ExoGen
Exothermic Generator System Controller

TOUCH SCREEN OPERATIONS MANUAL

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Introduction

ExoGen represents the next advancement in generator controls utilizing sophisticated flow loop algorithms to perform demand-based control on exothermic gas generators. ExoGen is designed to fully automate generator control including startup, shutdown, atmosphere, and automatic turndown.

For optimal metallurgical results, precise control of key process variable types is required. These variables include flow, CO_2, dew point, and gas-to-air ratio (before the mixture is cracked into exothermic gas). The header pressure of the generator outlet provides an indication of the furnace's demand for exothermic gas. A pressure sensor at the generator outlet measures the outlet header pressure; ExoGen will increase the air blower speed when more gas is needed and decrease the speed when less gas is needed.

ExoGen 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). ExoGen provides built-in data logging, alarm management, and maintenance scheduling.

NOTE: This is a first release manual of a product that is still in development. If you have any questions about this product, please contact SSi for assistance.

Important Safety Requirements

WARNING!

ExoGen 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.


Setup

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 ExoGen 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.

Touch Screen Interface

ExoGen features a touch screen interface. The main options available are **Menu, Control, Chart,** and **Alarms**. These are the options on the screen when ExoGen first starts.
- **Menu:** Provides access to ExoGen menu options. The most commonly used options are provided at the highest levels of the screen interface. Additional options can be found under Configuration. See page 8 for more on the high-level menu options; see page 19 for more on Configuration menu options.
- **Control:** Provides an overview of the system and displays critical control parameters. See page 9.
- **Chart:** Displays a trend chart of logged process data. See page 14.
- **Alarms:** Displays a report of alarms logged. See page 16.

When ExoGen is first started, the Control 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.
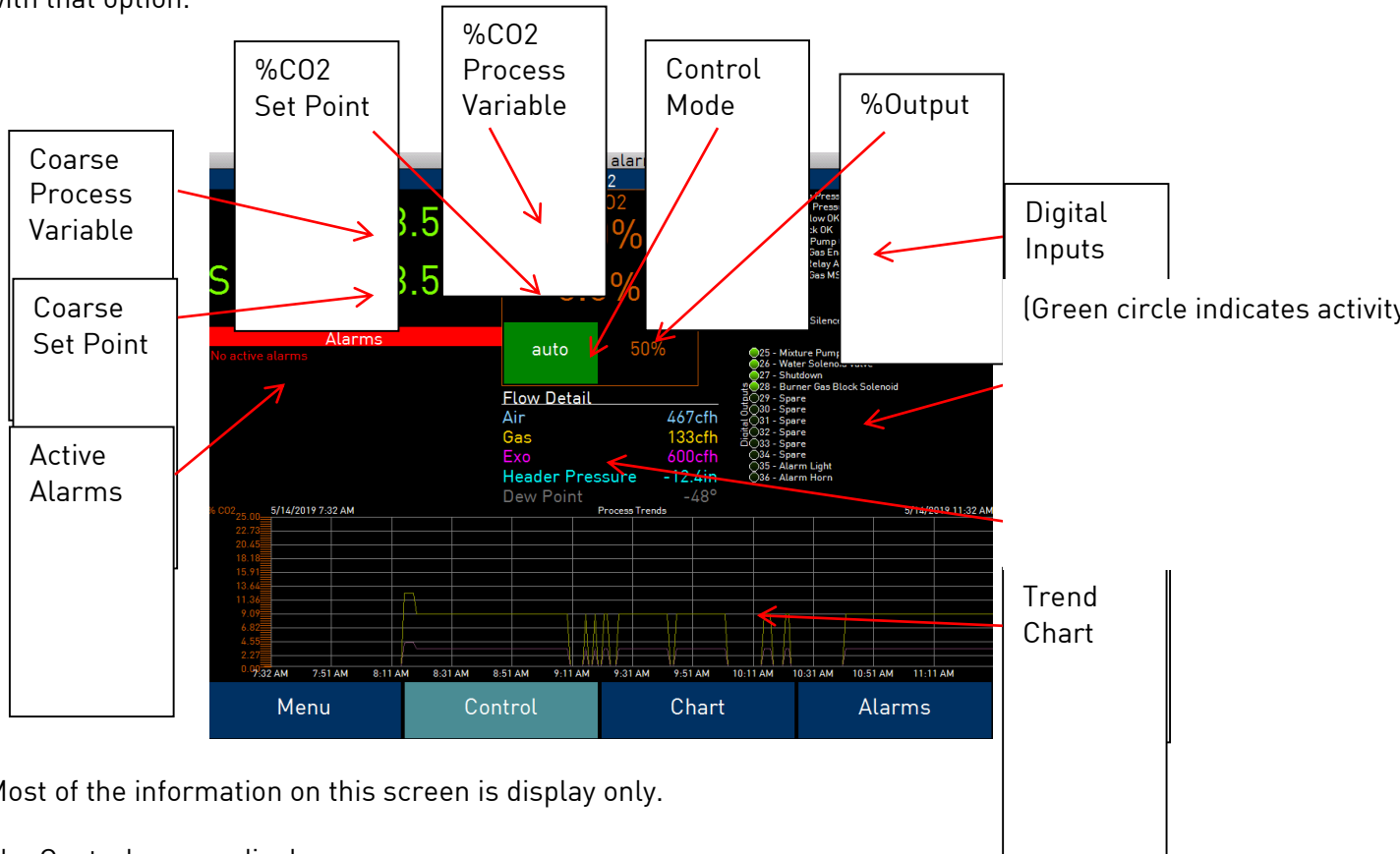
Most of the information on this screen is display only.

The Control screen displays:

- Coarse Process Variable and Set Point
- Active Alarms
- CO2 Process Variable, Set Point, Control Mode (Auto/Manual/Hold), and %Output. The Set Point is adjustable from this screen by tapping the displayed value.
- Flow Detail for Air, Natural Gas, Exothermic Gas, Header Pressure, and Dew Point.
- Digital I/O Statuses
- Trend Chart

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, which presents a list of tiled options, detailed below.

- CO2 Control
- Pressure Control
- Configuration
- Exogen Configuration
- Return

CO2 Control

%CO2 Process Variable	CO2 0.0%	Proportional Band = 4.0
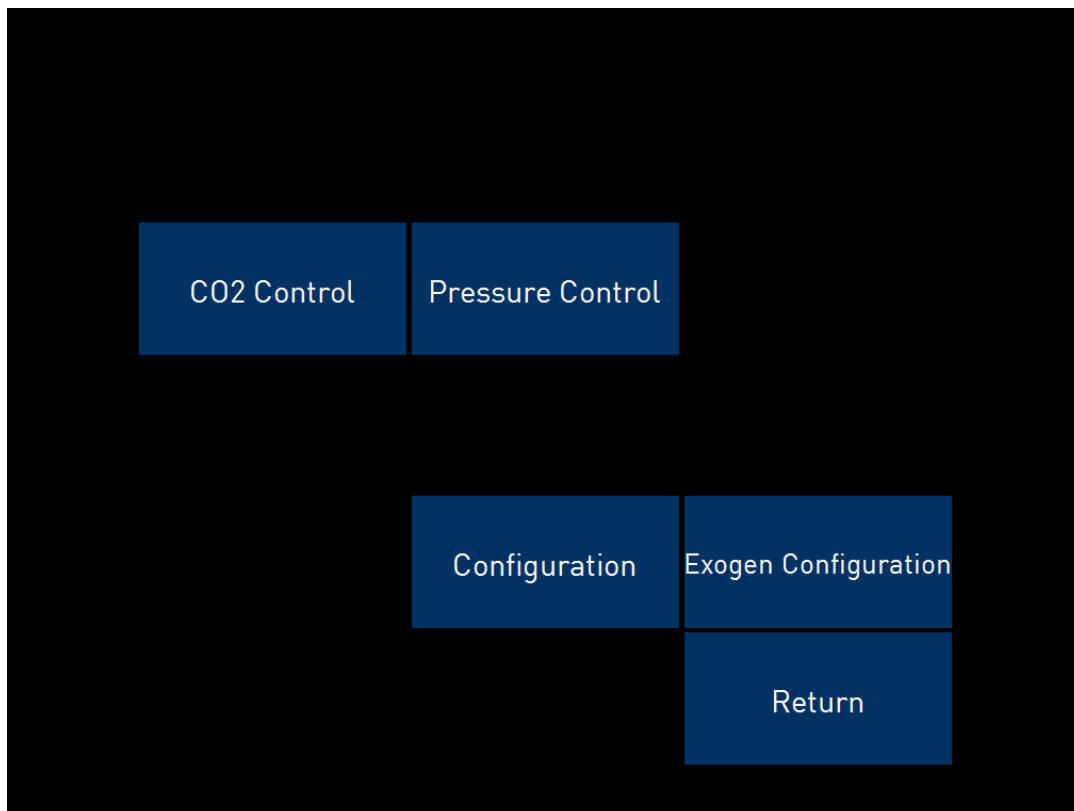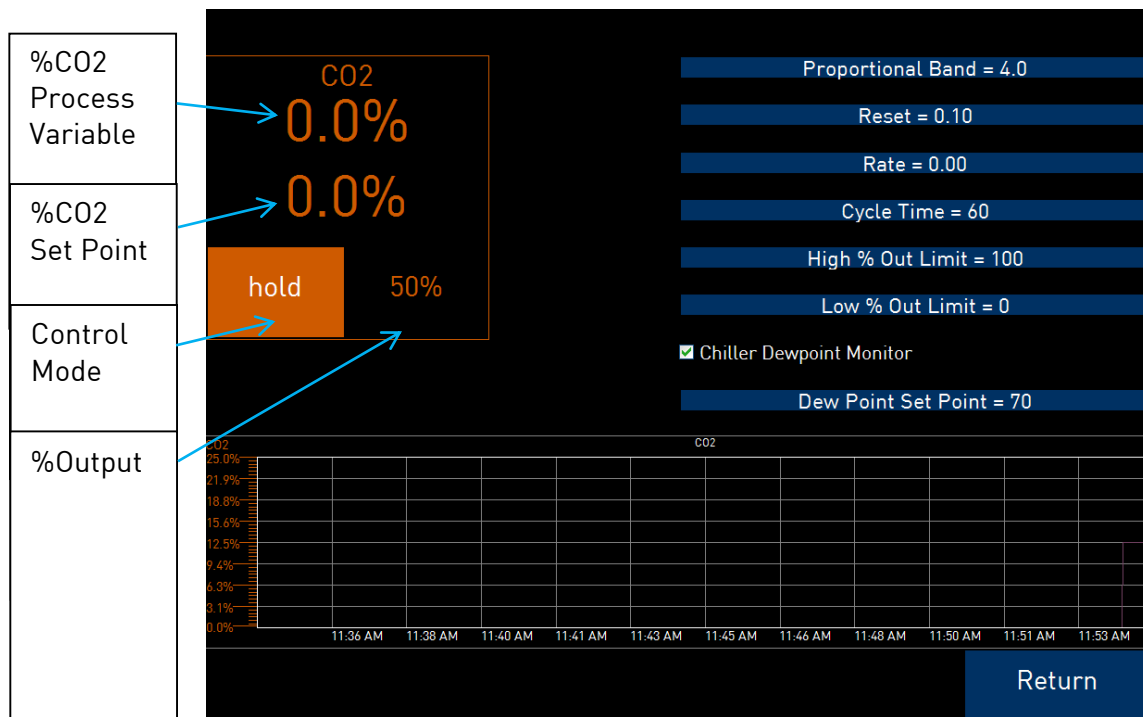
The CO2 Control screen displays the current Temperature, Setpoint, Control Mode, and Output Percentage on the top left of the screen. As on the control screen, the user can tap to change the setpoint.

The right side allows the user to view and control the following options:

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.

Cycle time: This field is typically set to the valve travel time multiplied by 1.5. The range is 0 – 500.

High % Out Limit: Sets the high output limit. (Example – if the High Limit is set to 80%, the ExoGen will not exceed 80% output, even if the desired set point is not being reached.)

Low % Out Limit: Sets the low output limit. (Example – if the Low Limit is set to 20%, the ExoGen will not drop below 20% output, even if the desired set point is not being reached.)

Chiller Dew Point Monitor: Enables or disables the Chiller Dew Point Monitor alarm.   This is used in conjunction with the dew point set point (see below).

Dew Point Set Point: Assigns the Dew Point Set Point for the Chiller Dew Point Monitor alarm. If the measured Dew Point exceeds the set point, an alarm will be generated.

Tap any option to adjust the settings.

The bottom of this screen displays a CO_2 trend chart. Tap "Return" to return to the Menu screen.

Pressure Control
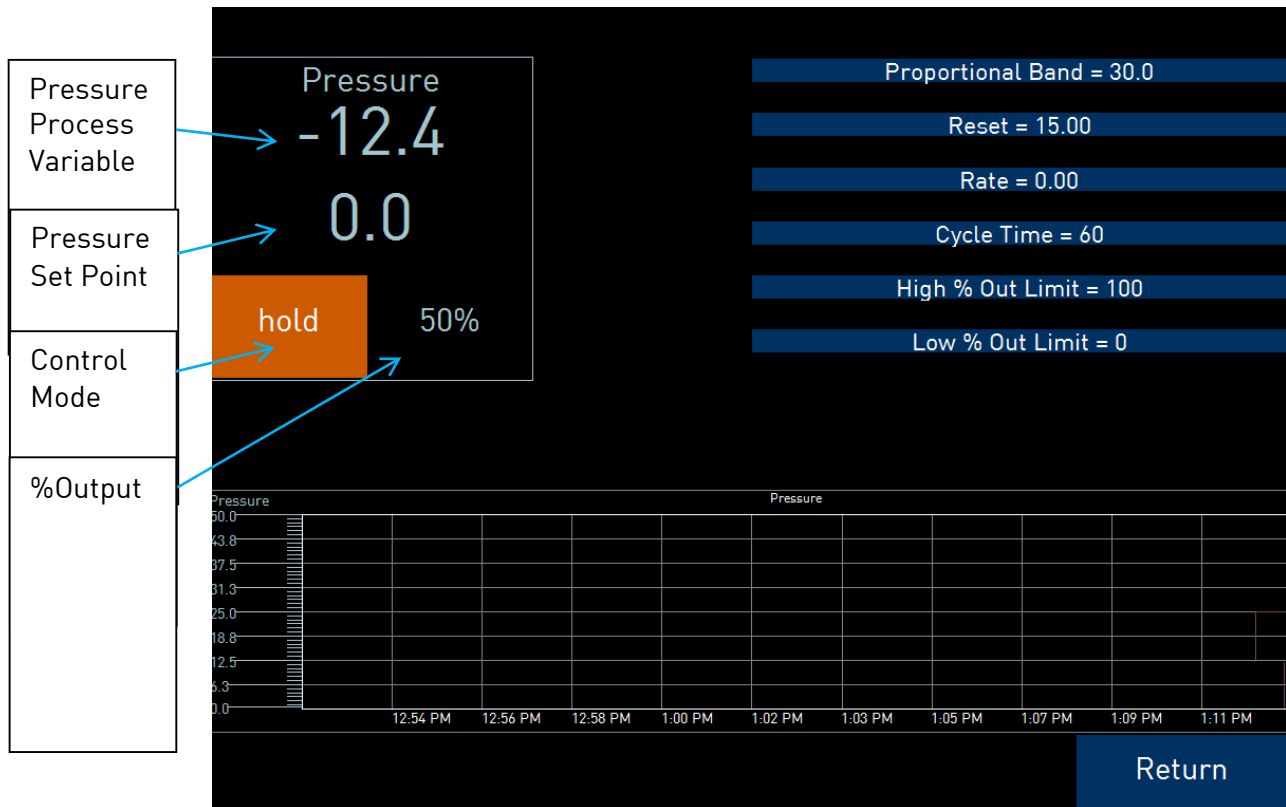
The Pressure Control screen is nearly identical in setup to the CO2 Control screen. As on the control screen, the user can tap to change the setpoint.

The right side allows the user to view and control the following options:

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.

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Super Systems Inc.

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.

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High % Out Limit: Sets the high output limit. (Example – if the High Limit is set to 80%, the ExoGen will not exceed 80% output, even if the desired set point is not being reached.)

Low % Out Limit: Sets the low output limit. (Example – if the Low Limit is set to 20%, the ExoGen will not drop below 20% output, even if the desired set point is not being reached.)

Tap any option to adjust the settings.

The bottom of this screen displays a Pressure trend chart. Tap "Return" to return to the Menu screen.

Configuration
This brings up the main Matrix configuration menu.

5/10/2019 11:57:28 AM

Logs
Board Status
Burnoff
Slave Instrument Status
Shutdown

| Login | Detail | Return |
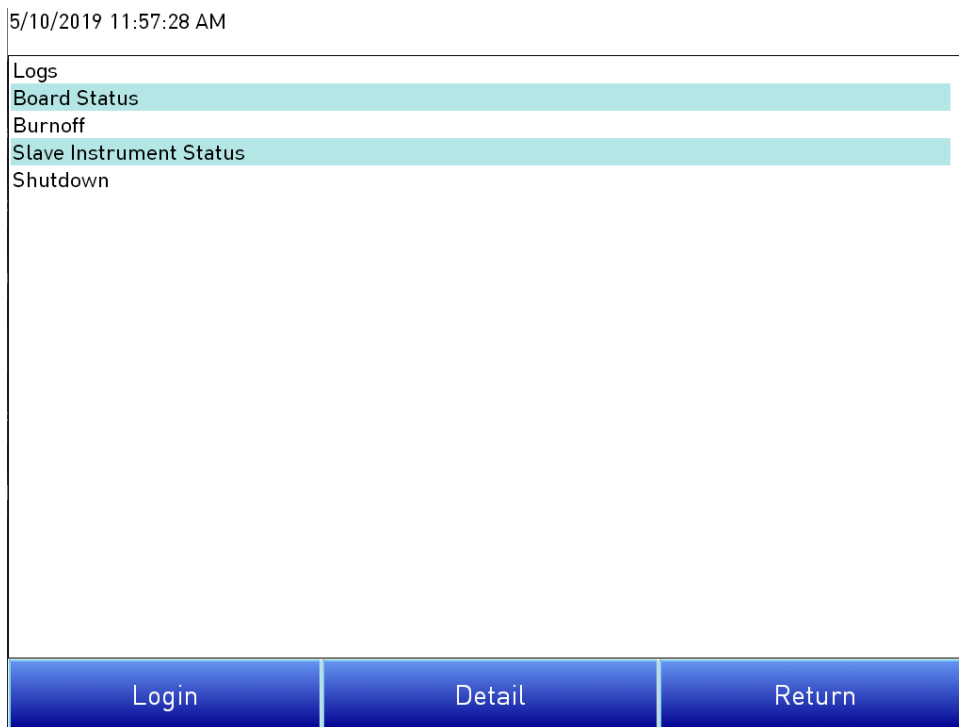
Tap "Login" to log in as a specified user. Note that different options will be available based on the logged-in user's permissions. Tap a menu option, then tap "Detail" to access those settings. Tap "Return" to return to the Menu screen.

These options are discussed in greater detail on page 19.

Exogen Configuration

This menu allows the user to adjust the following options:

```
                    Startup Ratio = 4.92

                 Startup Coarse Output = 50.0

                  Startup Hold Time = 30 sec

                Startup Pressure Output = 50.0

                     Run Ratio = 3.50

                     Trim Range = 10





                                              Return
```

Startup Ratio
This is the air-to-gas ratio that is maintained during the startup hold time.   This differs from the
Run Ratio (below).

Startup Coarse Output
The coarse output maintained during startup or if an issue is detected with flow feedback to the
system. This value is set in conjunction with Pressure Hold % Output.

Startup Hold Time
Duration (in seconds) to keep the Mixer loop in hold when the hold feature is activated.

Startup Pressure 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.

Run Ratio
This is the air-to-gas ratio that is maintained during normal operation.

Trim Range
Trim range, in %, of the run ratio set point where a %CO2 control loop output of 50% corresponds to no trim (coarse set point = run ratio), 0% removes Trim Range % from the coarse set point and 100% adds Trim Range % from the coarse set point.

For example, with a run ratio of 3.50, a 100% control output on the %CO2 loop would change the coarse ratio to 3.85.

Tapping "Return" will return the user to the Menu page.

Return
Returns the user to the Control Screen

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.

"**File**" will allow the user to open any custom templates that have been created.

"**Setup**" 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.

"**Data**" 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.

"**Date**" will allow the user to select a date and time on which to view data.

"**Back**" will move the chart's view backward in time by the specified chart interval.

"**Time**" 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.

"**Forward**" will move the chart's view forward in time by the specified chart interval.

"Realtime" 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, and Exit.
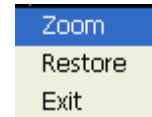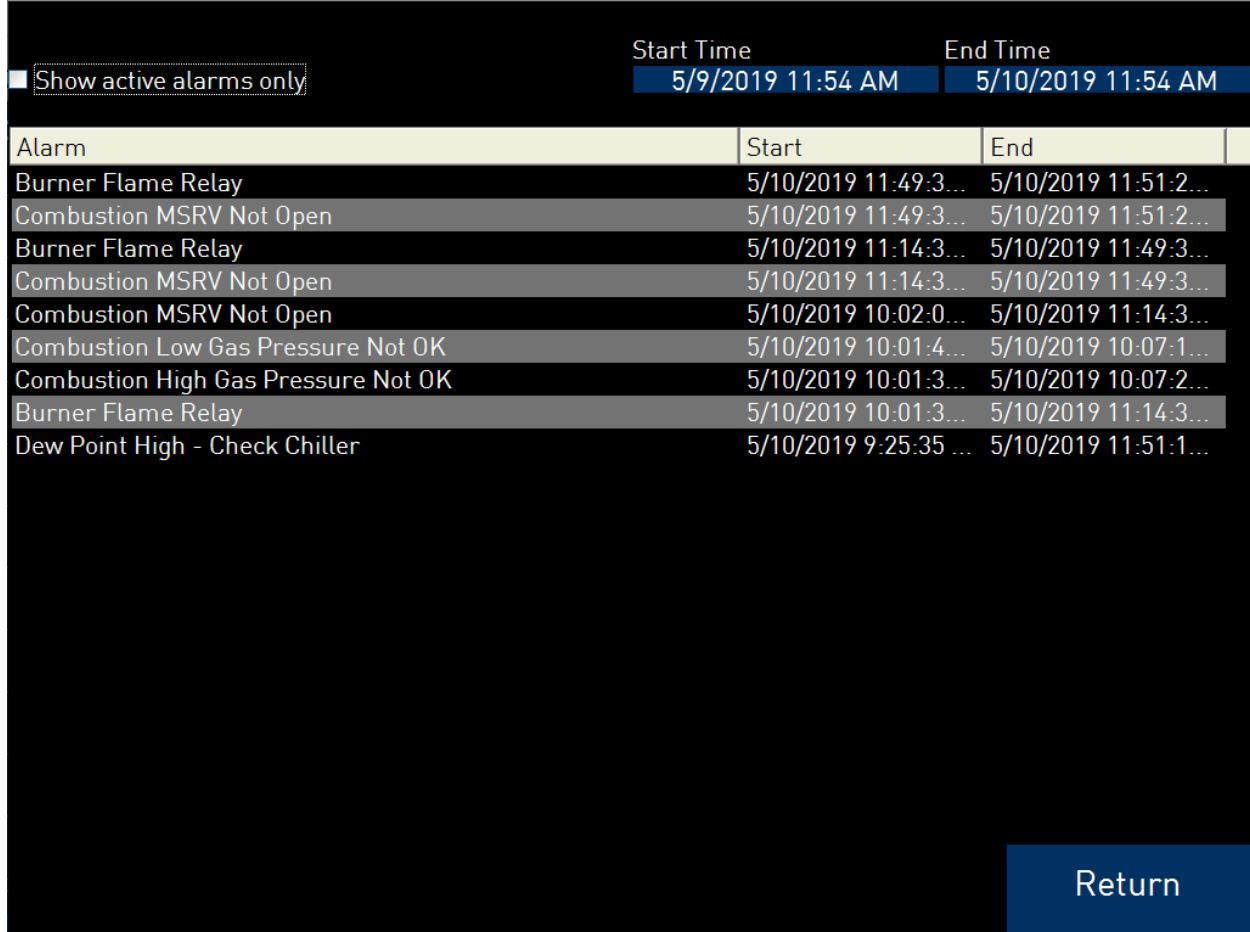
The **Zoom** option will allow the user to zoom in on a particular part of the screen. Once this has been selected, the user can take a stylus or a finger and create a box around the desired data. Once the user releases the stylus or finger, a zoom is no longer possible, and the user will need to re-select 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.

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

Alarms

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

Alarm	Start	End
	Start Time 5/9/2019 11:54 AM	End Time 5/10/2019 11:54 AM
Burner Flame Relay	5/10/2019 11:49:3...	5/10/2019 11:51:2...
Combustion MSRV Not Open	5/10/2019 11:49:3...	5/10/2019 11:51:2...
Burner Flame Relay	5/10/2019 11:14:3...	5/10/2019 11:49:3...
Combustion MSRV Not Open	5/10/2019 11:14:3...	5/10/2019 11:49:3...
Combustion MSRV Not Open	5/10/2019 10:02:0...	5/10/2019 11:14:3...
Combustion Low Gas Pressure Not OK	5/10/2019 10:01:4...	5/10/2019 10:07:1...
Combustion High Gas Pressure Not OK	5/10/2019 10:01:3...	5/10/2019 10:07:2...
Burner Flame Relay	5/10/2019 10:01:3...	5/10/2019 11:14:3...
Dew Point High – Check Chiller	5/10/2019 9:25:35 ...	5/10/2019 11:51:1...

☐ Show active alarms only

Return

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."

Alarm Detail

RELIEF SOL OPEN - FLOW

This alarm can be triggered by low flow conditions that are momentary and do not require operator intervention

Step	Troubleshooting
1	Check that demand from furnaces is greater than generator minimum flow capability
2	Verify VFD is running
3	Verify SOL266 is opened
4	Verify if VM408 is allowing gas flow. Confirm in Flow area on 'Control Screen'
5	Verify AGV2 is fully open

Return

Configuration Menu Options

The list of the operator-level menu options is:
- Logs
- Board Status
- Burnoff
- Slave Instrument Status
- Shutdown

The list of supervisor-level menu options is:
- Logs
- Board Status
- Burnoff
- Slave Instrument Status
- Factors
- Shutdown
- Load T/C
- Probe Burnoff Setup
- Manual Event Control
- PID
- Recipe Edit
- Trend Chart Edit

The list of administrator-level menu options is:
- Logs
- Board Status
- Burnoff
- Slave Instrument Status
- Shutdown
- Factors
- Load T/C
- Probe Burnoff Setup
- Manual Event Control
- PID
- Recipe Edit
- Trend Chart Edit
- Alarm Setup
- Alarm Group Setup
- Relay Assignments
- Programmer Configuration
- Furnace (?)
- Communications (?)
- Slave Instruments
- Analog Input
- Analog Input Curve Entry
- Analog Output
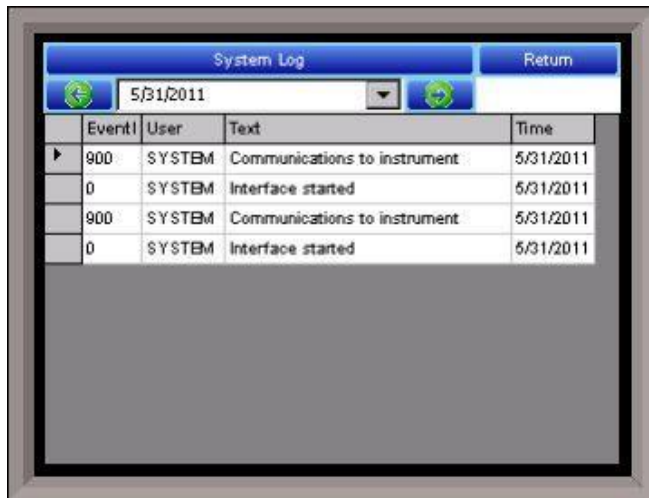- Auxiliary Analog Inputs (?)

- Slave Controller Setpoint Retrans
- Alternate PID
- Calculated Values
- Tuning Assistant
- Instrument Calculation
- Calibration
- Generic Instrument Setup
- Analog Output Trim
- Thermocouple Check
- Redundant Probe
- Valve Setup
- Security
- Configuration

The SSi code of the day can also be used to log in to the menu system. No user name will need to be entered when entering this code. Currently, the menu list is identical to the administrator-level list. The SSi code of the day is typically used for in-house configuration prior to shipment. The code can only be provided by Super Systems at (513) 772-0060.

To select any of the menu options, highlight that item by clicking on it, and click on the **Detail** button.
The **Return** button will return the user to the default display screen.

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 ExoGen Controller has run a recipe compared to the amount of time it has not run a recipe.

Board Status

Displays the status of various inputs and outputs. This menu is display-only and not editable.

Board Status

Analog Input 1	-18 V
Analog Input 2	2502 °
Analog Input 3	0.000 V
Analog Input 4	4.400 V
Analog Input 5	2502 °
Analog Input 6	0.000 V
Analog Input 7	-12.4 V
Analog Input 8	111 °
Analog Input 9	not present
Analog Input 10	not present
Analog Input 11	not present

Edit   Return

Burnoff

*Probe 1

Start Burnoff	
Impedance Test	
Cancel	
Next Burnoff In	0:00
Test Status	idle
Timer	
mV	0 mV
TC	0 °
Start mV	0 mV
Start TC	0 °
Last Burnoff	invalid

Edit   Return

The Burnoff menu manages various burnoff settings and functions. Use the drop down menu at the top of the screen to select the desired Probe.

Start Burnoff – Begins a burnoff based on the current settings

Impedance Test – Begins an impedance test.

Cancel – cancels the current action

The remaining options display information on the current or most recent test. These options are read-only and not editable.

Slave Instrument Status

This page is a display of the current process variables of each of the slave instruments communicating with the ExoGen Controller. These values are display-only, and cannot be modified from this screen. There are five possible messages that can occur to describe the instrument communications status.

Slave Instrument Status

Instrument 1	n/a
Instrument 2	n/a
Instrument 3	n/a
Instrument 4	n/a
Instrument 5	n/a
Instrument 6	n/a
Instrument 7	n/a
Instrument 8	n/a
Instrument 9	n/a
Instrument 10	n/a
Instrument 11	n/a
Instrument 12	n/a

Edit	Return

- N/A – No instrument is connected
- Bad – No communications exist
- ??? – Communications exist, but there are frequent errors
- ?OK – Communications exist, but there are occasional errors
- OK – Communication is established and working properly

For set-up of the auxiliary instruments go to the menu item "*Slave Instrument Setup*"

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

Shutdown

The Shutdown selection will display a screen asking whether or not to shut down the interface of the ExoGen Controller. When the operator interface is shut down, the ExoGen Controller is still functioning. IT can be monitored by connecting the Ethernet connection to a laptop computer, using Internet Explorer, and assigning a legitimate IP address. Choosing **Yes** displays a typical computer desktop screen with the **Start** button in the bottom left-hand corner. The power to the operator interface can now be turned off without upsetting any of the settings. Choosing **No** displays the initial Status Screen. *Note - Shutting down the Operator Interface does not shut down the ExoGen Controller*.

Factors

The Factors menu allows the user to set the CO and H factors. Use the dropdown menu to select the desired Programmer. Tap the desired Factor option, then tap "Edit" to enter a new value.

Programmer 1	
CO Factor	202
H Factor	0

Edit	Return

Programmer 1	
Load TC Enable	On
*Aux Analog Input 1	Not Active
*Aux Analog Input 2	Not Active
*Aux Analog Input 3	Not Active
*Aux Analog Input 4	Not Active
*Aux Analog Input 5	Not Active
*Aux Analog Input 6	Not Active
*Aux Analog Input 7	Not Active
*Aux Analog Input 8	Not Active
*Aux Analog Input 9	Not Active
*Aux Analog Input 10	Not Active
*Aux Analog Input 11	Not Active

Edit	Return

Off – T/C not enabled

Load T/C

The Load T/C screen allows the user to set the status of **Analog Inputs 1-24** and **Aux Analog Inputs 1-40**. The options are **Active** and **Not Active**. Use the dropdown to select the desired Programmer.

Load TC Enable
This value will manually toggle between **on**, **on + alarms**, and **off**.
On – T/C Enabled
On + Alarms – T/C Enabled, Programmer alarm114 provided if out of band (Default wait limits)

Probe Burnoff Setup

When a probe is in a furnace, soot will collect in the end of the probe, which will have a negative effect on the performance of the probe. Burnoffs are used to clean out the built-up carbon by burning it off of the probe.

Burnoff Time: This is the duration of the burnoff measured in seconds. SSi recommends a 90 second burnoff, and this will be the default value. However, it can be adjusted by the operator. Click on the **OK** button to set the new value, or click on the **Cancel** button to cancel.

Burnoff Time	0 sec
Burnoff Rec. Wait Time	0 sec
Burnoff Minimum Millivolts	0 mV
Burnoff Maximum Temper...	0 °
Burnoff Minimum Millivolts...	0 mV
Burnoff Maximum Temper...	0 °
Active Probe Inputs	none
Burnoff Interval Probe 1	0 min
Burnoff Interval Probe 2	0 min
Burnoff Interval Probe 3	0 min
Burnoff Interval Probe 4	0 min
Burnoff Interval Probe 5	0 min

Edit	Return

Rec Wait Time: The amount of time allotted to allow the probe measurements to return to a stable, accurate range after the burnoff is complete. This is measured in seconds. The control output is held until this time is elapsed. Clicking on the value will allow the user to change the value.

Interval: This is the amount of time between the beginning of one burnoff and the beginning of the next scheduled burnoff, in minutes. Default time for the instrument is 720 minutes (12 hours). However, the amount of time between burnoffs should be determined by the application.

Minimum Millivolts: The minimum measured millivolt tolerance of the probe required to start a burnoff. Clicking on the value will allow the user to change the value. SSi recommends the millivolt value gets down to 200 mV.

Maximum Temperature: The maximum measured temperature allowed during a burnoff. If the temperature value is exceeded **the burnoff will stop**. This is done to help maintain the life and the accuracy of your probe. SSi recommends a value of 1800 degrees. Clicking on the value will allow the user to change the value.

Digital IN 4 Assignment: The value for the digital input 4 assignment. Clicking on the value will allow the user to change the value, which can be either **event** or **Start Burnoff**.

Burnoff Minimum Millivolts Alarm Setpoint: The minimum millivolt value that must be reached in order for the "Insufficient mV drop during BO" alarm not to be generated. If the millivolt value does not drop below the minimum, the alarm will be generated.

Burnoff Maximum Temperature Rise Limit: The maximum number of degrees that the temperature is allowed to increase before the "Excessive TC rise during BO" alarm is generated.

Manual Event Control
Events are assignable outputs, used in recipes/programs. Typically, they are used to signal the recipe is complete, to turn process gases off and on, and tell the equipment to do a variety of tasks. The Manual Event Control submenu allows the user to force the events off or on.

The Manual Event Control menu option shows the user all of the events (**0 – 47**) and their current status. It also allows the user to manually control the status of any event by clicking on the value.   To change the status, highlight the specific event and click on the **Edit** button. The user will be able to select either an **On** value or an **Off** value. Select the desired Programmer using the dropdown menu at the top of the screen.
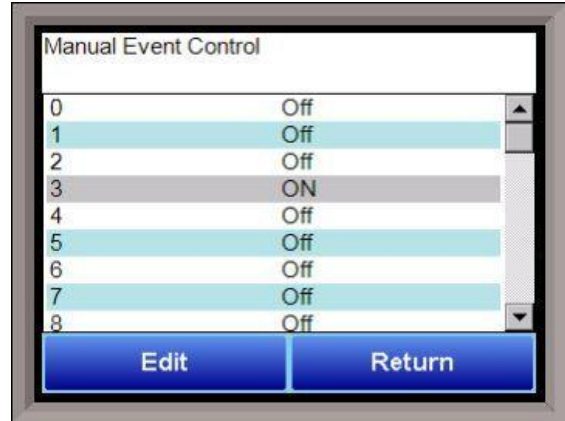
  WARNING!

  Before assigning or changing events, be certain that you are familiar with the function of the event whose status you are going to change. Changing the status of an event without knowledge of the result can lead to hazardous situations.

Clicking on the **OK** button will set the value, while clicking on the **Cancel** button will cancel the action.
The **Return** button will return the user to the menu screen.

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. For example this could be a control, overtemp, or load thermocouple on a batch furnace. Or it could be one thermocouple from eight temper furnaces. 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.
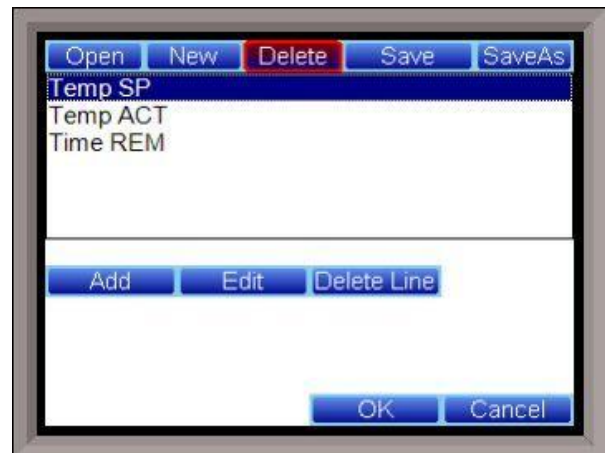
Open will allow the user to select a trend chart file to open up to edit.
New will create a new trend chart file to begin adding trend lines to.
Delete will delete a specified trend chart file.
Save will save all changes to the current trend chart file that have been made.
Save As will allow the user to save the current trend chart file as a new file with a different name.
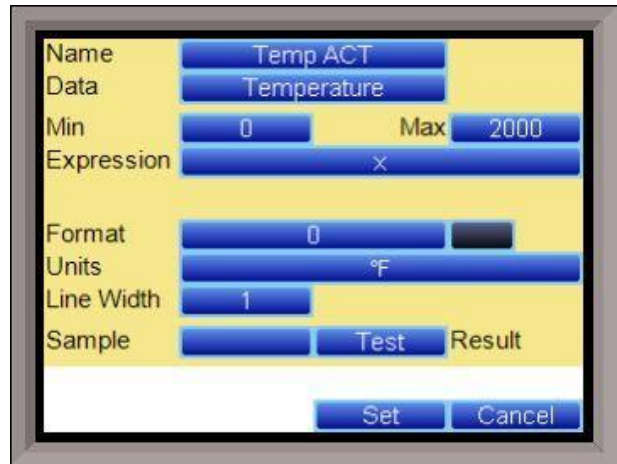
Once a new trench chart file has been created, or one has been opened, trend lines can be added, modified, or deleted. **Add** will add a new trend line to the file. **Edit** will allow the user to edit the information for a specific trend line. **Delete Line** will delete the specified line from the 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 ExoGen Controller. Some of the points have a name, such as "Temperature" or "Temperature SP", but others will just show the register in the ExoGen 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 in the **Error! Reference source not found.** menu.

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 ExoGen 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.

The **OK** button will close the screen and prompt the user to save any changes if changes have been made.

The **Cancel** button will close the screen and return to the menu screen.

Alarm Setup
Allows the user to adjust settings for different alarm groups. Select the desired alarm group from the dropdown menu at the top of the screen.

Alarm Type
Allows the user to select the alarm type. Options are **Band** and **Deviation.**

Alarm Setpoint
Allows the user to set the alarm setpoint. Use the numeric keypad to set the desired setpoint.

Atmosphere Loop alarms	
Alarm type	band
Alarm setpoint	10
Smart	Yes
Critical	No
0 SP inhibits alarm	Yes
Alarm delay	0 sec
Output low alarm set point	10.0 %
Output high alarm set point	90.0 %

Edit	Return

Smart
Allows the user to make the alarm a Smart alarm. Options are **Yes** or **No.**

Critical
Allows the user to make the alarm a Critical alarm. Options are **Yes** or **No.**

0 SP inhibits alarm
If enabled, a Setpoint of 0 will not trigger an alarm. Options are **Yes** or **No.**

Alarm Delay
Sets the delay of the alarm in seconds. Use the numeric keypad to set the desired delay.

Output low alarm setpoint
Allows the user to set the percent output alarm low setpoint. Use the numeric keypad to set the desired setpoint.
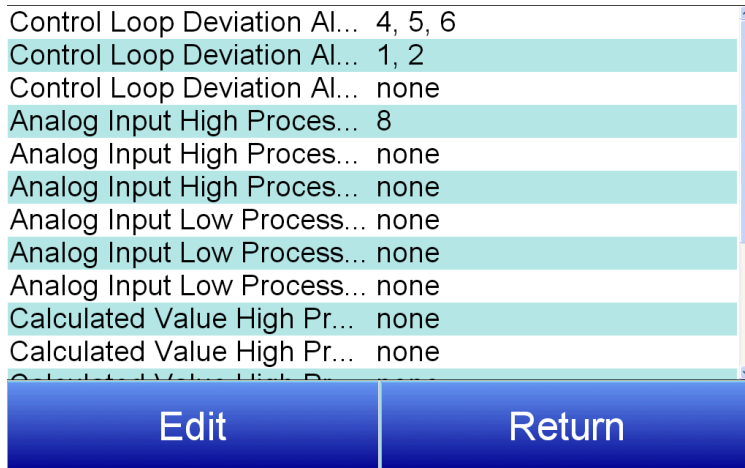
Output high alarm setpoint
Allows the user to set the percent output alarm high setpoint. Use the numeric keypad to set the desired setpoint.

Alarm Group Setup

Control Loop Deviation Al...	4, 5, 6
Control Loop Deviation Al...	1, 2
Control Loop Deviation Al...	none
Analog Input High Proces...	8
Analog Input High Proces...	none
Analog Input High Proces...	none
Analog Input Low Process...	none
Analog Input Low Process...	none
Analog Input Low Process...	none
Calculated Value High Pr...	none
Calculated Value High Pr...	none

Edit	Return

Relay Assignments

For each of four boards, there are 12 relay assignments available. The relay assignment options include:

Loop 1-15 Forward and Reverse
Nothing (not assigned)
Control Loop Groups 1, 2, 3 Individual and Combination Alarms
A/I (Analog Input) Groups 1, 2, and 3 Individual and Combination High and Low Alarms
Calc (Calculated) Groups 1, 2, and 3 Individual and Combination High and Low Alarms
% out High and Low Alarm Groups
Alarm
Control Loop Deviation
Input High and Low Alarms for Inputs 1-16
Input High and Low Alarms for Inputs 17-32
Calculated High Value Alarm
Calculated Low Value Alarm
Control Output High Alarm
Control Output Low Alarm
Generic Alarms 1-4
TC Check Alarm
Probe 1-8 burnoff
RPS (Redundant Probe System): Select, Alarm, bad probe 1, bad probe 2
Loop 1-16 Heat and Cool
Loop 1-16 Deviation Alarm
Programmer 1-8 Events 0-47
Flow Deviation Alarms Valves 1-8
Flow Deviation Alarms Any Valve

Relay Assignments	
Relay Assignment 1	loop 1 fwd
Relay Assignment 2	loop 1 rev
Relay Assignment 3	event 0
Relay Assignment 4	event 1
Relay Assignment 5	event 2
Relay Assignment 6	event 3
Relay Assignment 7	alarm 1
Relay Assignment 8	alarm 2

Edit	Return
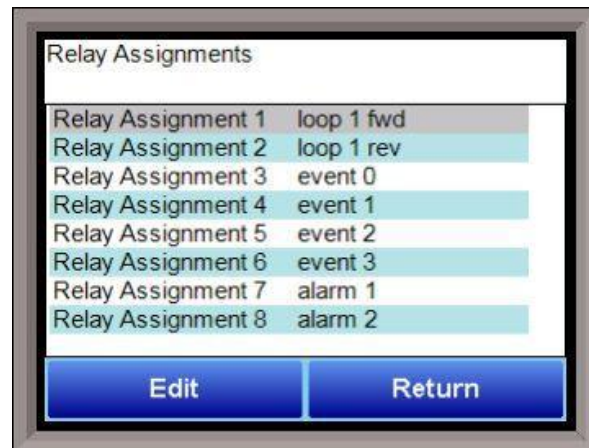
Flow Deviation Alarms Any Valve 1-4
Flow Deviation Alarms Any Valve 5-8
Generator Low Flow State (Only applicable to AutoGen)
O2 Alarm
Generator Critical Alarm (Only applicable to AutoGen)
Run Time Timer 1-25 Alarm
High PV Timer 1-8 Alarm
Alarm Groups 1-4
Alarm Groups 1-4 Not Acknowledged
Logic Alarm
Logic Alarm Not Acknowledged
Audible Logic Alarm Active
Vacuum Gauge 1-8 State A-F
Vacuum Gauge 1-8 Any State Active
Vacuum Gauge 1-8 No State Active
Flow Meter 1-8 RUN (applicable only to stepper valves requiring run command signal)
Flow Meter 1-8 Direction (applicable only to stepper valves required Direction command signal)
Not Assigned/Logic Calc Enabled (Typical)

NOTE: Invert State
Where applicable, this option can be used to make a relay normally closed for the inactive state. For example, if a relay is assigned to alarm 1, and no alarm is active, then the relay is open; if an alarm is active, then the relay contact is closed. If the reverse state is selected, and no alarm is active, the relay contact is closed; when an alarm is active, then the relay contact opens.

Programmer 1	
Programmer type	segment
SPP type	% Carbon
Atm/Loop 1 Source	PID 1
Temp/Loop 2 Source	PID 4
Event Source	internal
Quench Source	PID 12
End of Quench Event	7
Quench Speed Event	6
Quench Run Event	0
default hold time	90 min
deviation alarm delay	0 min
Clear Events/end of recipe	Yes

Edit	Return

Programmer Configuration
This option contains settings for various Programmers (chosen using the dropdown menu at the top of the screen).

Programmer type
Options are **step** or **segment**.

SPP type
Options are **%Carbon**, **Dew Point**, **O2**, and **Temperature**

Atm/Loop 1 Source
Options are **PID 1-16**, **Master Setpoint 1-4**, and **Instrument 1-15**.

Temp/Loop 2 Source
Options are **PID 1-16**, **Master Setpoint 1-4**, and **Instrument 1-15**.

Event Source

Allows for a slave instrument (or internal) to be the defined event control device. The types of instruments are: **Internal**, **Instrument 0** – **Instrument 24**. Internal is typical.

Quench Source

Allows for slave instrument (or internal) to be the defined quench control device. This is setup in the configurator furnace setup submenu. It will send the setpoint out to whatever instrument is configured for quench. Options are **PID 1-16**, **Master Setpoint 1-4**, and **Instrument 1-15.**
.

End of Quench Event

Tells the programmer which event to signal end of quench (related to which relay it is assigned). The default event for this is Event 7, but it can be changed in the furnace setup menu. This event turns on for one (1) minute when the quench timer is complete. The list of possible values is: **0 – 15**.

Quench Speed Event

Tells the programmer which event will signal the quench speed. The default event for this is event 6. This event will remain off if quench speed is set to low. It will turn on if quench timer is timing and quench speed is set to high with the QUENCH opcode. The list of possible values is: **0 – 15**.

Quench Run Event

Tells the programmer which event will signal quench run. The default event for this is 0. This event will stay on when the quench timer is timing. The list of possible values is: **0 – 15**.

Default hold time

Sets the default hold time in minutes. Use the numeric keypad to enter your selection.

Deviation alarm delay

Sets the deviation alarm delay time in minutes. Use the numeric keypad to enter your selection.

Clear Events/end of recipe

When activated, events will be cleared when a recipe is completed. Options are **Yes** or **No.**

Start Quench

This option will determine what event starts the quench cycle. It determines whether the quench timer starts immediately after it sees the quench opcode or if it waits for an input event If this option is set to start on an opcode, when the recipe reaches the step, it will preload the timer and start timing immediately. If it is set for an input, it will preload the timer but wait until it sees the input configured go high before it starts timing. The options are: **On Recipe Opcode** or **0 – 31**.

Quench Hold Event

This option will determine which event will hold the quench cycle. It is used to hold the quench timer with an external device. If the input that is configured turns on then the quench timer will go into a hold mode. Options are **none**, or **0-15**

Quench idle speed

Sets the quench idle speed. Use the numeric keypad to enter your selection.

Zone Setups

WARNING: This screen should not be changed without consulting SSi at (513) 772-0060.

*Slave Instrument Setup must be configured prior to Zone Assignment setup

The zone setups feature allows the ExoGen Controller program to change set points on all instruments of a multi-zone furnace. The ExoGen Controller has up to five temperature and atmosphere zone assignments available (**Zone Assignment 1 – Zone Assignment 5**).   Typically, the first zone is configured to the programmer's atmosphere or temperature instrument. That is the master set point that will be propagated to the other configured zone instrument set points on set point change. For example, the user may want to set 4 temperature zones from a recipe where the programmer temperature instrument is loop 2. In this case, zone 1 would be configured as loop 2. Subsequent zones would be configured as previously configured slave temperature controllers.

 If the *ZONE_OFF* (Zone Offset) opcode had been used in the program, the set point sent to the specified zone instrument would have the offset added. For example, a 3-zone pit furnace, where the bottom zone usually has a higher set point. The middle zone and the top zone usually have a lower set point. The bottom zone temperature controller is assigned to zone 1, the middle temperature controllers to zone 2, and the top zone controller to zone 3.

If the first three steps of a program are as shown below, then the bottom zone set point is 1775, the middle zone is 1750, and the top zone is 1800.

Step	Opcode	Temperature	Option
1	*ZONE_OFF*	25	Zone 1
2	*ZONE_OFF*	50	Zone 3
3	*SETPT*	1750	

The first step sets the offset for zone 1 to 25 degrees; therefore, the bottom zone controller would be sent a set point of 1775 when step 3 is executed. Likewise step 2 sets the offset for zone 3 to 50 degrees. The top zone then receives a set point of 1800. The middle zone controller would receive the 1750. The temperature controller displayed on the Status Display is instrument #2.   If instrument #2 were the top zone controller then the Status Display would show the 1800-degree set point.

When using the multi-zone offset feature, the temperature controller assigned as instruments 1 and 2 should be i̶n̶ ̶z̶o̶n̶e̶ ̶t̶h̶a̶t̶ ̶w̶i̶l̶l̶ ̶n̶o̶t̶ ̶b̶e̶ ̶o̶f̶f̶s̶e̶t̶.

Atmosphere and Temperature

Atmosphere and Temperature

Zone	Atmosphere	Source	Off			
1	Off	Loop 1	0	Off	Loop 1	0
2	Off	Loop 1	0	Off	Loop 1	0
3	Off	Loop 1	0	Off	Loop 1	0
4	Off	Loop 1	0	Off	Loop 1	0
5	Off	Loop 1	0	Off	Loop 1	0

Atmosphere and Temperature
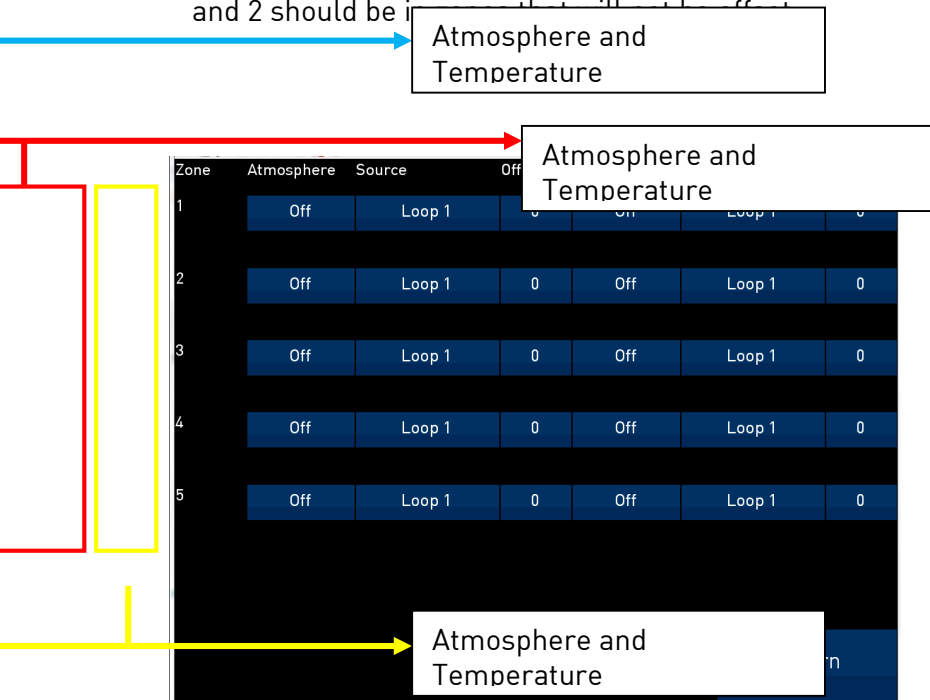
Atmosphere
This option will allow the user to set the zone number for the assignment. The range is **0 – 5**.

Source
This will allow the user to set the atmosphere or temperature instrument for the zone assignment. The options are
Loop 1-16, Master Setpoint 1-4, Instrument 1-15, and **Flow Meter 1-8.**

Offset
This option will allow the user to enter an offset for the assignment. The range is **-4000 – 4000**.

Temperature
This option will allow the user to set the zone number for the assignment. The range is **0 – 5**.

Furnace

The Furnace menu option is an administrative access only option. Do not make any adjustments on the screen without first contacting Super Systems, Inc. at (513) 772-0060.

Date and Time
This value is the current date and time on the ExoGen Controller only (not the local computer or the touch screen, if applicable). The time on the controller is displayed in the 24-hour format, so 8 = 8 AM, and 14 = 2 PM. *Note: The date*

Furnace	
Date and Time	7/28/2018 8:32:17 AM
Device Name	Matrix Controller
Temperature Mode	°F
Web access code, level 1	0
Web access code, level 2	0
Port 1 number of AIBs to ...	4
Port 1 number of DACs to...	4
Port 1 number of Digital I/...	8
Port 2 number of AIBs to ...	6
Profiler Mode	Off
PVT Type	% Carbon

Edit	Return

and time of the touch screen can be changed (if necessary) by selecting the date and time in the lower right corner on the touch screen, once the screen software has been shut down and the Windows™ desktop is visible. Then, at the CE screen the date and time can be changed by double taping the time in the bottom right corner and setting it, then select "apply". For this to take effect the screen needs to be rebooted; on the older TPC 642 displays the registry needs to be saved under TPC Configuration icon, the Misc Tab and then reboot the touch screen. The date and time that is recorded on the flash card (and therefore the datalog data) is the date and time of the Advantech display, not the controller.

Device Name
Allows the user to enter a name for the device. Use the keypad to enter your selection.

Temperature Mode
This allows the operator to choose either degrees Fahrenheit or degrees Celsius for the temperature. The options are **°C** or **°F**. Pressing **OK** will set the choice.

Web access code, level 1
Allows the user to set the code for level 1 web access. Use the numeric keypad to enter your selection.

Web access code, level 2
Allows the user to set the code for level 2 web access. Use the numeric keypad to enter your selection.

Port 1 number of AIBs to scan

This sets the number of expected Analog Input Boards that the Matrix should expect to communicate to.

Port 1 number of DACs to scan
This sets the number of expected Analog Output Boards that the Matrix should expect to communicate to.

Port 1 number of Digital I/O boards to scan
This sets the number of expected Digital I/O Boards that the Matrix should expect to communicate to.

Port 2 number of AIBs to scan
This sets the number of expected Analog Input Boards that the Matrix should expect to communicate to.

Profiler Mode
Options are **Off, enable and step,** and **Programmer.**

PVT Type
PVT Type is used to configure features in the Matrix for furnace applications. It enables or inhibits features, such as probe tests for %Carbon or Redundant Probe Alarms for RPS, in furnace control applications. This feature is not used in generator or mixing applications.

There are six PVT choices. Each type has specific factory default values that are relevant for the selected type.

not used	Millivolts
%Carbon	Redundant Probe System
Dew Point	Vacuum

Not used: The feature is not activated. No probe maintenance options are available.

%Carbon: Process variable will calculate for carbon potential along with a temperature loop. Loop 1 is based off of Input 1 (terminals 31, 32 probe sensor millivolts) and Input 2 (terminals 29, 30 probe TC). These two inputs together constitute loop 1. Loop 2 comes from Input 3 (terminals 27, 28) which is temperature control.

Dew Point: Control will be for dew point along with a temperature loop. Loop 1 is based off of Input 1 (terminals 31, 32 probe sensor millivolts) and Input 2 (terminals 29, 30 probe TC). These two inputs together constitute loop 1. Loop 2 comes from Input 3 (terminals 27, 28) which is temperature control.

Millivolts: Control is based off the millivolt reading. Also reads temperature.

Redundant Probe System: enables RPS features

Vacuum: enables vacuum leak-up testing.

Communications

IP Address	192.168.0.195
IP Mask	255.255.248.0
IP Gateway	192.168.7.254
RS485 Host port baud	19200
RS485 Host port mode	Modbus
RS485 Host Port bits	8N1
address	1
RS232 Slave port baud	19200
RS232 Slave port mode	Modbus slave
RS232 Slave Port bits	8N1
RS232 host port baud	19200
RS232 host port mode	Modbus

Edit	Return

Communications
Warning: Changes to this screen should not be made without consulting SSi at 513-772-0060. This screen will show the Ethernet and RS-232/RS-485 communications information for the ExoGen Controller.

IP Address
NOTE: This screen option is for changing *the controller's IP address*. If you need to change the *IP address of the Touch Screen*, see the instructions in Appendix A of the Touch Screen

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 9220 controller or to other devices on your network. This is necessary if the Touchscreen will be communicating to the 9220 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
NOTE: This screen option is for changing *the controller's IP mask*. If you need to change the *IP mask of the Touch Screen*, see the instructions in Appendix A of the Touch Screen Manager manual, available at www.supersystems.com.

This will identify the Subnet mask of the controller. The Subnet mask must be in the "xxx.xxx.xxx.xxx" format.

IP Gateway
NOTE: This screen option is for changing *the controller's IP gateway*. If you need to change the *IP gateway of the Touch Screen*, see the instructions in Appendix A of the Touch Screen Manager manual, available at www.supersystems.com.

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	1000000
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**

RS485 Host port bits
Options are **8N1, 8O1, 8E1, 8N2, 8N1, 7O1, 7E1,** and **7N2**.

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 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	1000000
9600	38400	230400	

RS232 Slave port Mode
This will set the mode for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The options are **Modbus slave, Modbus master, televac, Televac MX200, Varian,** and **Leybold**

RS232 Slave port bits
Options are **8N1, 8O1, 8E1, 8N2, 8N1, 7O1, 7E1,** and **7N2**.

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	1000000
9600	38400	230400	

RS232 Host port Mode
This will set the mode 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 USB communications. The list of options is:

1200	14400	57600	460800
2400	19200	76800	921600
4800	28800	115200	1000000
9600	38400	230400	

USB Host port Mode
This will set the mode for USB communications. This setting is fixed at **Modbus master.**

Subprocessor Slave Baud
This will set the baud rate for subprocessor communications. The list of options is:

1200	14400	57600	460800
2400	19200	76800	921600
4800	28800	115200	1000000
9600	38400	230400	

Subprocessor slave mode
This will set the mode for subprocessor communications. This setting is fixed at **Modbus AIB.**

PLC Type
The list of options is:
Micrologix Modbus
MCMmodule Modbus
DF1 PLC5
DF1 Slik
Passive

Slave Instruments
WARNING: This screen should not be changed without consulting SSi at 513-772-0060.

This screen will allow the user to configure up to 30 slave instruments through the ExoGen Controller. To set up a slave instrument, highlight the instrument number and click on the **Edit** button.

The list of available slave instruments will be shown on the screen. The list is color coded by type – Blue for Atmosphere, Red for Temperature, Yellow for Events, and White for User-Selected Instrument. Highlight an instrument to select it as the instrument to use.
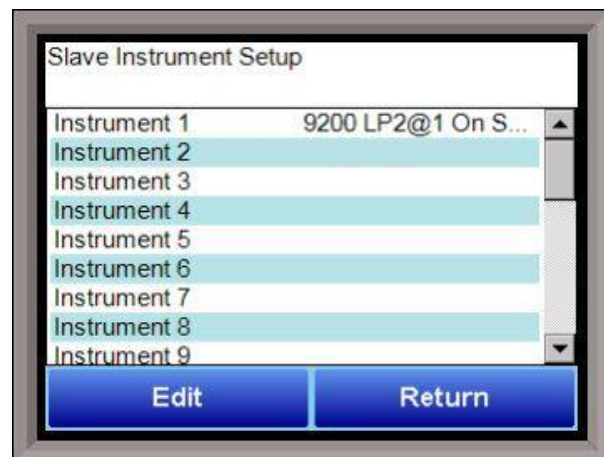
User devices User 1 – 15 can also be selected.

T** All devices on the same slave port must utilize the same protocol
** An address of zero (0) will disable the instrument** Some controllers (AC20 for example) can provide dual functions (atmosphere and events) and must have the same address assigned for both.

The slave port is next to the address. The Slave port option can be: **Slave 1**, **Slave 2**, or **RS-232**.

Some instruments may not be shown in the list of instruments. User Instruments 1 through 16 are used to set up a non-listed instrument as a slave instrument using the Generic Instrument Setup menu.

The **OK** button will set the slave instrument, and the **Cancel** button will cancel the setup.

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

Hysteresis
This value is the Hysteresis value. The Hysteresis is a set number that works with the alarm to help control a motor or pump longer to reach a set amount to come back into band before it will shut off motor or pump.

Example: Using quench oil as an example, suppose the SP is 200 °F. The alarm is set as a deviation of +10 °F.   At 210 °F, the alarm is active and the pump will run to cool the oil. With a hysteresis of 8 °F, the alarm and pump will turn off at 202 °F.   It will turn back on when it is 10 °F above setpoint. If the setpoint is still 200 °F, then at 210 °F, it will turn on again.

Clicking on this value will display an input box from which the user can select a new value. The range is from **-32767** to **32767**.

Smart Alarm
This value is a display of the Smart Alarm status. 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.

Example: If the SP is 1700 °F and the band is 10 °F, the alarm will not be active until the PV reaches 1690 °F. The value can be either **disabled** or **enabled**.

ON Delay Time
This value is the On Delay Time for the alarm. Clicking on this value will display an input box from which the user can select a new value. The range is from **-32767** to **32767**.

0 Setpoint Blocks Alarm
This value will allow a 0 setpoint to block an alarm. The options are either **No** or **Yes**.

BO/Impedance inhibits alarm

If BO/Impedance inhibits alarm is turned to Yes, no alarm will sound if the carbon percentage drops because of a burnoff.

Inhibit Source
Alarms can be inhibited in order to prevent false or unnecessary alarm notifications. The Inhibit Source option will allow the user to set the source of the inhibit signal. The options are: **None**, **Input 1 – Input 4**, **Soak timer inactive** (The alarm will not happen if the furnace is in a soak if this option is selected), and . **Input 6 – Input 15**.

Disable on open input
An alarm can be disabled when an input the open in order to avoid false or unnecessary alarms. This option will allow the user to specify if the alarm is disabled when the input is open. The options are either **no** or **yes.**

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

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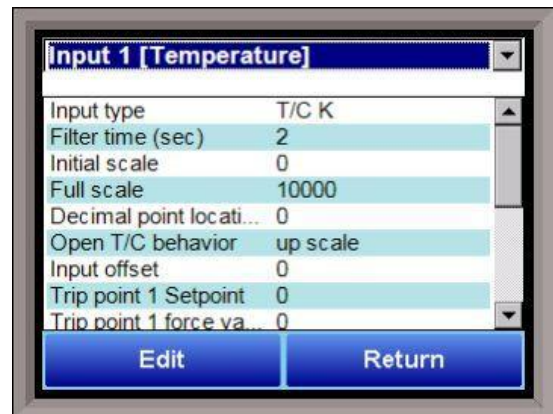
Input Type
The thermocouple type for most applications can be modified depending on your specific needs. *Note - some of the inputs DO NOT allow the user to modify the Input type*. To change the Input type, first select which input you want to change by selecting it in the pull-down at the top of the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

B	S	12.5 volts **
C	T	781.25mV
E	2.5 volts	195.3125 mV
J	1.25 volts	
K	78.125 mV	
N	19.53125 mV	
NNM	4-20 mA **	
R	25 volts **	

** – When the specified input type is selected, a jumper located inside the case will need to be placed on that specific input for reading this selection. If jumper is not placed on input, then damage could occur to the board. Please consult SSI before making any changes.

Filter time

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. The range is **0** to **32767**.

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. The range is **–32768** to **32767**.

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. The range is **–32768** to **32767**.

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. The range is **0** to **4**.

Open TC 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. The range is **–32768** to **32767**.

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 value at which the trip point will be activated, forcing the displayed value to the "force value" set below. This value must be something that the input can achieve.

Trip Point 1 Force Value: This is the value that the input will be forced to display when the trip point SP (set above) has been achieved.

<u>Trip Point 1 Direction</u>: This is the trip point 1 direction. Options are **input above setpoint** or **input below setpoint**.

If you choose **input above SP** then the PV for the selected input will need to transition above the Trip Point 1 SP value set above.
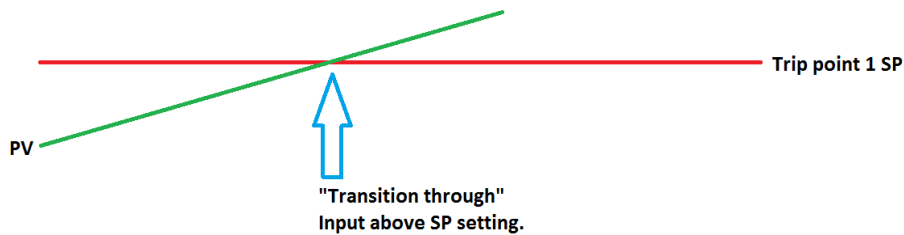
If you choose **input below SP** then the PV for the selected input will need to transition below the trip point SP value set above.
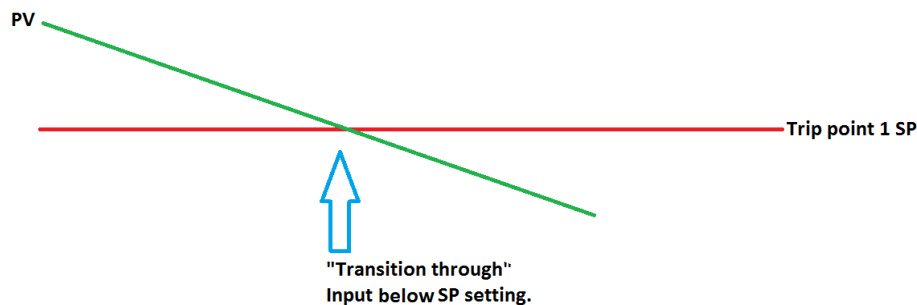
Example (when OPEN INPUT is set for 1 trip point):

Open Input	one trip point
Trip Point 1 Setpoint	10
Trip Point 1 Force Value	0
Trip Point 1 Direction	input below setpoint

In this example when this input's PV goes below 10 then the displayed value will be forced to ZERO. <u>IF</u> it cannot or does not go below 10 then the forced value will never happen.

Trip Point 2 Setpoint, **Trip Point 2 Force Value**, and **Trip Point 2 Direction** function identically to the above.

High Alarm Setpoint
This is the setpoint for the high input limit.

High Alarm Hysteresis
This is the hysteresis for the high input limit. The range is **–32768** to **32767**.

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. Options are **Yes** or **No**.

High Alarm Critical
Determines whether the alarm is critical (**Yes**) or not critical (**No**). A critical alarm must be acknowledged to unlatch it.

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 high input limit. The range is **–32768** to **32767**.

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. Options are **Yes** or **No**.

Low Alarm Critical
Determines whether the alarm is critical (**Yes**) or not critical (**No**). A critical alarm must be acknowledged to unlatch it.

Low Alarm Delay
The delay (in seconds) before the low alarm is generated.

High 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.

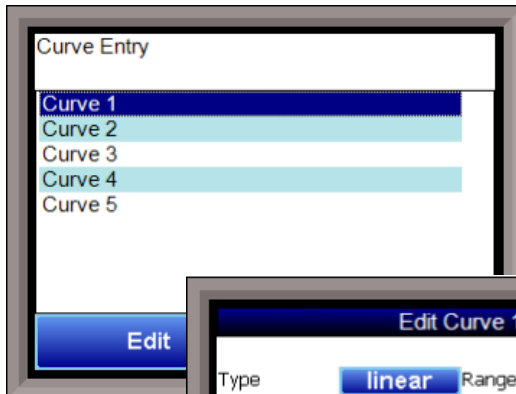**High limit alarm for control shutdown hysteresis**
This is the hysteresis applied to the corresponding setpoint (described above).

T/C Correction Curve
This will allow the user to enable the T/C correction curve.   The options are: **No** and **Yes**.

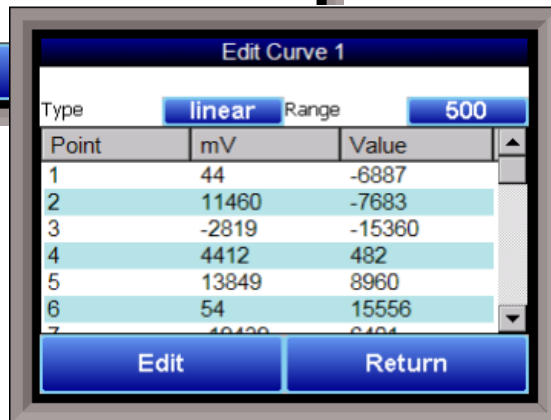The **Return** button will return the user to the menu screen.

Analog Input Curve Entry

Most types of inputs that are used in SSi controllers are already setup with a curve built for most every type of thermocouple available, certain vacuum sensors, etc. 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 off of 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.

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

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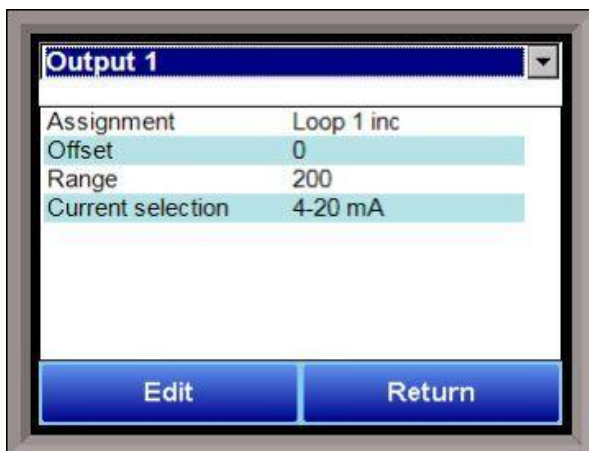
The ExoGen Controller has the option of six analog outputs. The outputs are ranged for a 4 – 20 milliamp signal or a 0 – 20 milliamp signal. Each output comes with a factory default configuration dependent on the application. Each output can be modified prior to shipment to your facility or in the field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

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. Options are:

control out inc loop 1-16

control out dec loop 1-16
control out combo loop 1-16
process variable loop 1-16
set point loop 1-16
input loop 1-16
Calculated Value 1-6
Master SP 1-4
RPS Select 1-8
Flow meter setpoint 1-8
Flow meter output 1-8

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. See below for more examples.

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
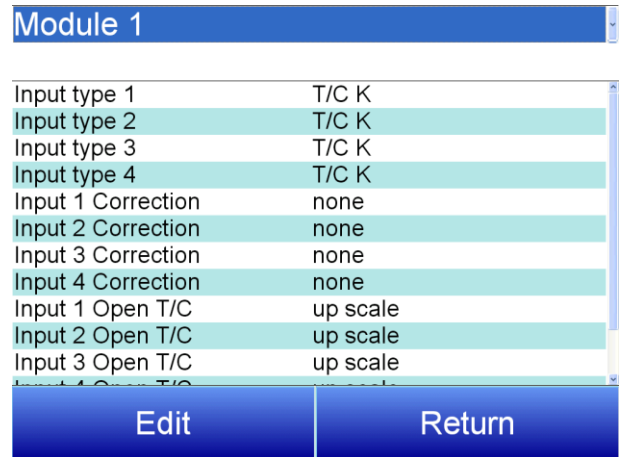 Offset = 800 (starting point)
  Range = 400

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

Aux Analog Inputs

The Auxiliary Analog Input Setup menu option allows the user an input selection of four inputs per module, four input corrections per module, and four input open T/Cs per module. There are ten (10) modules available. It is configurable for voltage of T/C (universal input), and it is typically used for Load T/Cs, motor speed feedback, current speed devices, and Auxiliary Flow Meters.

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.

Module 1	
Input type 1	T/C K
Input type 2	T/C K
Input type 3	T/C K
Input type 4	T/C K
Input 1 Correction	none
Input 2 Correction	none
Input 3 Correction	none
Input 4 Correction	none
Input 1 Open T/C	up scale
Input 2 Open T/C	up scale
Input 3 Open T/C	up scale
Input 4 Open T/C	up scale

| Edit | Return |

Input 1 – Input 4
This will select the input types for the module. The options are:

T/C B	T/C R	1.25 V	4-20mA (62)
T/C C	T/C S	160mV	625mV
T/C E	T/C T	80mV	312.5mV
T/C J	T/C D	40mV	781.25mV
T/C K	T/C G	20mV	195.3125mV
T/C N	T/C P	4-20mA (62), 10:1	
T/C NNM	2.5V	4-20mA (124)	

Input 1 Correction – Input 4 Correction
This option will set a correction curve for the input. The options for the input corrections are: **none**, **Curve 1 – Curve 3**.

Input 1 Open T/C – Input 4 Open T/C
This option will allow the user to set the direction of the open T/C for each input. The options are: **Up Scale** or **Down Scale**.

Calibration (Auxiliary Analog Inputs)
The user will need a calibrator capable of outputting a temperature, voltage, and millivolt signal to calibrate the zero, span or cold junction value. The user will need to connect the calibrator to one of the inputs on the data logger for the channel that will be calibrated. It is recommended to let everything (calibrator and data logger) sit for approximately thirty minutes to allow the temperature to achieve equilibrium. Set up the calibrator for the specific thermocouple type, i.e. type K, type J, etc. Then, source a specific temperature, like 1000°F, or millivolt to the connected input. It is recommended that the actual temperature used be similar to an appropriate process temperature. For example, if your equipment normally operates at 1700°F, then perform the cold junction calibration using a 1700 °F signal. It is important to note that when performing a zero or span calibration, *do not use* regular thermocouple wiring. Instead, use any kind of regular sensor wire, or even regular copper wire. To perform the calibrations, the user will need a calibrator that is capable of outputting volts, millivolts, and temperature.

The "Zero/Span" tab will allow the user to perform a zero and span calibration on the selected board.

The help button - - next to the "Range" drop-down list will allow the user to select a range based upon an input type if the range is not known.

Select the input type and click on the **OK** button. The correct millivolt range will be displayed in the drop-down list. Click on the **Cancel** button to cancel this action.

Below is a listing of the suggested ranges for the various TC types.

TC Type mV Range Chart

TC Type	Range in mV
B	17.5
C	65
E	65
J	65
K	65
N	65
NNM	65
R	65
S	17.5
T	65

Slave Controller Setpoint Retrans
Allows the user to set a Setpoint automatically to a slave instrument. Select the desired instrument from the dropdown at the top of the screen.

SP source
This option sets where the system receives the SP from. Options are **Off, Loop 1-16,** and **Master Setpoint 1-4**

SP offset
This option sets a fixed offset to the SP source above. Use the numeric keypad to enter a desired offset value.

SP delay for drop in SP
This value sets a delay (in sec) before the SP is changed. Use the numeric keypad to enter a desired delay value.

Alternate PID

IMPORTANT!

Atmosphere Loop set 1	
Prop Band (0 for On/Off)	4.0
Reset	0.10
Rate	0.00
integral preset	0
Control Low Limit	-100
Control High Limit	100

Edit	Return

PID Auto Switching must be enabled in the PID Loop Setup menu before Alternate PID Setup settings will be applied. This applies only to the Loop 1 – Loop 3 Set1-Set 3 menu options. All other menu options are for recipe Opcode PID control.

The Alternate PID Setup menu option allows for sets of PID values to be used on the first loop via the programmer. This is frequently used if a different PID would be more suitable once a furnace reaches a certain temperature.

NOTE: The feature of PID Auto Switch is disabled for the entire duration of the recipe when the Opcode PIDLOAD is executed. See the PID Loop Setup section for more information.

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**.

Control High Limit
This is the high limit value. The range is **–100** to **100**.

Control Low Limit
This is the low limit value. The range is **–100** to **100**.

Calculated Values
Options for each calculated value (1 through 8) are as follows:

Calculated Value
The result of the calculation. This is display-only and not editable.

Calculation Type:
This sets the type of calculation performed. Options are **none, %C, Dew point, %O2, O2 offset log, DA, K_N, super K_N, lambda dew point, lambda %C, lambda O2, generator, nitrogen methanol,** and **FNC generic.**

*Calculated Value 1	
Calculated Value	0.00
Calculation Type	generator
Calculated value decimal ...	2
Source for calculations	Valve Group 1
High alarm setpoint	99.99
High alarm hysteresis	0.01
Smart	No
Critical	No
Alarm delay	0 sec
Low alarm setpoint	-99.99
Low alarm hysteresis	0.01

Edit   Return

Calculated Value Decimal Point:
The number of decimal places for display of the calculated value result. This is usually forced by the calculation type.

Source for Calculations:
The source of the data used in the calculations.

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:
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
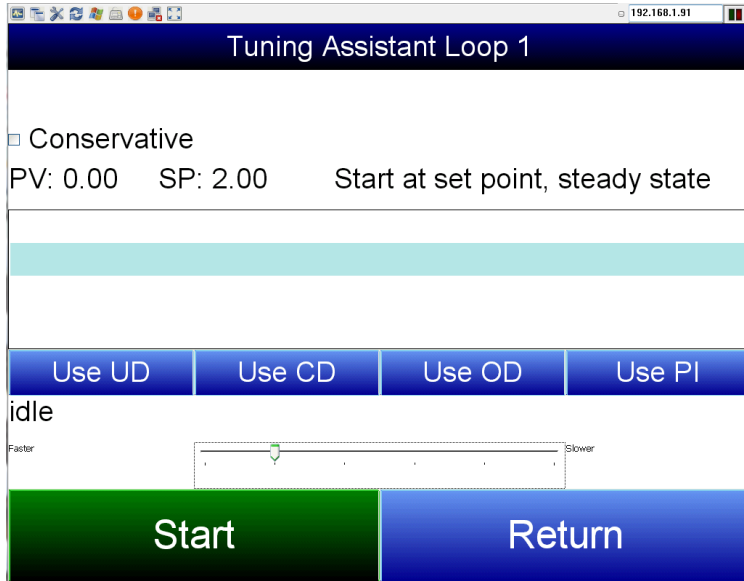
Tuning Assistant

The Tuning Assistant menu option will allow the user to automatically generate the PID loop settings for the temperature control loops in the ExoGen Controller. Select the loop to tune and click on the **Edit** button to auto tune that loop.

Note: The four buttons at the bottom of the screen: **Use UD (Under Damped), Use CD (Critically Damped), Use OD (Over Damped),** *and* **Use PI** *will be inaccessible until some PID settings are loaded into the PID settings list above the buttons.* The **Return** button in the bottom right of the screen will display the previous screen.

The "Conservative" option will allow the user to minimize, if not remove, the possibility for an overshoot of the setpoint. If a small overshoot is acceptable, leave the "Conservative" checkbox unchecked. If, however, no overshoot is desired, then checking the "Conservative" checkbox will accomplish this.

The current PV value, along with the setpoint, is listed above the PID settings list.

Pressing the **Start** button will begin the auto tune process. *Note: The process may take a few seconds to start.* The "Idle" line will change to display the process for the auto tune. The line will display a pointer value.

Note: The **Start** *button will be disabled while the tuning is running.* Pressing the **Abort** button will abort the process. If the **Cancel** button is pressed while a tuning is running, a message box will be displayed confirming the action.

During the tuning, the temperature will oscillate around the setpoint 3 times before Tuning Assistant suggests tuning parameters. Depending on the heating and cooling abilities of the equipment, this can take a few minutes up to a few hours.

When the tuning is finished, the PID settings list will be populated with suggested values and the four buttons underneath will be enabled. The line above the PID settings list will read "Idle" again as well.

The user has the option to select only one of these sets of values: either the Under Damped set, the Critically Damped set, the Over Damped set, or the PI set. To select the set of values, press the corresponding

button. For example, to select the Critically Damped set of values, press the **Use CD** button.

The under damped values will reach the setpoint faster, but there will be more overshoot involved.
The over damped values will work to minimize the overshoot, but it will be slower than the under damped values.

The critically damped values provide a balance between the underdamped and overdamped values with regard to time and overshoot.

The PI values are the proportional band and the reset value (the *P* and the *I* from *PID*).

There is also a "Faster/Slower" slider bar to adjust the speed of the tuning process.

Once a set of values has been accepted, the user can press the **Return** button to exit the screen. The accepted values can be viewed on the *PID Loop Setup* menu option. In future tuning sessions, the most recent tuning parameters will be retained and adjusted PID sets will be offered.

Instrument Calculation
The Instrument Calculation menu allows programming code-like lines to be executed at a variable time interval per step. *Note: It is important to contact Super Systems at (513) 772-0060 before creating or modifying any Instrument Calculation customization*.

General Description
The Instrument Calculation allows for fifty (50) lines of program and fifty (50) program variables. Program variables allow for storage on intermediate results of calculations.
A program variable is designated by a v followed by a number from **0** to the number of variables – 1.
A Lower or Upper case "V" is valid, as well as leading zeroes. The following are all considered the same variable: V3, v3, v0003.
The ExoGen Controller's Modbus registers can be used as input variables in the equations without restriction. To protect the instrument, Modbus registers are restricted as output registers.
Modbus registers are designated by an upper or lower case "M" followed by a number.
Note – The standard Modbus routine is called to retrieve the Modbus variable, therefore a 0x8000 (-32768) will be returned for an invalid register.
Note – Modbus registers are stored with integer values, so adjustments will need to be made for decimal values.
If the instrument can have external analog input boards, or the instrument is a Video Recorder or DAQ, these inputs can be accessed directly as A1 through A40. By using the "A" designation, the Modbus register number is not needed and the variable is scaled to the correct value (decimals included) based on the input type specified.
In a Video Recorder, the slave instrument data slots can be defined as variables D1 through D32. D31 and D32 are extra slots and have no restrictions as output variables. D1 through D30 are shared with the first ten (10) slave instruments in groups of three (3) – PV, SP, PO – and caution should be used when assigning as outputs.
A line in the program of the instrument calculation must start with a variable or a keyword. Variables must be followed by an equal sign (=) and then an expression. The expression can be a simple assignment (V1 = 3) or a variable operation variable as described below (V1 = M225 * 0.1).

Keywords *MUST* be entered in capital letters only.

The list of valid keywords is: **IF**, **ELSE**, **ENDIF**, **QUE**, **RLY**, and **END**.

"IF" must be followed by an expression which is a variable, relationship operator, then variable. The list of valid relationship operators is: **>** (Greater Than), **<** (Less Than). **=** (Equals), **>=** (Greater Than or Equal To), **<=** (Less Than or Equal To), **!=** (Not Equal To), and **==** (Equal To). *Note – The "=" and "==" relationship operators are identical.*

The list of valid bitwise operators is: **&** (AND), **|** (OR), **^** (XOR), **<<** (Left Shift), and **>>** (Right Shift).

The result of the "IF" relationship test determines if the lines following the "IF" statement will be executed or not.

The "ELSE" and "ENDIF" must be on a line by themselves. "ELSE" will toggle the program based on the result of the "IF" test. "ENDIF" will close out the "IF".

Example:

IF V1 >= 30

V3 = V2 * 1.5

ELSE

V3 = 5

ENDIF

In this example, if the value in V1 is greater than or equal to 30, then the value of V3 will be the value of V2 multiplied by 1.5. If the value in V1 is less than 30, the value of V3 will be 5.

EVERY "IF" must have a closing "ENDIF". However, the "ELSE" is optional.

The "QUE" is used to send data to a slave instrument and must have three (3) variables separated by spaces. The first is the slave instrument number, the second is the register number, and the third is the data to send.

Example:

QUE 3 1129 V1

This example will send the value of V1 to register 1129 on instrument 3.

The "RLY" is used to control a relay if the relay assignment is 999. The "RLY" must be followed by a variable which is the relay number (**1 – 8**) and a relationship expression.

Example:

RLY 5 M554 < 2

This example would turn Relay 5 ON if the communication status for instrument 5 was bad.

The "END" keyword will stop the lines from running, and start over from line 1.

There are a few functions that are available as well. The list of valid functions is: **FSIN** (Sine), **FCOS** (Cosine), **FEXP** (Exponent), **FLOG** (Logarithm), **FLN** (Natural Logarithm), **FSQRT** (Square Root), **FABS** (Absolute Value), and **FPOW** (Power). The Sine and Cosine functions need to have the parameter in radians. A function must be in all caps and begin with an "F" and have a pair of parenthesis. An undefined function returns the value of the expression in the parenthesis. *Note – A pair of parenthesis by themselves is considered an undefined function.*

The instrument calculation has limited parsing ability. This is kept to variables, operation, variable – i.e. V1 = 12.25 * V2. Another example is M128 = V1/100.

A negative sign (-) in front of the number is considered part of the number – i.e. V1 = -2.55 + V2.

A variable to the parser is one of the following: a program variable (Vxx), a Modbus register (Mxxx), a number, or a function.

Example:

V1 = (V2 * 1.35) + (V3 * V4)

This example will multiple V2 by 1.35 and multiply V3 and V4 together, and add those two results and store that value in V1.

The maximum length of a program line is thirty-one (31) characters.

The following are the valid mathematical operators: + (Addition), - (Subtraction), * (Multiplication), / (Division), and % (Modulo Divide – integer only).
The difference between Division and Modulo Division is that Modulo will always return an integer value.
Example:
11 / 4 = 2.75
11 % 4 = 2 (The .75 will not be returned)

Calculation Time In MS (0 to Disable)
This is the calculation time for the calculations. This will specify the delay between executing a line. Each line has the same delay between them, even if they are blank. A value of zero (0) will keep the calculations from being performed. The range is **0 – 10000**.

Editor
This option will display the screen where the calculations can be entered.
To edit a line, click on the **Edit** button. This will bring up the keyboard, which will allow the user to change the text for the calculation. If **Edit** is clicked on a blank line, a new calculation can be entered.
To Insert a blank line in between lines, select the line *BELOW* where the inserted line is going to go and click on the **Insert** button.
To delete a line, highlight the line and click on the **Delete** button.
To erase a line, highlight the line and click on the **Clear** button.
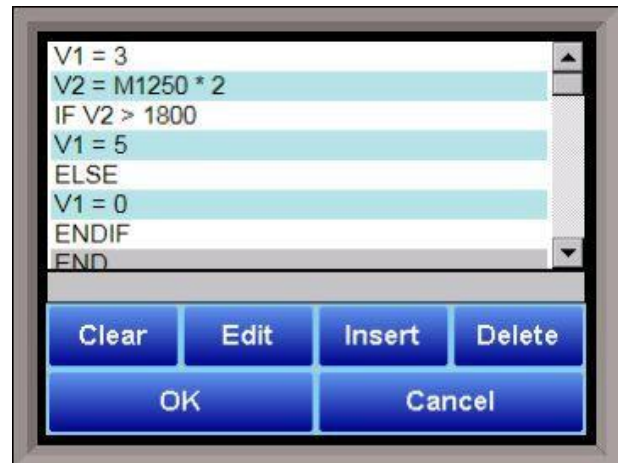
Calibration
Calibration provides you with options for performing a zero and span calibration of the input and output boards, as well as adjusting the cold junction.

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.
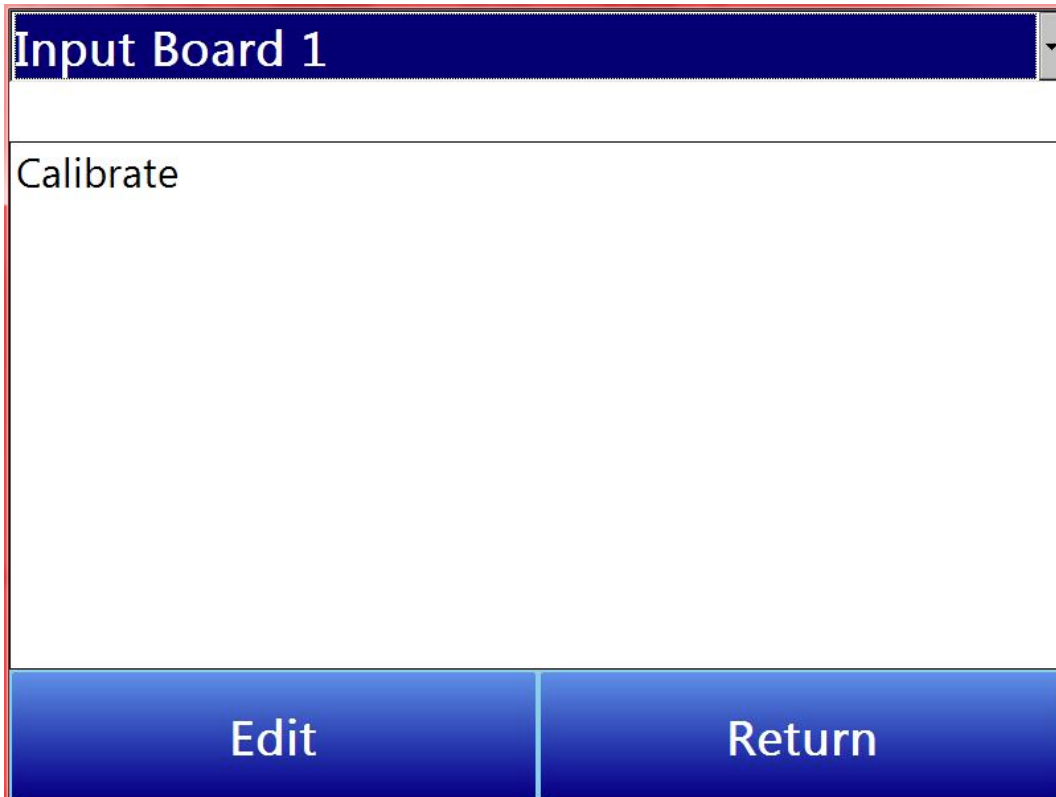
Zero/Span Calibration (Calibrate Inputs)

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

1. Select Zero or Span.

Calibrate Analog Inputs

○ Calibrate Inputs   Select Zero or Span   Calibrate

● Trim TC

● Adjust Cold Junction   Select Range   Set Nominal

◼ Input 1: 0.0011

◼ Input 2: 0.00

◼ Input 3: 0.0247

◼ Input 4: 0.0246

Idle...

Return

2. Select range.

Select Input Range to Calibrate

None

20 mV

40 mV

80 mV

160 mV

320 mV

640 mV

1.25 V

2.50 V

OK   Cancel

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 controller.
1. Select the TC type.
2. Enter the measured Cold Junction temperature at the terminals.
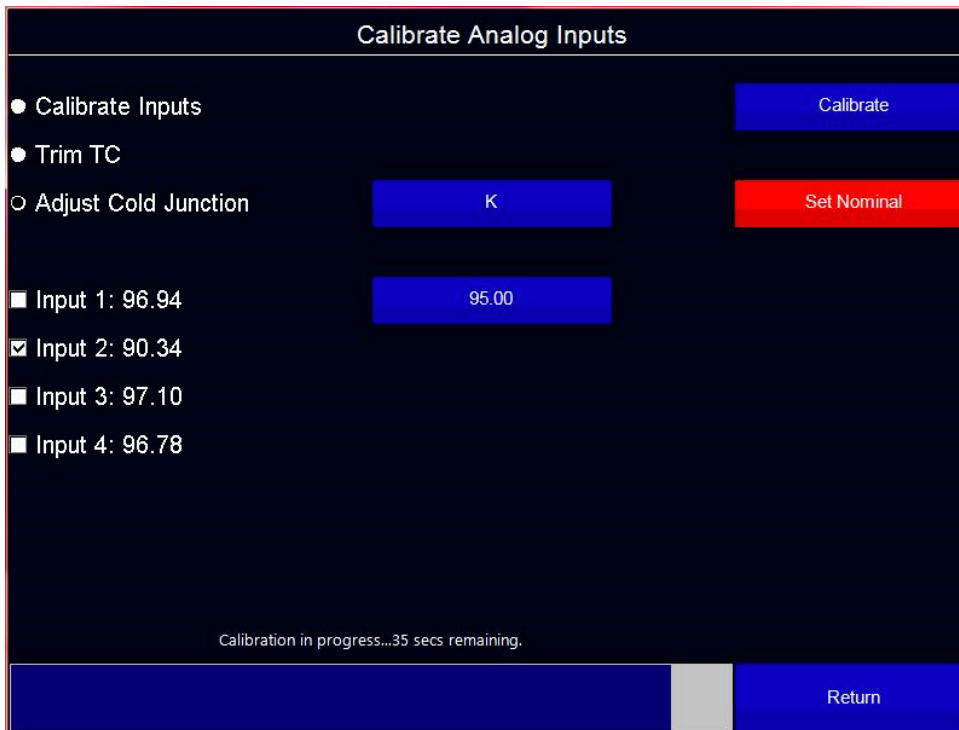
3. Tap Calibrate.

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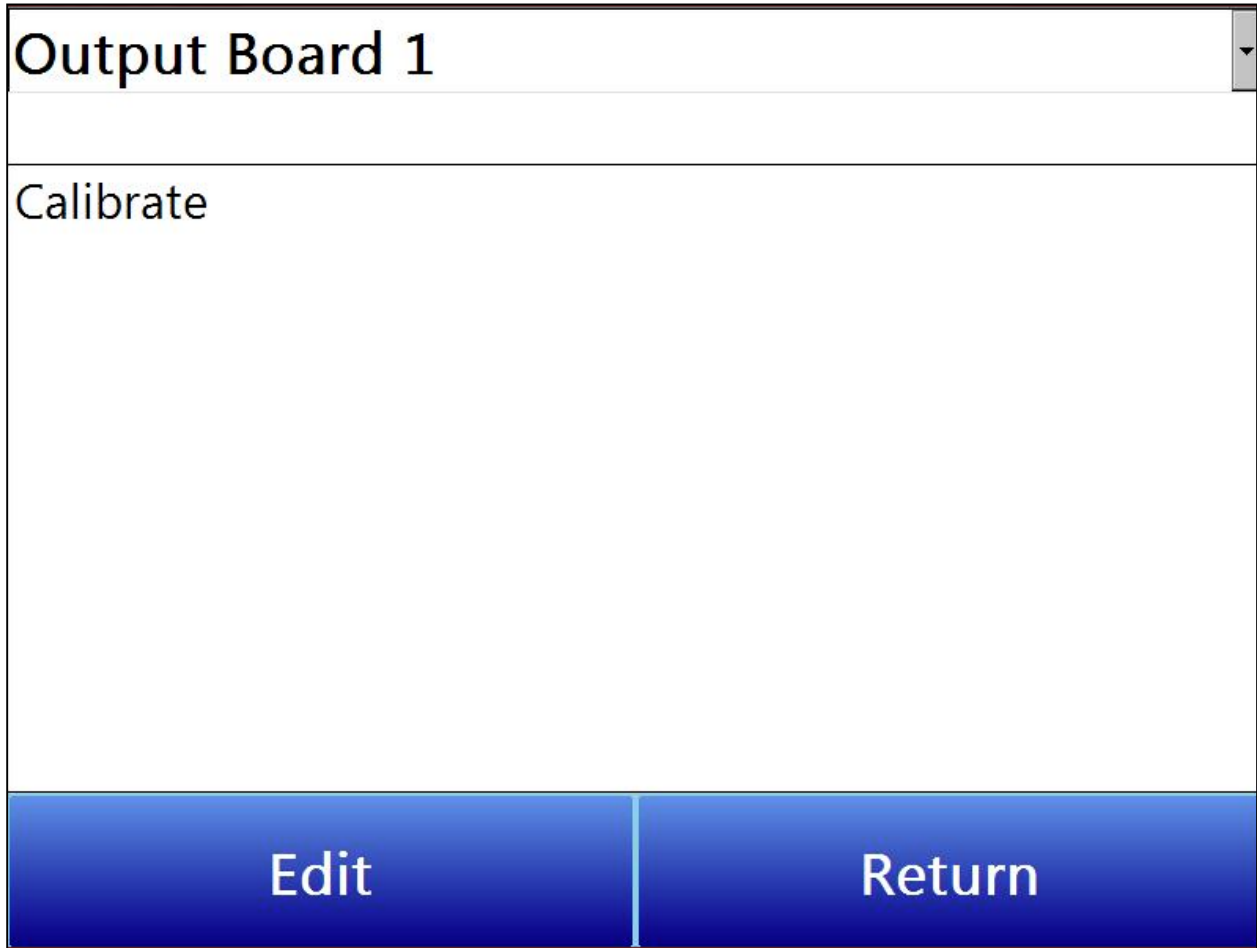
The Calibrate Analog Outputs screen will appear. This screen is shown below.

Calibrate Analog Outputs

- Output 1
- Output 2
- Output 3
- Output 4

Select Zero or Span	Calibrate
Prep for calibration	Set Nominal
Cancel	
Enter Measured Value	

Last calibration result = Success

Return
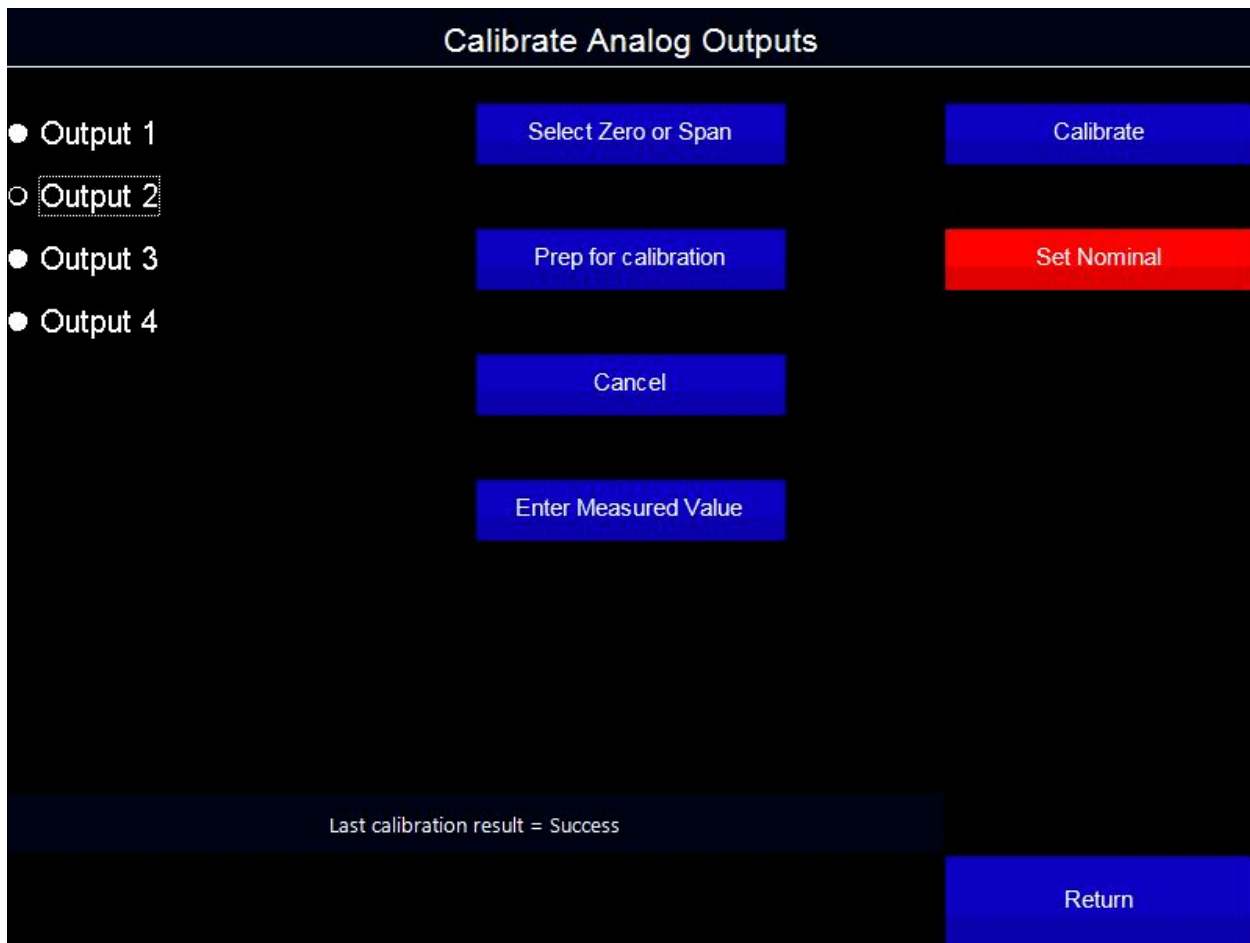
From the Calibration Analog Outputs screen, follow these steps:

1. Select the output to calibrate (1-4).

2. Select Zero or Span using the Select Zero or Span button.

Select Output Calibration Type

: Span

◉ Zero

○ Span

OK	Cancel

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.

Enter measured mA., Current Value:

4.043

7	8	9		Esc
4	5	6		Clear
1	2	3		+/-
0	.			OK

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).

Generic Instrument Setups

The generic instrument's data will be stored in certain registers on the host instrument, such as the ExoGen Controller. Each instrument is allotted a certain set of registers, starting with register 1000. To determine the beginning register, use the following calculation: (100 * generic instrument's number (1 – 16)) + 900. Therefore, instrument 1 would begin at register 1000: (100 * 1) + 900. Instrument 7 would begin at register 1600: (100 * 7) + 900. Each instrument is allotted 100 registers, therefore, instrument 1's allotment is from register 1000 to 1099 on the ExoGen Controller, instrument 2's allotment is from register 1100 to 1199 on the ExoGen Controller, etc.

The *Generic Instrument Setups* menu is split into two parts: **Coms**, and **Data**. The screen lists the generic instruments from Instrument 1 to Instrument 16. Select the desired instrument to configure, then choose **Coms** or **Data**.

Read 1 Register	0
Read 1 Count	0
Read 1 Storage Offset	0
Read 1 Function	3
Read 2 Register	0
Read 2 Count	0
Read 2 Storage Offset	0
Read 2 Function	3
Read 3 Register	0
Read 3 Count	0
Read 3 Storage Offset	0
Read 3 Function	3

Edit   OK

Coms
The three reads can be set up on this screen.

Read 1 Register, Read 2 Register, Read 3 Register
The Read *X* Register field will be the register in the ExoGen Controller that the instrument will read from. The range is **0 – 32767**.

Read 1 Count, Read 2 Count, Read 3 Count
The Read *X* Count field will be the number of successive registers to read. The range is **0 – 100**.

Read 1 Storage Offset, Read 2 Storage Offset, Read 3 Storage Offset
The Read *X* Storage Offset field will be the offset in the generic instruments registers (1000 – 1099 for Instrument 1, 1100 to 1199 for Instrument 2, etc). The range is **0 – 100**.

Data

PV	▼
Offset	1225
Instrument Register	125
Input Type	Integer
Exponential	n/a
Input Scaler	0
Output Type	Integer
Exponential	n/a
Output Scaler	0

Edit   OK

The Process Variable (PV), Setpoint (SP), and Output (Out) can be set up from this screen. Select the desired option from the drop-down list to configure those settings.

Offset
The Offset field is the instrument's register offset. The range is **0 – 32767**.

Instrument Register
The Instrument Register field is the register in the ExoGen Controller. The range is **0 – 32767**.

Input Type
The Input Type field will determine what kind of type the value will be. The options are: **Integer**, **Big Endian**, **Big Endian Byte Swap**, **Little Endian**, or **Little Endian Byte Swap**.

Exponential
The Exponential field will determine if there is an exponent value. For "Integer" Input Types, exponents do not apply, so this field is not modifiable. If the Input Type is not "Integer", the options for the exponential are: **Yes** or **No**. This will cause the Scaler to be a power of 10.

Input Scaler
The Input Scaler field will determine the input scaler range. The Scaler is a power of ten in the range **-30** to **+30**.

Output Type
The Output Type will determine what kind of the output value will be. The options are: **Integer**, **Big Endian**, **Big Endian Byte Swap**, **Little Endian**, or **Little Endian Byte Swap**.

Exponential
The Exponential field will determine if there is an exponent value. For "Integer" Input Types, exponents do not apply, so this field is not modifiable. If the Input Type is not "Integer", the options for the exponential are: **Yes** or **No**. This will cause the Scaler to be a power of 10.

Output Scaler
The Output Scaler field will determine the Output Scaler range. The Scaler is a power of ten in the range **-31** to **+31**.

Analog Output Trim
This options allows the user to set data for 12 Analog Output Trim entries. Select the desired option and tap "Edit" to make adjustments. Max Temp and Max Output can be set for 8 points. Tap the desired point, then tap "Edit." Tap the desired button on the ensuing screen and use the numeric keypad to enter desired settings.

Thermocouple Check
This menu option allows the values 16 pairs of thermocouples to be compared to one another. If the thermocouples go out of band, it is possible to set up an alarm that will alert the operators of this error. Use the dropdown menu at the top of the screen to select the desired pair.

Enabled
Enables the thermocouple check. Options are **Yes** or **No**.

TC 1 This assigns the first thermocouple that will be compared. The options are:
Analog Input 1-24
Slave Instrument 1-15 PV
Aux Analog Input 1 - 40

TC 2 This assigns the second thermocouple that will be compared. The options are:
Analog Input 1-24
Slave Instrument 1-15 PV
Aux Analog Input 1 - 40

Tolerance Band This allows the operator to set the tolerance band between the thermocouples being compared. The range is **-9999 to 9999.**

TC 2 Offset This allows for an offset to be assigned to the second thermocouple and taken into account when the comparison between values is made. The range is **-9999 to 9999.**

Redundant Probe

Enabled
Enables the Redundant Probe. Options are **Yes** or **No.**

Probe PV Mode
Probe PV mode sets the minimum and maximum mV for switching probes based on the expected range of operation based on the application. mV is full range.

Options are **%C (min 950mV, max 1300mV), %O2 (min 0mV, max 600mV),** and **mV (min 0mV, max 1300mv)**

Redundant Probe 1 (Board 1 probes)	
Enabled	No
Probe PV Mode	%C (min 950mV, max 13...
Band (mV)	0 mV
Alarm/switch delay (mins)	0 Minutes
Probe Switch Mode	highest
Edit	**Return**

Band (mV)
This is the millivolt difference that must be observed in order to change probes. For example, when the ExoGen is selecting the highest probe with probe 1 as 1055 mV and a band of 20 mV, and if probe 2 hits 1076 mV, the system will start counting down the Alarm Delay timer (below). When the delay times out, probe 2 would be selected. If probe 2 comes back in band (drops to 1075), the timers starts over again. Use the numeric keypad to enter the desired value.

Alarm/switch delay (mins)
This is the number of minutes that the RP waits to switch probes when an out-of-band condition is detected. Use the numeric keypad to enter the desired value.

Probe Switch Mode

This determines how the specified probe is selected. Options are **highest, lowest,** and **manual.**

Air	
Flow	0
Flow setpoint	0
Flow zero	0
Flow span	9000
Valve Maximum	9000
Valve trim enable	No
Target setpoint	0
Valve trim range	750
Decimal point location	0
Alarm deviation SP	0
Alarm delay (sec)	0 1/10 sec
~~Flow source~~	~~Analog Input 2~~
Edit	Return

Valve Setup
Flow
(View-only): The current flow rate through the valve.

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
Target setpoint refers to the Flow Setpoint + (Loop%output * trim range)
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 Input 1-24,** and **Analog Input 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**, **NH₃**, **misc**, **Endo**, **N₂**, and **CO₂**.

Valve setpoint mode
Determines what area of the system will be tracked to control the valve. Options are: **no action, track total flow, track NH₃, track Atmosphere Loop Output forward, track Temperature Loop Output forward, track Loop 3-16 Output forward, track Atmosphere Loop Output reverse, track Temperature Loop Output everse,** and **track Loop 3-16 Output reverse**

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
Adjusts the speed.

Flow Control Out
Indicates how much of the gain is being used. This is display-only and is not editable.

Flow Control Run/Stop
Indicates whether the valve is moving or stopped. This is display-only and is not editable.

Flow Control Direction
Indicates the direction that the valve is moving. This is display-only and is not editable.

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	Alarm	Outputs 15-96
Process start	Alarm Horn	
Alarm silence	Emergency Purge	
Retort not overtemp	Process N2 On	
800°	N2 Flowing	
1400°	N2 Timer Done	
Nitrogen Pressure	Methanol On	
Process Nitrogen Flowing	Methanol Flowing	

Emergency Purge	Probe BO
Fce Open/High Flow	Heat
Recirc Fan Running	Cool
Pilots On	Air On
Emergency Nitrogen Flowing	Natural Gas on
Inputs 13-23	Ammonia on

Minimum Flow Shut Down
This feature stops the valve from driving after the indicated time in seconds, if the unit is unable to achieve set point.

Minimum % for Variable Gain, Current
This feature changes the speed of the valve based on the control % out, so that when there is error the faster Flow Gain is used, but as the PV gets closer to SP the gain is reduced for finer control.

Minimum Gain at Minimum %
The lower % Output where the Minimum Gain at Minimum % is applied. The gain is interpolated between Minimum Gain and Flow Gain over the Minimum % and 100%.

Security
Allows the user to set the Supervisor and Administrator Passcodes.

Configuration

Allows the user to set custom text for various display options. Custom fields include:

PID Loop Text
Analog Input Text
Analog Output Text
Digital I/O Text
Calculated Value Text
Vacuum Gauge Text
Valve Text
Probe Text
Aux Analog Input Text
Programmer Event Text

PID Loop Text	Appearance
Analog Input Text	
Analog Output Text	
Digital I/O Text	
Calculated Value Text	Compact/Repair Database
Vacuum Gauge Text	Screen Communications
Valve Text	Language
Probe Text	
Aux Analog Input Text	Read/Write Data
Programmer Event Text	
	Return

The Configuration menu also includes:

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.

The Media option will be the type of connection the touch screen is using to connect to the controller. The options are COM1-4 and 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.

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 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.

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 #
New	First release	6/7/2019	2268
A	Clarified Trip Point section	4/6/2022	2321

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.