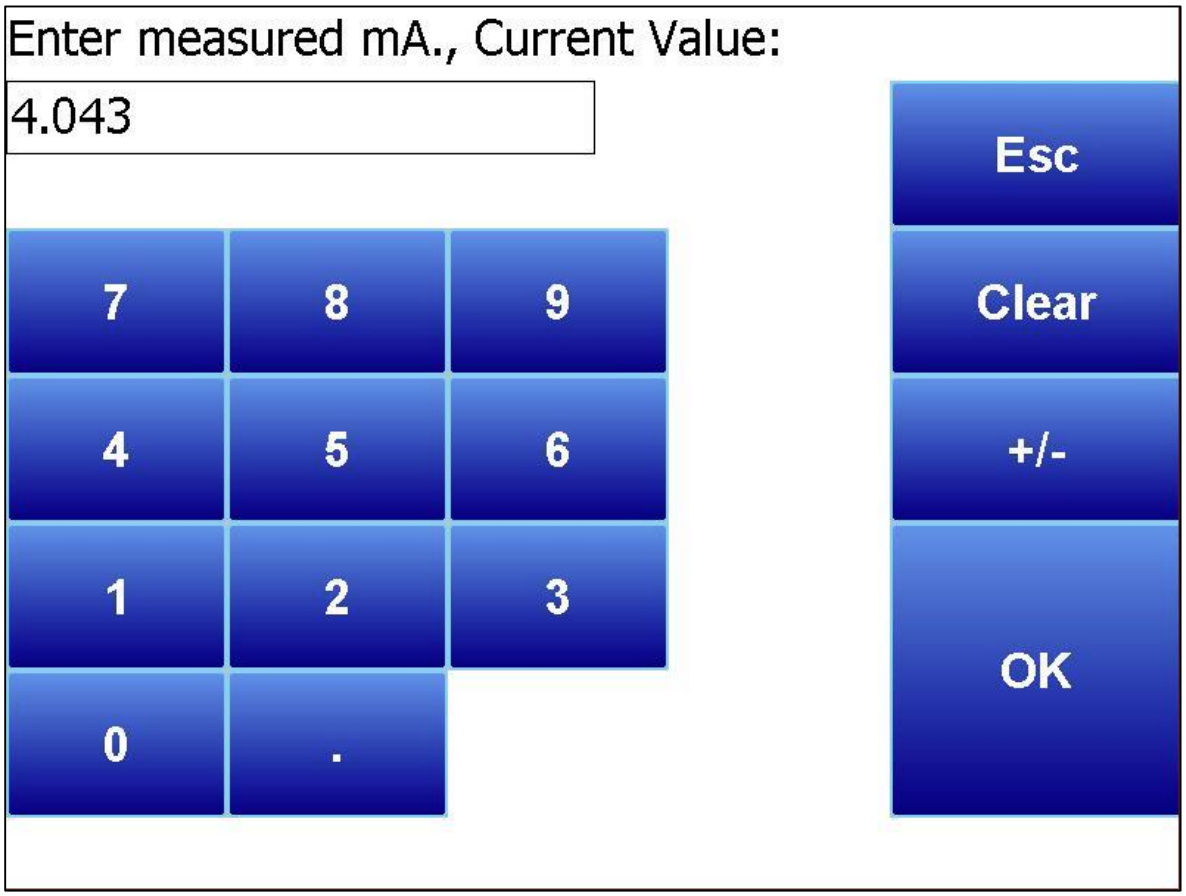
From the Calibration Analog Outputs screen, follow these steps:

1. Select the output to calibrate (1-4).
2. Select Zero or Span using the Select Zero or Span button.



3. Tap Prep for calibration. This causes the analog output to generate the minimum or maximum output (4 or 20 mA).

4. Measure the current at the output terminals and enter that value using the Enter Measured Value button under the Cancel button.



Note: Cancel will undo the prep for cal at any time.

5. Tap Calibrate to complete the calibration.

Note: Set Nominal is only used in the event that a mistake was made during calibration. Set Nominal will reset the board to its factory default calibration. It will take up to a minute for this process to finish. All four outputs will be reset (not just the selected output).

Valve Setup

The Valve Setup menu allows you to change settings for up to 8 valves controlled by the Autogen. Valves are selected from the dropdown menu. The first three valves are set by default as Air, Gas, and Trim. Valves 4-8 are unnamed. The following options are available for each valve:

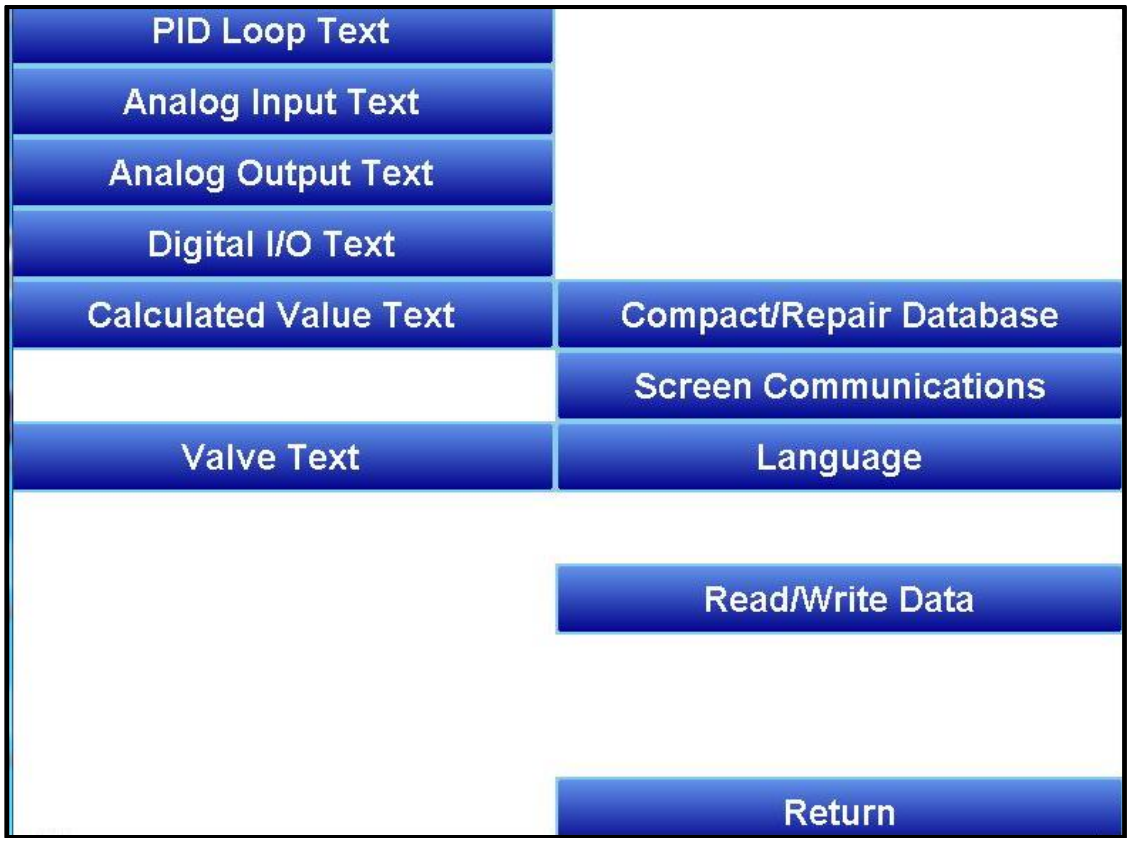
- Flow (View-only): The current flow rate through the valve. Note that applicable units can be changed through the **Device Setup** menu.
- Flow setpoint: The desired setpoint for the flow rate.
- Flow zero: The desired low end of the flow rate range.
- Flow span: The difference between the upper and lower flow range.
- Valve Maximum: The maximum flow rate for the valve.
- Valve trim enable: Enables the valve trim functionality. Settings are **Yes** and **No**.
- Target setpoint:
- Valve trim range: The amount of change that the valve trim will be capable of producing.
- Decimal point location: This will affect the value and the location of the decimal when it is displayed. The number entered will move the decimal point that many spaces to the left. (For example, if Decimal point location is set to 1, a reading of 2590 would become 259.0)

- Alarm deviation SP: Sets the range beyond which an alarm will be triggered.
- Alarm delay (sec): The desired delay before an alarm will sound. The delay is measured in tenths of a second.
- Flow source: The source for the flow measurement. Options are ***Direct write**, ***Slave Instrument 21**, **misc**, **Endo**, **N2**, **Aux Inputs 1-24**, and **Analog Inputs 1-24**.
- Curve: Sets an applicable Flow Curve. Options are **Curves 1-40** and **None**.
- Gas Type: Sets the appropriate gas type. Options are **DA**, **NH_3**, **misc**, **Endo**, **N_2**, and **CO_2**.
- Valve setpoint mode: Determines what area of the system will be tracked to control the valve. Options are: **no action, track total flow, track NH_3, track Coarse Loop Output, track Dew Point Trim Output, track Pressure Output, track Tubes 1-3 Output, and **track Loops 7-16 Output .**
- Valve setpoint tracking %: Sets what percentage that the Valve setpoint mode will factor into valve control.
- Control output device: Determines how output will be controlled. Options are **no action** and **stepping motor control**.
- Low Flow SP: Adjusts the setpoint for low flow levels.
- Normal Flow SP: Adjusts the setpoint for normal flow levels.
- Flow Gain: This is used if the Matrix has control of the valve (i.e. not using an eFlo to control the flow rates). The gain is used to control the valve speed.
- Flow Control Out: View only. If the matrix has control of the valve (i.e. not using an eFlo to control the flow rates), this is the Matrix's %Output for the valve control.
- Flow Control Run: View only. If the matrix has control of the valve (i.e. not using an Eflo to control the flow rates), this is the Matrix's Run Command (Stop, Run) for the valve if it is a stepper-style valve motor.
- Flow Control Direction: View only If the matrix has control of the valve (not using an Eflo to control the flow rates), this is the Matrix's Direction Command (Open/Closed) for the valve if it us a Stepper style valve motor.
- Open Limit Switch Assignment and Close Limit Switch Assignment: These options allow the user to set what factors will influence the opening and closing action of the valve. Options are:
    - None
    - Shutdown
    - Input 2
    - Mix Pump Not Faulted
    - Mixer Pump Running
    - Fire Check OK
    - Reaction Gas Not Low
    - Reaction Gas Not High
    - Mix Pump Pressure Not Low
    - Purge/BO Blower
    - Endo Pressure Not High
    - Reset/Endo Pressure Too High
    - Burnoff Pilot Flame On
    - Tubes 1-3 Not Overtemp
    - Tubes 1-3 Flame On
    - Tubes 1-3 Burner Gas On
    - Tubes 1-3 Making Gas
    - Tubes 1-3 Purge Timer

  - Start Tubes 1-3 Burner
  - Start Tubes 1-3 Burnout
  - Start Purge Tubes 1-3
  - Tubes 1-3 Cooling Fan
  - Start Purge/BO Blower
  - Outlet Pressure Relief
  - Endo Shutdown Relay
  - Outputs 7, 11-12, 16-18.
  - Coarse Valve Run
  - Coarse Valve Open
  - Trim Valve Run
  - Trip Valve Open
  - Alarm Light
  - Alarm Horn
- Minimum Flow Shut Down: View only
- Minimum % (1%-94% valid) for Variable Gain, ??????)
- Minimum Gain at Minimum %:

Security
This screen allows you to change the supervisor and administrator passcodes.

Configuration
The Configuration screen provides configuration options for AutoGen.



PID Loop Text:
This screen allows you to set specific text for naming each PID loop.

Analog Input Text:
This screen allows you to set specific text for naming each analog input.

Analog Output Text:
This screen allows you to set specific text for naming each analog output.

Digital I/O Text:
This screen allows you to set specific text for naming each digital input/output.

Calculated Value Text:
This screen allows you to set specific text for naming each calculated value.

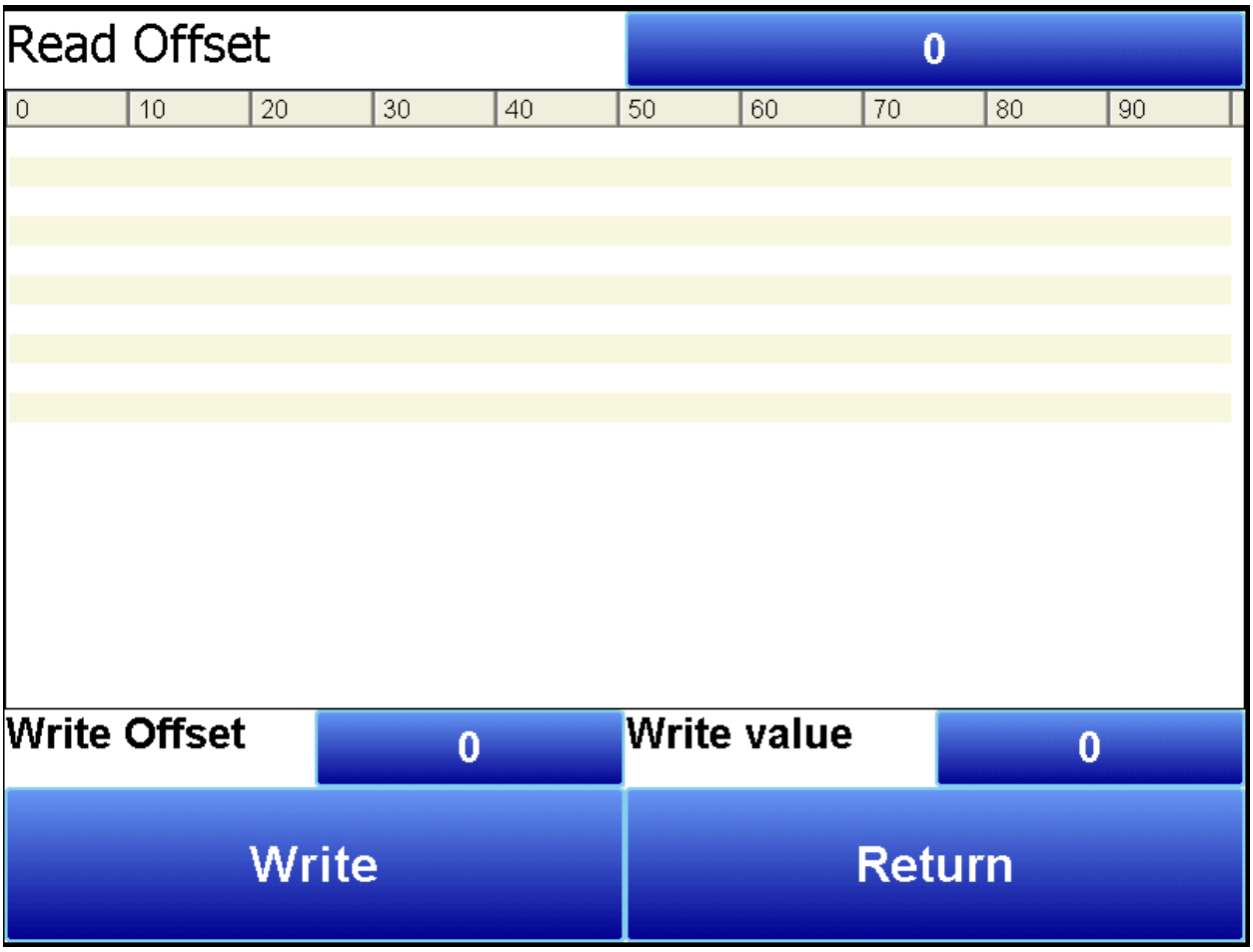
Valve Text:
This screen allows you to set specific text for naming each valve.

Compact/Repair Database:
Compacting the database will free up extra space, which will speed up the amount of time it takes the software to communicate with the database. This should be done as needed. Please consult SSi (513-772-0060) for details

Screen Communications:
This screen provides options for configuring touch screen communications. See the Screen Communications section on page 31.

Language:
This screen provides options for changing the language used in the touch screen.

Read/Write Data:
Using this option, you can read from and write values directly to Modbus registers within the controller. This menu option is used mainly for technical support reasons. You will need to contact SSi at (513) 772-0060 before trying to access the Read/Write Data option.



Registers from the controller will be read and displayed on the screen. The user will be able to read from and write to the AutoGen's registers. When the screen is first displayed, it will read the first 100 registers from the controller and display them in a column format. The top of the list will show "0", "10", "20", etc. These are the column headers. Each value in the column will be a logical increment of the header, where the first value in the column equals the header value.

The number box in the top left of the screen is the beginning register to read from. This will default to 0 when the screen starts. To read registers 100 – 199, edit the value to read "100". **Note:** Changing the value will automatically begin the read process. This process could take a few seconds to complete.

The "Write offset" value will allow the user to write a specific value listed in the "Write value" box to the register listed in the "Write offset" box. Click on the Write button to write the value to the register. Click on the Return button to return to the Configuration menu.

Replacement Parts – eFlo 2.0 Autogen

Part	Part Number
12.1" Operator Interface	31299
TS Manager/PC Configurator Software	13339
RS485 comms cable for 12.1"	20576
Flash Card	31604
Flash Card Reader	13333
RS232 Cable	33027
24V DC Din Rail Mounted Power Supply	31135 or 31137
Base Controller Module	13705
Module, analog input	13701
Module, analog output	13702
Module, 12 digital inputs	13703
Module, 12 digital outputs	13704
6 Amp Circuit breaker	33096
2 Amp Circuit breaker	33097
Dew Point Sensor	A20881
Dew Point Filter Element	31027
DP Transmitter – 0-10wc	31184
DP Transmitter – 0-50wc	31185
eFlo 2.0 Coarse Valve	141.KP.A.CRS
eFlo 2.0 Trim Valve	141.KP.A.TRM
AutoGen Air Filter Assembly, 2"	37034
AutoGen Air Filter Assembly, 1¼"	37038
AutoGen Filter Element, 2"	37035
AutoGen VFD (determined at time of engineering)	TBD
Controller, ¼ Limit, 804L	31350
Sensor, Standard Range Dew Point	31038
Blower (size/current determined at time of engineering)	TBD

Replacement Parts – eFlo 1.5 Autogen

Part	Part Number
12.1" Operator Interface	31299
TS Manager/PC Configurator Software	13339
RS485 comms cable for 12.1"	20576
Flash Card	31604
Flash Card Reader	13333
RS232 Cable	33027
24V DC Din Rail Mounted Power Supply	31135 or 31137
Terminal block, pluggable 6-pos	33305
Terminal block, pluggable 2-pos	33312
6 Amp Circuit breaker	33096
2 Amp Circuit breaker	33097
Matrix brain board assembly	A20892
Dew Point Sensor	A20881
Dew Point Filter Element	31027
DP Transmitter – 0-10wc	31184
DP Transmitter – 0-50wc	31185
Pressure Transducer, 5"	31189
eFlo 1.5 Coarse Valve	14-A-CRS
eFlo 1.5 Trim Valve	14-A-TRM
AutoGen Air Filter Assembly, 2"	37034
AutoGen Air Filter Assembly, 1¼"	37038
AutoGen Filter Element, 2"	37035
AutoGen VFD (determined at time of engineering)	TBD
Controller, ¼ Limit, 804L	31350
Sensor, Standard Range Dew Point	31038
Blower (size/current determined at time of engineering)	TBD

Replacement Parts – eValve Autogen

Part	Part Number
12.1" Operator Interface	31299
TS Manager/PC Configurator Software	13339
RS485 comms cable for 12.1"	20576
Flash Card	31604
Flash Card Reader	13333
RS232 Cable	33027
24V DC Din Rail Mounted Power Supply	31135 or 31137
Terminal block, pluggable 6-pos	33305
Terminal block, pluggable 2-pos	33312
6 Amp Circuit breaker	33096
2 Amp Circuit breaker	33097
Matrix brain board assembly	A20892
Dew Point Sensor	A20881
Dew Point Filter Element	31027
DP Transmitter – 0-10wc	31184
DP Transmitter – 0-50wc	31185
Pressure Transducer, 5"	31189
eValve High Flow	14-VG-HF
eValve Low Flow	14-VG-LF
AutoGen Air Filter Assembly, 2"	37034
AutoGen Air Filter Assembly, 1¼"	37038
AutoGen Filter Element, 2"	37035
AutoGen VFD (determined at time of engineering)	TBD
Controller, ¼ Limit, 804L	31350
Sensor, Standard Range Dew Point	31038
Blower (size/current determined at time of engineering)	TBD

Warranty

Limited Warranty for Super Systems Products:

The Limited Warranty applies to new Super Systems Inc. (SSI) products purchased direct from SSI or from an authorized SSI dealer by the original purchaser for normal use. SSI warrants that a covered product is free from defects in materials and workmanship, with the exceptions stated below.

The limited warranty does not cover damage resulting from commercial use, misuse, accident, modification or alteration to hardware or software, tampering, unsuitable physical or operating environment beyond product specifications, improper maintenance, or failure caused by a product for which SSI is not responsible. There is no warranty of uninterrupted or error-free operation. There is no warranty for loss of data—you must regularly back up the data stored on your product to a separate storage product. There is no warranty for product with removed or altered identification labels. SSI DOES NOT PROVIDE ANY OTHER WARRANTIES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOME JURISDICTIONS DO NOT ALLOW THE LIMITATION OF IMPLIED WARRANTIES, SO THIS LIMITATION MAY NOT APPLY TO YOU. SSI is not responsible for returning to you product which is not covered by this limited warranty.

If you are having trouble with a product, before seeking limited warranty service, first follow the troubleshooting procedures that SSI or your authorized SSI dealer provides.

SSI will replace the PRODUCT with a functionally equivalent replacement product, transportation prepaid after PRODUCT has been returned to SSI for testing and evaluation. SSI may replace your product with a product that was previously used, repaired and tested to meet SSI specifications. You receive title to the replaced product at delivery to carrier at SSI shipping point. You are responsible for importation of the replaced product, if applicable. SSI will not return the original product to you; therefore, you are responsible for moving data to another media before returning to SSI, if applicable. Data Recovery is not covered under this warranty and is not part of the warranty returns process. SSI warrants that the replaced products are covered for the remainder of the original product warranty or 90 days, whichever is greater.

Revision History

Rev.	Description	Date	MCO #
	Initial Release	11/1/2019	2273
A	Added Alarms and Coarse Set Up Info, Added revised Startup procedures	7/28/2020	2296

Appendix 1: Example of Deviation Alarm Usage

The following illustrates how a Deviation Alarm may be used in coarse adjustment. These same principles can be adapted to other control loops.

Assume the following values.

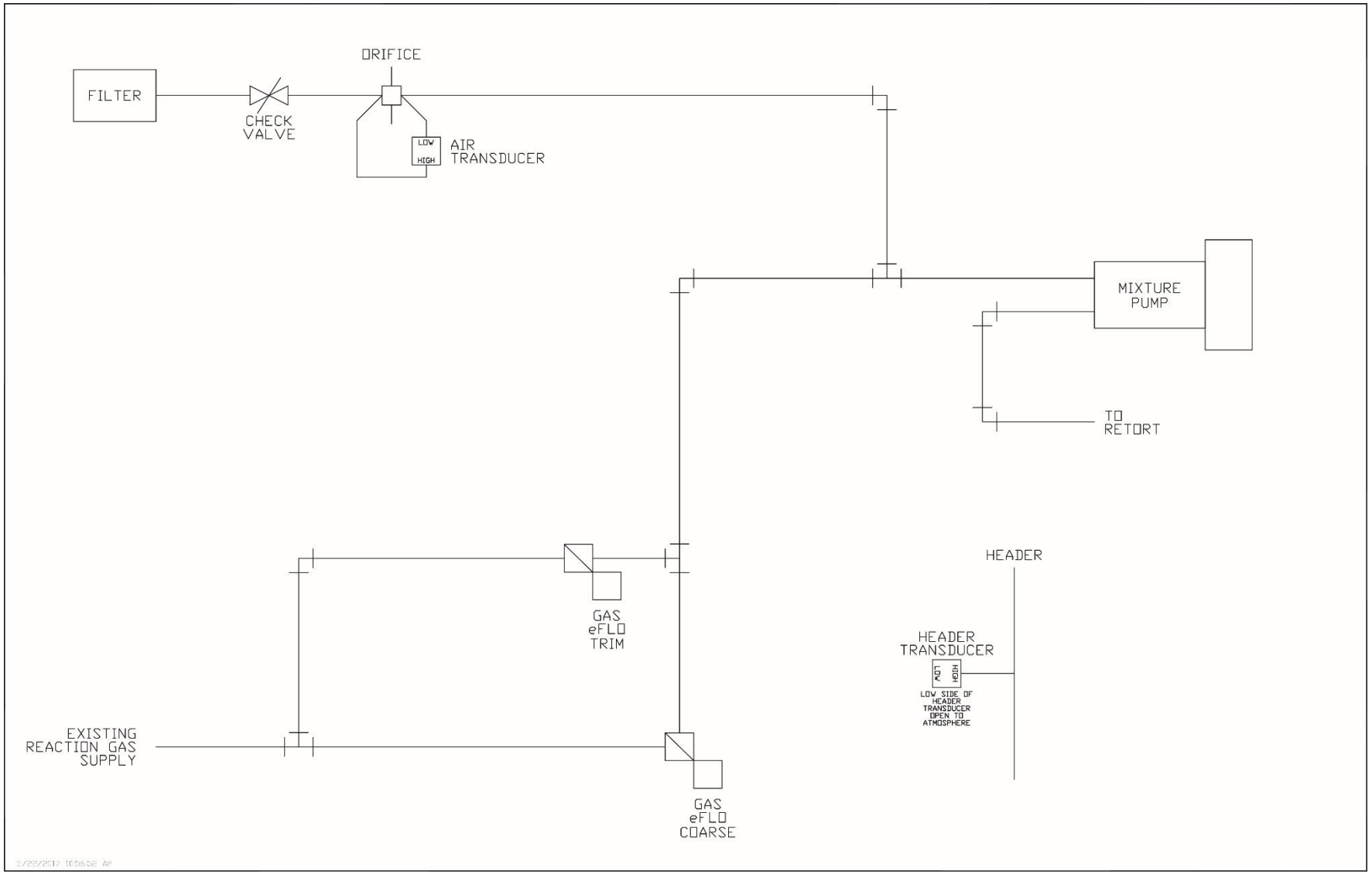
Setpoint = 2.75
Deviation Alarm = ±0.20
Deviation Alarm Delay = 45 seconds

In this scenario, assume the Process Variable starts at 2.65. The error is 0.10, which is within the 0.20 Deviation Alarm band; therefore, no Deviation Alarm will be generated.

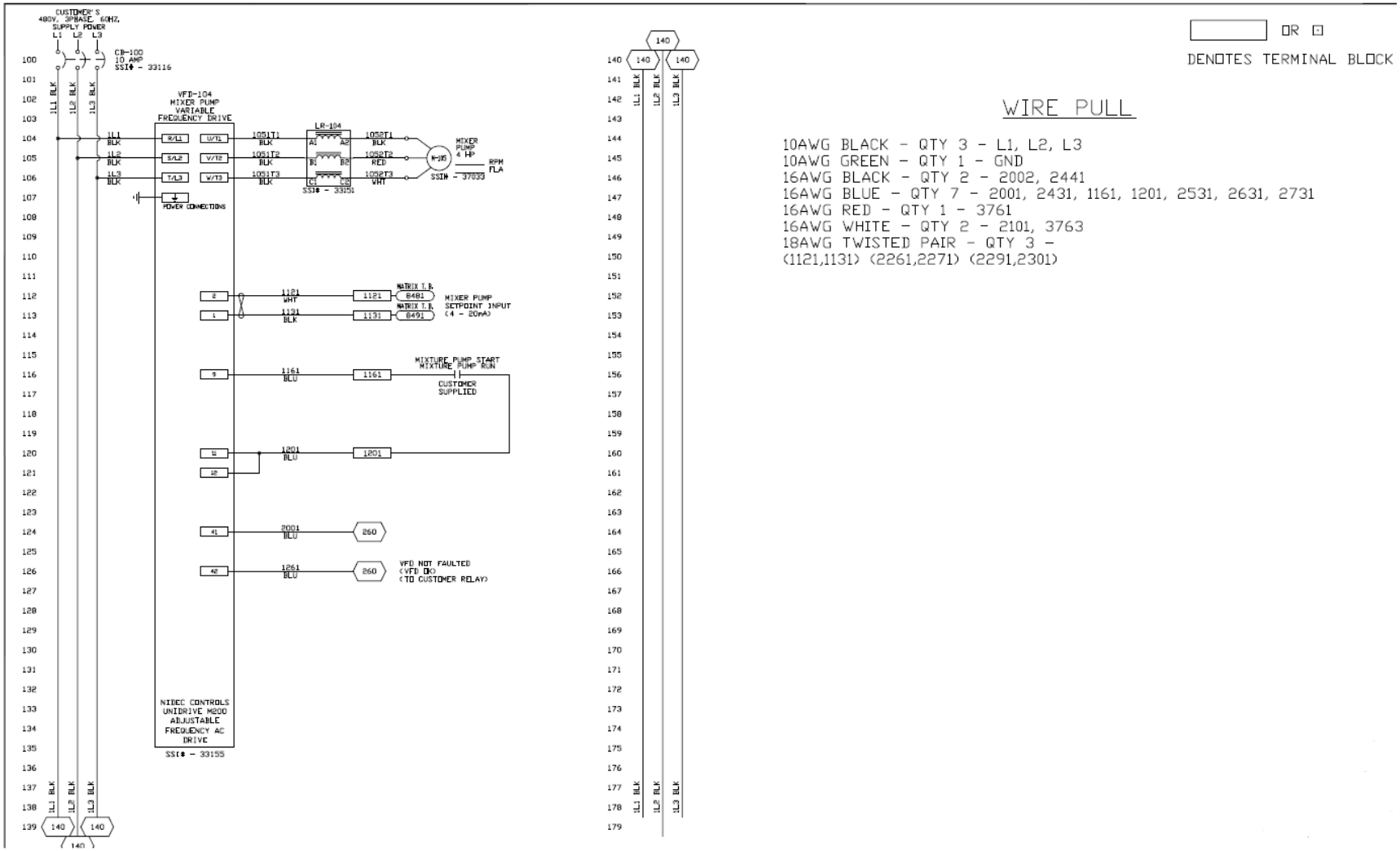
The Process Variable drops to 2.50 while the controller adjusts output to increase the value. The error is now 0.25. After 20 seconds, the Process Variable increases to 2.62, resulting in an error of 0.13. Because the error fell back into the Deviation Alarm band within 45 seconds (Deviation Alarm Delay) of being out of band, no Deviation Alarm will be generated.

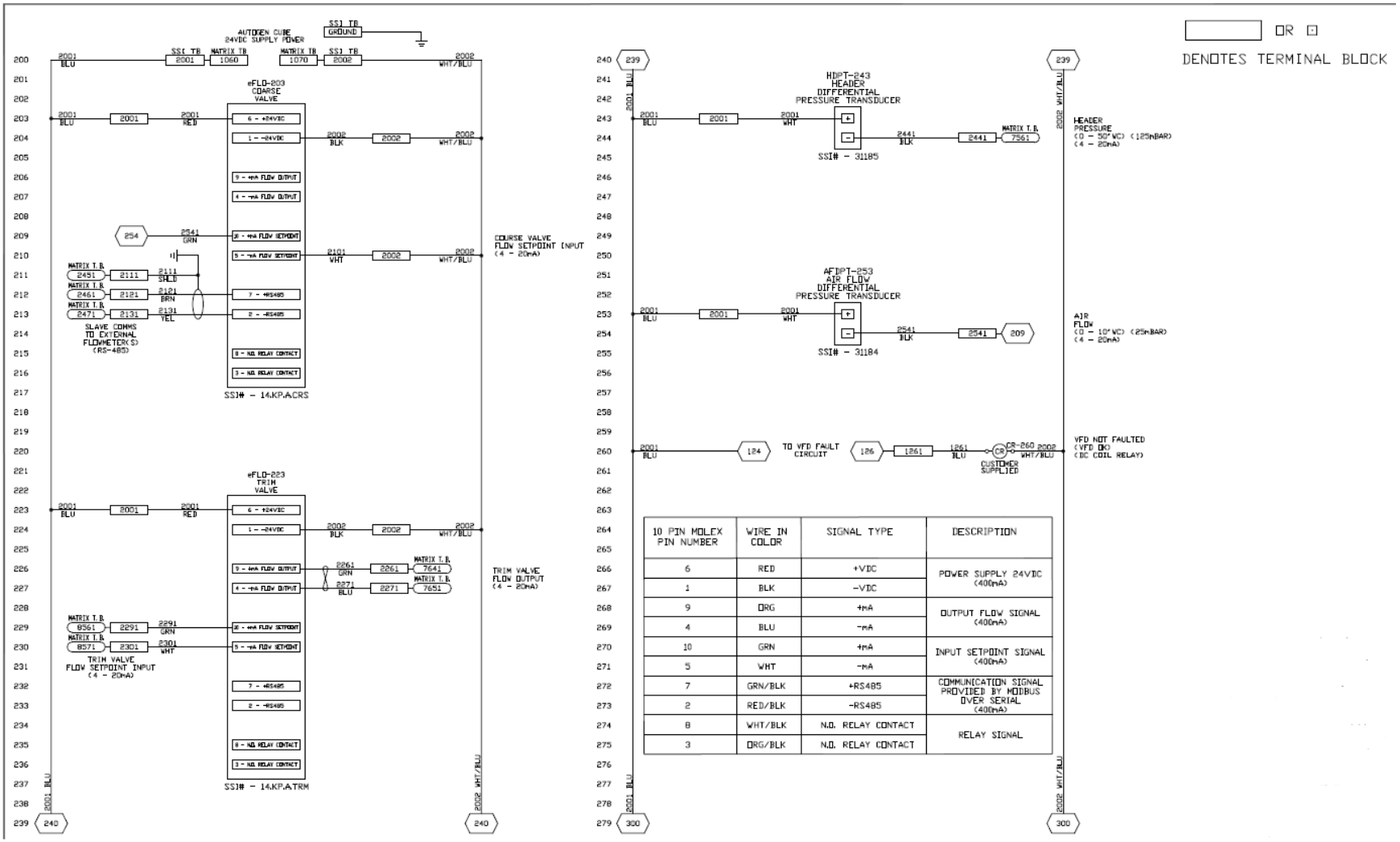
Five minutes later, the Process Variable drops to 2.50 again. The controller responds by increasing output. 45 seconds pass and the Process Variable is 2.53. The error is now 0.22. A Deviation Alarm is generated because the error is out of the Deviation Alarm band after the Deviation Alarm Delay time has passed.

Appendix 2: Piping Diagram

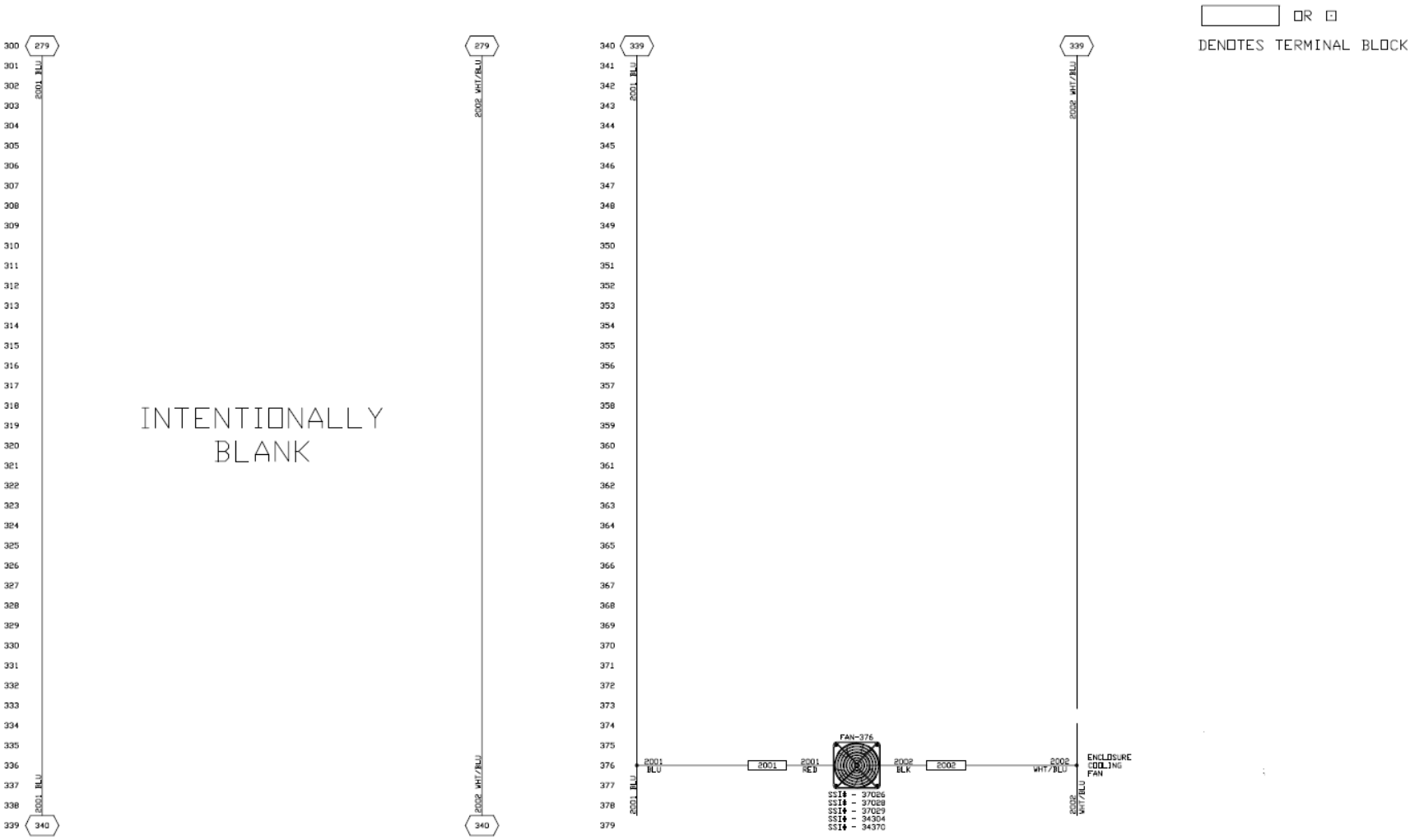


Appendix 3: Cube Electrical Diagram





10 PIN MOLEX PIN NUMBER	WIRE IN COLOR	SIGNAL TYPE	DESCRIPTION
6	RED	+VDC	POWER SUPPLY 24VDC (400mA)
1	BLK	-VDC	
9	ORG	+mA	OUTPUT FLOW SIGNAL (400mA)
4	BLU	-mA	
10	GRN	+mA	INPUT SETPOINT SIGNAL (400mA)
5	WHT	-mA	
7	GRN/BLK	+RS485	COMMUNICATION SIGNAL PROVIDED BY MODBUS OVER SERIAL (400mA)
2	RED/BLK	-RS485	
8	WHT/BLK	N.O. RELAY CONTACT	RELAY SIGNAL
3	ORG/BLK	N.O. RELAY CONTACT	


OR
DENOTES TERMINAL BLOCK
INTENTIONALLY
BLANK
FAN-376
ENCLOSURE
COOLING
FAN

Appendix 4: I/O List

Analog Inputs are addresses 1-8
Analog Outputs are addesses 9-16

AutoGen Analog Input Configuration				
Card and Position	**Card Address**	**Matrix Analog Input #**	**Description**	**Signal**
Analog Input Card 1	1			
Input 4		Analog Input 4	Tube #2 Temp	T/C K
Input 3		Analog Input 3	Spare	T/C K
Input 2		Analog Input 2	Tube #1 Temp	T/C K
Input 1		Analog Input 1	Dew point	1V
Analog Input Card 2	2			
Input 4		Analog Input 8	Outlet	T/C K
Input 3		Analog Input 7	Header Press.	4-20mA
Input 2		Analog Input 6	Trim Flow	4-20 mA
Input 1		Analog Input 5	Tube #3 Temp	T/C K
Analog Input Card 3	3			
Input 4		Analog Input 12	Spare	T/C K
Input 3		Analog Input 11	Tube #6 Temp	T/C K
Input 2		Analog Input 10	Tube #5 Temp	T/C K
Input 1		Analog Input 9	Tube #4 Temp	T/C K

AutoGen Analog Output Configuration				
Card and Position	**Card Address**	**Matrix Analog Output #**	**Description**	**Signal**
Analog Output Card 1	9			
Output 4		Analog Output 4	Mixer Pump VFD	4-20mA
Output 3		Analog Output 3	Trim Valve Motor	4-20mA
Output 2		Analog Output 2	Tube #2 Heat	User Config
Output 1		Analog Output 1	Tube #1 Heat	User Config
Analog Output Card 2	10			
Output 4		Analog Output 8	Tube #6 Heat	User Config
Output 3		Analog Output 7	Tube #5 Heat	User Config
Output 2		Analog Output 6	Tube #4 Heat	User Config

Output 1		Analog Output 5	Tube #3 Heat	User Config

Digital Inputs are addresses 222,223,226,227,228
Digital outputs are addresses 224,225,229

AutoGen Digital Input Configuration			
Card and Position	**Card Address**	**Matrix Digital Input #**	**Input Description**
Digital Input Card 1	222		**Digital Input #1**
Digital Input 1		0	Shut down combustion
Digital Input 2		1	Alarm silence
Digital Input 3		2	Mixer pump not faulted
Digital Input 4		3	Mixer Pump Running/Burner gas pressure not low
Digital Input 5		4	Fire check OK
Digital Input 6		5	Reaction gas not low
Digital Input 7		6	Reaction gas not high
Digital Input 8		7	Mixer pump pressure not low
Digital Input 9		8	Purge/burnout blower
Digital Input 10		9	ENDO pressure not high
Digital Input 11		10	Reset for ENDO press. not high
Digital Input 12		11	Burnout pilot on
Digital Input Card 2	223		**Digital Input #2**
Digital Input 1		12	Tube 1 not overtemp
Digital Input 2		13	Tube 1 flame on
Digital Input 3		14	Tube 1 burner gas on
Digital Input 4		15	Tube 1 making gas
Digital Input 5		16	Tube 1 purge timer
Digital Input 6		17	Start tube 1 burner
Digital Input 7		18	Start tube 1 burnout
Digital Input 8		19	Tube 1 cooling fan
Digital Input 9		20	Tube 2 not overtemp
Digital Input 10		21	Tube 2 flame on
Digital Input 11		22	Tube 2 burner gas on
Digital Input 12		23	Tube 2 making gas
Digital Input 12		59	Tube 3 cooling fan

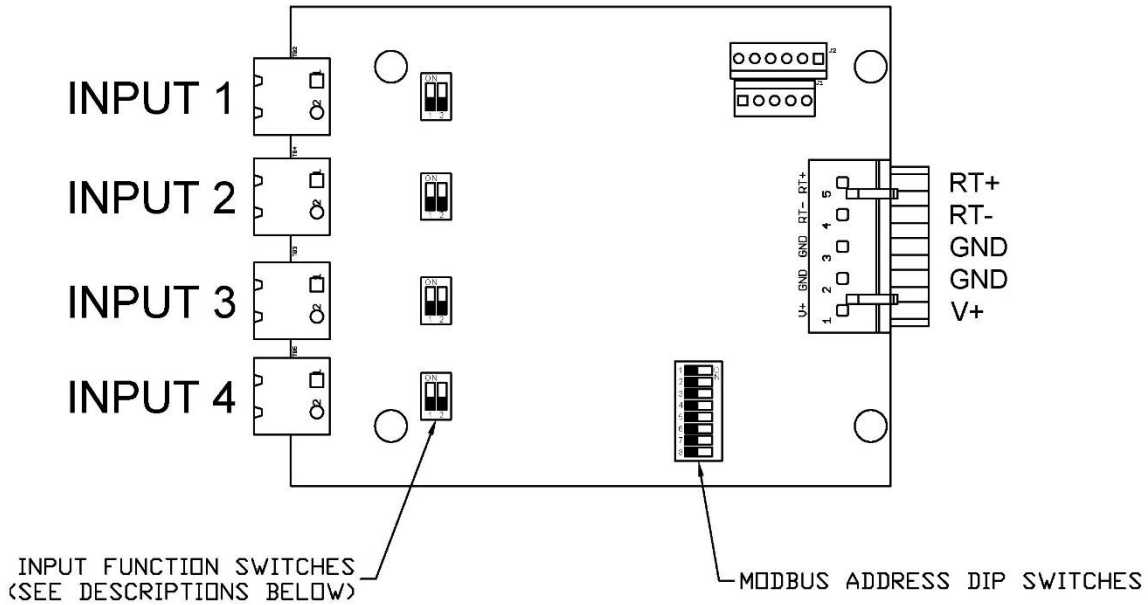
AutoGen Digital Input Configuration			
Digital Input Card 3	226		**Digital Input #3**
Digital Input 1		48	Tube 2 purge timer
Digital Input 2		49	Start tube 2 burner
Digital Input 3		50	Start tube 2 burnout
Digital Input 4		51	Tube 2 cooling fan
Digital Input 5		52	Tube 3 not overtemp
Digital Input 6		53	Tube 3 flame on
Digital Input 7		54	Tube 3 burner gas on
Digital Input 8		55	Tube 3 making gas
Digital Input 9		56	Tube 3 purge timer
Digital Input 10		57	Start tube 3 burner
Digital Input 11		58	Start tube 3 burnout
Digital Input Card 4	227		**Digital Input #4**
Digital Input 1		60	Tube 4 not overtemp
Digital Input 2		61	Tube 4 flame on
Digital Input 3		62	Tube 4 burner gas on
Digital Input 4		63	Tube 4 making gas
Digital Input 5		64	Tube 4 purge timer
Digital Input 6		65	Start tube 4 burner
Digital Input 7		66	Start tube 4 burnout
Digital Input 8		67	Tube 4 cooling fan
Digital Input 9		68	Tube 5 not overtemp
Digital Input 10		69	Tube 5 flame on
Digital Input 11		70	Tube 5 burner gas on
Digital Input 12		71	Tube 5 making gas
Digital Input Card 5	228		**Digital Input #5**
Digital Input 1		72	Tube 5 purge timer
Digital Input 2		73	Start tube 5 burner
Digital Input 3		74	Start tube 5 burnout
Digital Input 4		75	Tube 5 cooling fan
Digital Input 5		76	Tube 6 not overtemp
Digital Input 6		77	Tube 6 flame on
Digital Input 7		78	Tube 6 burner gas on
Digital Input 8		79	Tube 6 making gas

Digital Input 9		80	Tube 6 purge timer
Digital Input 10		81	Start tube 6 burner
Digital Input 11		82	Start tube 6 burnout
Digital Input 12		83	Tube 6 cooling fan

AutoGen Digital Output Configuration			
Card and Position	**Card Address**	**Matrix Digital Output #**	**Output Description**
Digital Output Card 1	224		**Digital Output #1**
Digital Output 1		24	Start Purge/Burnout Blower
Digital Output 2		25	Outlet pressure relief
Digital Output 3		26	Endo shutdown
Digital Output 4		27	Start purge tube 1
Digital Output 5		28	Start tube 1 burner
Digital Output 6		29	Tube 1 burnout mode
Digital Output 7		30	Tube 1 Heat
Digital Output 8		31	Start purge tube 2
Digital Output 9		32	Start tube 2 burner
Digital Output 10		33	Tube 2 burnout mode
Digital Output 11		34	Tube 2 Heat
Digital Output 12		35	Operate
Digital Output Card 2	225		**Digital Output #2**
Digital Output 1		36	Start purge tube 3
Digital Output 2		37	Start tube 3 burner
Digital Output 3		38	Tube 3 burnout mode
Digital Output 4		39	Tube 3 Heat
Digital Output 5		40	Probe Burnout (if applicable)
Digital Output 6		41	Spare
Digital Output 7		42	Spare
Digital Output 8		43	Spare
Digital Output 9		44	Spare
Digital Output 10		45	Spare
Digital Output 11		46	Alarm light
Digital Output 12		47	Alarm Horn
Digital Output Card 3	229		**Digital Output #3**
Digital Output 1		84	Start purge tube 4
Digital Output 2		85	Start tube 4 burner
Digital Output 3		86	Tube 4 burnout mode
Digital Output 4		87	Tube 4 Heat

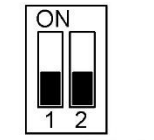
Digital Output 5		88	Start purge tube 5
Digital Output 6		89	Start tube 5 burner
Digital Output 7		90	Tube 5 burnout mode
Digital Output 8		91	Tube 5 Heat
Digital Output 9		92	Start purge tube 6
Digital Output 10		93	Start tube 6 burner
Digital Output 11		94	Tube 6 burnout mode
Digital Output 12		95	Tube 6 Heat

Appendix 5: Analog Input Board – Dip Switch Settings (1.5 and eValve models)



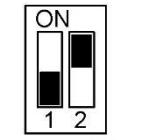
INPUT FUNCTION SWITCH 1:
OFF = VOLTAGE MEASUREMENT
ON = CURRENT (mA) MEASUREMENT
(CONVERTS CURRENT TO VOLTAGE)

INPUT FUNCTION SWITCH 2:
OFF = NO VOLTAGE DIVIDER
ON = INPUT WILL BE DIVIDED BY 10



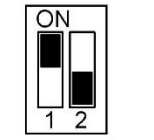
DEFAULT SETTING
1 = OFF
2 = OFF

USE FOR:
- ALL THERMOCOUPLE TYPES
- VOLTAGE INPUTS LESS THAN 1.25VDC



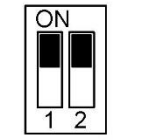
1 = OFF
2 = ON

USE FOR:
- VOLTAGE INPUTS GREATER THAN 1.25 VDC



1 = ON
2 = OFF

USE FOR:
- NO KNOWN USES AT THIS TIME

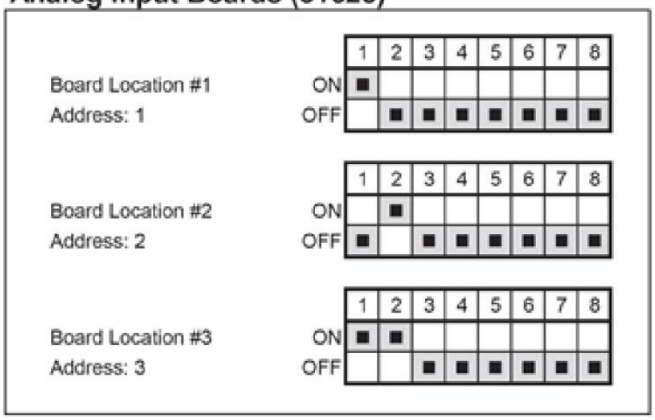


1 = ON
2 = ON

USE FOR:
- 4-20mA INPUTS

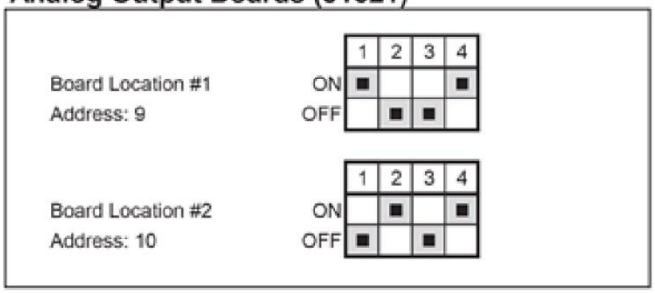
Appendix 6: Dip Switch Settings for Board Addressing

Analog Input Boards (31625)



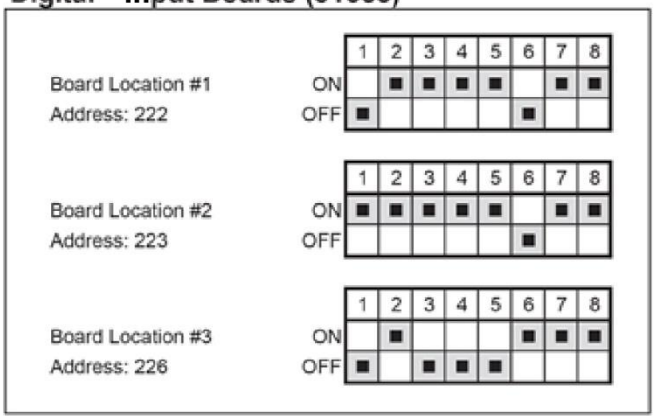
Connectors used per board:
(4) P/N 33312 2-Position Connector

Analog Output Boards (31621)



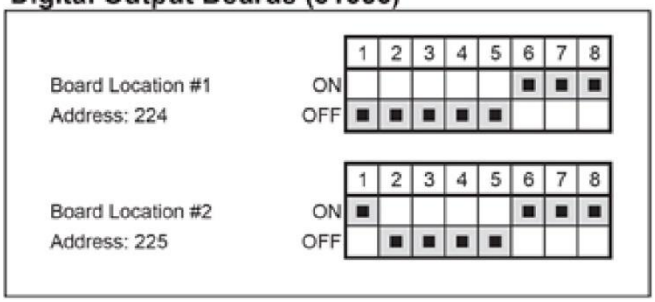
Connectors used per board:
(1) P/N 33305 6-Position Connector

Digital Input Boards (31655)



Connectors used per board:
(2) P/N 33305 6-Position Connector
(1) P/N 33312 2-Position Connector

Digital Output Boards (31656)



Connectors used per board:
(2) P/N 33305 6-Position Connector
(1) P/N 33312 2-Position Connector

Appendix 7: Maintenance

The maintenance listed below is only listed for the supplied equipment associated with the AutoGen product. This list does not cover any items unrelated to the AutoGen system, does not include any OEM recommended procedures, and does not include any OEM supplied components. Refer to vendor's literature and OEM manuals for all other items.

Mixer Pump/Blower: No maintenance required/possible. Listen for any unusual noise.

Main Air Filter: Check the air filter weekly, and adjust the timing of filter replacement as required based upon visual inspection. Replace as needed. NOTE: A dirty air filter will result in the mixture pump working harder to maintain the air flow that it needs for the system. Over time, this will work the pump harder (shorten life) and reduce the capacity of the generator.

Air Orifice Assembly: Check tubing to verify tightness. Check monthly.

Flowmeters: Verify calibration across test ports. Check semi-annually.

Pressure Transmitters: Check tubing to verify tightness. Follow manufacturer's specifications for zero/span and calibration of transmitter. Check semi-annually.

Dewpoint Sensor: Perform yearly calibration or sensor exchange for the dew point cell. Check filters weekly, and adjust the timing of the filter replacement as required based upon visual inspection. NOTE: A dirtly/contaminated filter will restrict the flow of sample gas to the dewpoint sensor, and can provide an incorrect or delayed measurement of the dewpoint of the gas.

Daily Maintenance: Verify dew point reading with portable certified and calibrated dew point analyzer.

Weekly Maintenance: Verify endo gas composition with portable certified and calibrated 3-gas analyzer. Clean VFD junction box filter and main cabinet filter.

Monthly Maintenance: Blow/Clean out the endothermic heat exchangers. The heat exchangers are used to quickly cool the endothermic gas from its temperature to below 300˚F (the cooler the gas the better). If this gas is not cooled properly, the reaction can reverse, resulting in poor gas being sent to the equipment.

Semi-Annual Maintenance: Power down the panels and blow out excessive dust/dirt with air nozzle.

Annual Maintenance: Verify piping for tightness. Check for leaks.

Appendix 8: Alarms

The following table lists standard AutoGen alarms and possible causes. Non-standard or system-specific alarms may not be listed here. Alarm notifications are typically generated after an appropriate delay time to reduce the occurrence of unwanted nuisance indications.

Description	Events Possibly Causing the Alarm (Triggers and/or Root Causes)
RELIEF SOL OPEN-PRESSURE	This alarm can be triggered by high pressure that may be momentary and does not require operator intervention. If alarm persists: 1. Check that demand from furnaces is greater than generator minimum flow capability. 2. One or more Inlet valves must be opened. 3. If burning off to vent can: One or more outlet valves must be opened. 4. If running Endo to furnace: One or more outlet valves must be opened fully and furnace inlet is unobstructed. 5. Firecheck screen, Retort catalyst or cooler may be plugged.
RELIEF SOL OPEN - FLOW	This alarm can be triggered by low flow conditions that are momentary and do not require operator intervention. If alarm persists: 1. Check that demand from furnaces is greater than generator minimum flow capability. 2. Verify Mixer Pump is running. 3. Verify Main Reaction Gas Solenoid is opened. 4. Verify Coarse Adjust Gas Control Valve is allowing gas flow. Confirm in Flow area on "Control Screen".
TUBE 1 COOLING FAN FAULT	1. Re-set motor overload and check for cause of overload. 2. Check circuit protection devices.
TUBE 1 OVERTEMP	1. Check for cause of over temperature and correct. 2. Reset the Overtemp 3. Re-start burner.
ENDO OUTLET TEMP HIGH	1. Check to make sure cooling fans are operating. 2. Check air flow through cooling fans. Inspect and clean air filters. 3. Exterior and interior of coolers may need to be cleaned.

Description	Events Possibly Causing the Alarm (Triggers and/or Root Causes)
REACTION GAS PRESSURE HIGH	1. Verify pressure switch is set to print and operating correctly. 2. Verify supply regulator is set to print.
MIXER PUMP FAULT	1. Check fault code on drive. 2. Re-set fault by pushing red stop PB on VFD.
FIRECHECK TRIPPED	1. Check cause of flame back feed. 2. Re-set by pulling and turning firecheck valve shut off latch.
REACTION GAS PRESSURE LOW	1. Confirm valve reaction gas hand valve is open. 2. Verify pressure switch is set to print and operating correctly. 3. Check that supply regulator is set to print
MIXER PUMP PRESSURE	1. Confirm that pressure control loop is in auto mode. 2. Check to make sure VFD is operating and at correct frequency. 3. Check Mixer pump filter.
PURGE/BURNOUT BLOWER FAULT	Re-set motor overload and check for cause of overload.
TUBE 1 PURGE	1. Check to make sure purge hand valve is open. 2. Check to be sure purge solenoid valve is energized and open during purge event. 3. Check to make sure purge timer is timing. 4. Make sure Purge/Burnout Blower runs during event.
TUBE 1 FLAME OFF	1. Check for correct gas pressure at low gas and high gas pressure switches. 2. Verify Valves burner gas valves are full open. 3. Remove and check flame detecting device.
TUBE 2 COOLING FAN FAULT	1. Re-set motor overload and check for cause of overload. 2. Check circuit protection devices.
TUBE 2 OVERTEMP	1. Check for cause of over temperature and correct. 2. Reset the Overtemp 3. Re-start burner.
BURN OUT NO PILOT (Burn Off) Optional Alarm	1. Verify a flame is present on burnoff can pilot. 2. If no flame is present, relight the pilot. 3. If a flame is present turn off and verify flame detector operation.
TUBE 2 PURGE	1. Check to make sure purge hand valve is open. 2. Check to be sure purge solenoid valve is energized and open during purge event. 3. Check to make sure purge timer is timing. 4. Make sure Purge/Burnout Blower runs during event.

Description	Events Possibly Causing the Alarm (Triggers and/or Root Causes)
TUBE 2 FLAME OFF	1. Check for correct gas pressure at low gas and high gas pressure switches. 2. Verify Valves burner gas valves are full open. 3. Remove and check flame detecting device.
TUBE 3 COOLING FAN FAULT	1. Re-set motor overload and check for cause of overload. 2. Check circuit protection devices.
TUBE 3 OVERTEMP	1. Check for cause of over temperature and correct. 2. Reset the Overtemp 3. Re-start burner.
TUBE 3 PURGE	1. Check to make sure purge hand valve is open. 2. Check to be sure purge solenoid valve is energized and open during purge event. 3. Check to make sure purge timer is timing. 4. Make sure Purge/Burnout Blower runs during event.
TUBE 3 FLAME OFF	1. Check for correct gas pressure at low gas and high gas pressure switches. 2. Verify Valves burner gas valves are full open. 3. Remove and check flame detecting device.
SHUTDOWN COMBUSTION PB PRESSED	Pull out pusbhtton. Restart burner (s).
ENDO SHUTDOWN - COARSE RATIO >4	1. Verify that either inlet or outlet (depending on which tubes are making gas) valves are allowing enough flow to establish a ratio. 2. Check air and gas flow feedback for correct flows.
ENDO SHUTDOWN - AIR FLOW SENSOR	1. Verify Coarse Valve is powered on. 2. Contact SSI.
ENDO SHUTDOWN - GAS FLOW SENSOR	1. Verify Coarse Valve is powered on. 2. Contact SSI.
TUBE 1 TEMPERATURE DEVIATION	1. Check for proper tube temperature 1900°F (1038°C) degrees for making gas. 2. Confirm that Tube 1 burner is on. 3. Check Tube 1 temperature loop output %.
TUBE 2 TEMPERATURE DEVIATION	1. Check for proper tube temperature 1900°F (1038°C) degrees for making gas. 2. Confirm that Tube 2 burner is on. 3. Check Tube 2 temperature loop output %.

Description	Events Possibly Causing the Alarm (Triggers and/or Root Causes)
TUBE 3 TEMPERATURE DEVIATION	1. Check for proper tube temperature 1900°F (1038°C) degrees for making gas. 2. Confirm that Tube 3 burner is on. 3. Check Tube 3 temperature loop output %.
COARSE DEVIATION ALARM	1. Check to see if ratio is within acceptable limits. 2. Confirm coarse ratio loop is in auto mode. 3. Check coarse ratio output %.
DEW POINT DEVIATION ALARM	1. Check to see if Dew point is within acceptable limits. 2. Confirm Dew point loop is in auto mode. 3. Check Dew point loop output %.
COARSE HIGH OUTPUT	1. Check to see if coarse ratio is within acceptable limits. 2. Contact SSI
COARSE LOW OUTPUT	1. Check to see if coarse ratio is within acceptable limits. 2. Contact SSI
TRIM HIGH OUTPUT	1. Check to see if dew point is within acceptable limits. 2. Coarse ratio value may need to be decreased.
TRIM LOW OUTPUT	1. Check to see if dew point is within acceptable limits. 2. Coarse ratio value may need to be increased.
HEADER PRESSURE LOW	1. Check Pressure on Control Screen. 2. Make sure pressure loop is in auto. 3. Verify pressure with handheld manometer
HEADER PRESSURE INPUT OUT OF RANGE	Check Header Pressure Transducer for loose wire.
DEW POINT INPUT OUT OF RANGE	Check Dew point for loose wire.
TUBE 1 INPUT OUT OF RANGE	Check Tube 1 Thermocouple for loose wire.
TUBE 2 INPUT OUT OF RANGE	Check Tube 2 Thermocouple for loose wire.
TUBE 3 INPUT OUT OF RANGE	Check Tube 3 Thermocouple for loose wire.

Appendix 9: Additional Documentation

eFlo 1.5 http://www.supersystems.com/wp-content/uploads/eFlo_g2_Manual_Operation.pdf

eFlo 2.0 http://www.supersystems.com/wp-content/uploads/eFlo2_Manual.pdf

Simple Dew http://www.supersystems.com/wp-content/uploads/Simple_Dew_Manual_Operation.pdf

Gold Probe http://www.supersystems.com/wp-content/uploads/Gold_Probe_Manual_Operation.pdf

Bazooka Probe http://www.supersystems.com/wp-content/uploads/Bazooka_Probe_Manual_Operation.pdf