



# SuperSystems

incorporated



## NitroMeth Plus (Nitrogen Methanol Mixing and Control System) Operations Manual

Please read, understand, and follow these instructions before operating this equipment. Super Systems, Inc. is not responsible for damages incurred due to a failure to comply with these instructions. If at any time there are questions regarding the proper use of this analyzer, please contact us at 513-772-0060 for assistance.

**Super Systems Inc.**

USA Office

*Corporate Headquarters:*

7205 Edington Drive

*Shipping Address:*

7245 Edington Drive

Cincinnati, OH 45249

Phone: (513) 772-0060

<http://www.supersystems.com>

**Super Systems Europe**

Unit E, Tyburn Trading Estate,

Ashold Farm Road, Birmingham

B24 9QG

UNITED KINGDOM

Phone: +44 (0) 121 306 5180

<http://www.supersystemseurope.com>

**Super Systems México**

Sistemas Superiores Integrales S de RL de CV

Acceso IV No. 31 Int. H Parque Industrial

Benito Juarez

C.P. 76120 Queretaro, Qro.

Phone: +52 442 210 2459

<http://www.supersystems.com.mx>

**Super Systems China**

No. 369 XianXia Road

Room 703

Shanghai, CHINA

200336

Phone: +86 21 5206 5701/2

<http://www.supersystems.cn>

**Super Systems India Pvt. Ltd.**

A-26 Mezzanine Floor, FIEE Complex,

Okhla Indl. Area, Phase – 2

New Delhi, India 110 020

Phone: +91 11 41050097

<http://www.supersystemsindia.com>

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## Introduction

SSI's NitroMeth Plus provides precise measurement and control for consistent atmosphere generation used in many furnace applications. The system includes flow measurements, necessary set points, digital data logging, necessary safeties and an easy to use and understand interface.

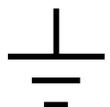
### Installation Safety Requirements

#### Safety Symbols

Various symbols are used on the instrument; they have the following meaning:



Caution, (refer to the accompanying documents)



Functional earth (ground) terminal!

The functional earth connection is required for safety purposes and to ground RFI filters.

#### Personnel

Installation must only be carried out by technically qualified personnel.

#### Enclosure of live parts

To prevent hands or metal tools from touching parts that may be electrically live (powered), the controller must be installed in an enclosure.

#### *Caution:* Live sensors



Do not connect live (powered) sensors to any signal input on the controller. Live sensors are sensors that must be connected to the main's supply. The controller has transient protection circuits connected between the inputs and the earth connection that might be damaged by live (powered) sensors.

## **Wiring**

It is important to connect the controller in accordance with the wiring data given in this handbook. Take particular care not to connect AC supplies to the low voltage power supply input. Use copper wires for 24V DC power supply to the instrument. Ensure that the wiring of installations comply with all local wiring regulations. For example in the United Kingdom use the latest version of the IEE wiring regulations, (BS7671). In the USA use NEC Class 1 wiring methods.

## **Power Isolation**

The installation must include a power isolating switch or circuit breaker. This device should be in close proximity to the controller, within easy reach of the operator and marked as the disconnecting device for the instrument.

## **Earth leakage current**

Due to RFI Filtering there is an earth leakage current of less than 0.5mA. This may affect the design of an installation of multiple controllers protected by Residual Current Device, (RCD) or Ground Fault Detector, (GFD) type circuit breakers.

## **Over current protection**

To protect the internal PCB tracking within the controller against excess currents, the AC power supply to the controller and power outputs must be wired through a fuse or circuit breaker specified in the technical specification.

## **Voltage rating**

The maximum continuous voltage applied between any of the following terminals must not exceed 24V DC

- relay or triac output to logic, DC or sensor connections;
- any connection to ground.

The controller should not be wired to VAC. The 24V DC power supply voltage across the connections and between the power supply and ground must not exceed 2.5kV. Where occasional voltage over 2.5kV are expected or measured, the power installation to both the instrument supply and load circuits should include a transient limiting device.

These units will typically include gas discharge tubes and metal oxide varistors that limit and control voltage transients on the supply line due to lightning strikes or inductive load switching. Devices are available in a range of energy ratings and should be selected to suit conditions at the installation.

## **Conductive pollution**

Electrically conductive pollution must be excluded from the cabinet in which the controller is mounted. For example, carbon dust is a form of electrically conductive pollution. To secure a suitable atmosphere in conditions of conductive pollution, fit an air filter to the air intake of the

cabinet. Where condensation is likely, for example at low temperatures, include a thermostatically controlled heater in the cabinet.

### Over-temperature protection

When designing any control system it is essential to consider what will happen if any part of the system should fail. In temperature control applications the primary danger is that the heating will remain constantly on. Apart from spoiling the product, this could damage any process machinery being controlled, or even cause a fire. Reasons why the heating might remain constantly on include:

- the temperature sensor becoming detached from the process;
- thermocouple wiring becoming a short circuit;
- the controller failing with its heating output constantly on;
- an external valve or contactor sticking in the heating condition;
- the controller set point set too high.

Where damage or injury is possible, we recommend fitting a separate over temperature protection unit with an independent temperature sensor, which will isolate the heating circuit. Please note that the alarm relays within the controller will not give protection under all failure conditions.

### Installation requirements for EMC

To ensure compliance with the European EMC directive certain installation precautions are necessary as follows:

- When using relay or triac outputs it may be necessary to fit a filter suitable for suppressing the emissions. The filter requirements will depend on the type of load. For typical applications we recommend Schaffner FN321 or FN612.

### Routing of wires

To minimize the pick-up of electrical noise, the wiring for low voltage dc should be routed away from high-current power cables. Where it is impractical to do this, use shielded cables with the shield grounded at one end.



The NitroMeth Plus is powered by 24 VDC, not LINE Voltage. Please be careful when connecting power to this controller. Connecting anything other than 24 VDC will cause serious damage.

The variety of input and output combinations allows SSi to configure the system to control **temperature and atmosphere.**

The product is available in five different screen sizes. 3.5", 5.7", 12", 15", and 17".

### **Mounting**

The NitroMeth Plus is a free-standing system. It must be anchored to the floor and located in an area that is free of excessive vibration and heat. For additional information, please contact SSi.

## Wiring

Refer to supplied electrical schematics for interconnection between the NitroMeth Plus System and the equipment.

## Electrical Installation

The NitroMeth Plus System requires 120VAC Single Phase 60hz, 10Amp for main power supply. Additionally, the NitroMeth Plus System has digital and analog signals for feedback from the equipment and/or to control items outside of the NitroMeth Plus System (temperature, alarms, motors, etc...) Since each installation is unique to the site, the customer is responsible for providing adequate power and making it available to the power supply.

### **SSi requirement:**

MOVs must be wired across the isolation relay coil terminals on all isolation relays that are connected to solenoids. **Further...** MOVs must be connected across the HOT and NEUTRAL wires when the solenoid is wired to them. **IT IS AN ABSOLUTE MUST to have the MOVs at BOTH LOCATIONS.**

## Ancillary Items

The following items can be included with the system: a flash card, a flash card reader, and a software CD with Configurator, the Configurator manual, TS Manager, and .NET 2.0. The flash card is installed in the operator interface and the flash card reader connects to a Windows® based computer.

The operator interface includes a connection for a mouse and a keyboard. These may be connected to the operator interface via USB, allowing the operators to use a mouse and keyboard instead of the touch screen.

## Setup

Setup consists of setting the local time if required. As shipped from the factory the communications ports are set at 19200 baud in Modbus mode.

Time will be set for local time in Cincinnati, Ohio (EST /EDT) or time zone of location of city and state on sales order.

*NOTE: The date 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.*

## Additional Features

The Operator Interface (touch screen) contains a removable compact Flash or SD Card that can be used to transfer data from the system to a computer. It is located on the back of the touch screen (see Flash Card & Flash Card Reader section for more details).

Also included is a Utility Software CD that includes SSi's TS Manager. TS Manager is a utility program that can be loaded onto any Windows® based computer (operating Windows XP or higher). This software will allow the computer to read the data from the TS Flashcard, and allow it to be viewed in a manner that is similar to a strip chart recorder.

## 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 DIN rail mounted unit using Internet Explorer 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 **192.168.0.200**. 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.

## Instrument Start-up

On power-up, the Operator Interface will display a Microsoft Windows desktop screen for a few seconds and then switch to the default Status screen.



## Flash Card & Flash Card Reader

*Never remove the flash card when the Operator Interface is "ON".*

To properly shut down the Operator Interface, press the **Menu** button on the default status screen. Once the menu has been displayed, select the *Shutdown* option. At the prompt, press **Yes** to shut down the Operator Interface. See the Chapter 2 – section for information on navigating and using the menu system. This will display a conventional Microsoft Windows screen. Sliding the black switch to the OFF position (located directly over the green power connector, on the back of the Operator Interface) or removing the 24VDC plug will turn off the power to the Operator Interface.

Once the Operator Interface is turned off, remove the compact flash card cover at the top or side of the display unit, exposing the card. Press the black release button or press card in to eject, and the card will pop out of the slot. To replace the flash card, simply return the card to the slot making sure that the release button is in its UP position, and replace the flash card cover to its proper position. To restore power to the unit, move the black switch to the right or ON position or connect plug.

## NitroMeth Plus Operation

The NitroMeth system is designed to meet NFPA specifications while also being user-friendly and operationally safe.

The NitroMeth system follows the NFPA86E guidelines for a Purge In and Purge Out. With the Furnace Chamber above 1400°F, Pilots Active, and Recirc Fan Running, the operator can press the **Process Start** pushbutton to initiate a Purge In. The Purge In will flow nitrogen into the furnace, measuring and calculating the actual flow rate, until 5 volume exchanges have occurred. At the completion of the Purge In, the methanol will automatically start flowing into the equipment. Settings for the flow rates, control method, etc. can be found in the NitroMeth submenus.

With nitrogen and methanol now flowing into the furnace, the operators should continue to monitor the equipment to verify that a positive burnoff has been established at all atmosphere outlets (doors, effluents, etc.), and verify that the burnoff pilots at these locations do not appear to be “pulling in.” If they do appear to be pulling in, flow rates should be increased, or the system should be placed in a Purge Out to safely shut down the equipment for inspection of possible air leaks.

With the establishment of positive burnoff, the operators can now manually enter temperature and atmosphere setpoints using the NitroMeth system, and/or run a recipe. Refer to the appropriate NitroMeth manual sections on how to do this.

To Purge Out the system, press the **Shutdown System** pushbutton. At this time, the system will only flow nitrogen into the furnace, measuring and calculating the actual flow rate, until 5 volume exchange have occurred. At the completion of the Purge Out, the nitrogen will automatically stop flowing, and the system will be in an Idle State.

## Control Screen

The Control Display shows an overview of the current status information: Setpoints and process variables; control modes; Probe mV and TC readings; time of the next scheduled burnoff; CO Factor; current recipe step and status; event inputs and outputs.

In addition, there are six active buttons along the bottom of the Status Display: **Menu, System, Control, Recipe, Chart, and Alarms.**

The **Menu** button will display the menu options.

The **System** button will display an overview of the NitroMeth Plus system.

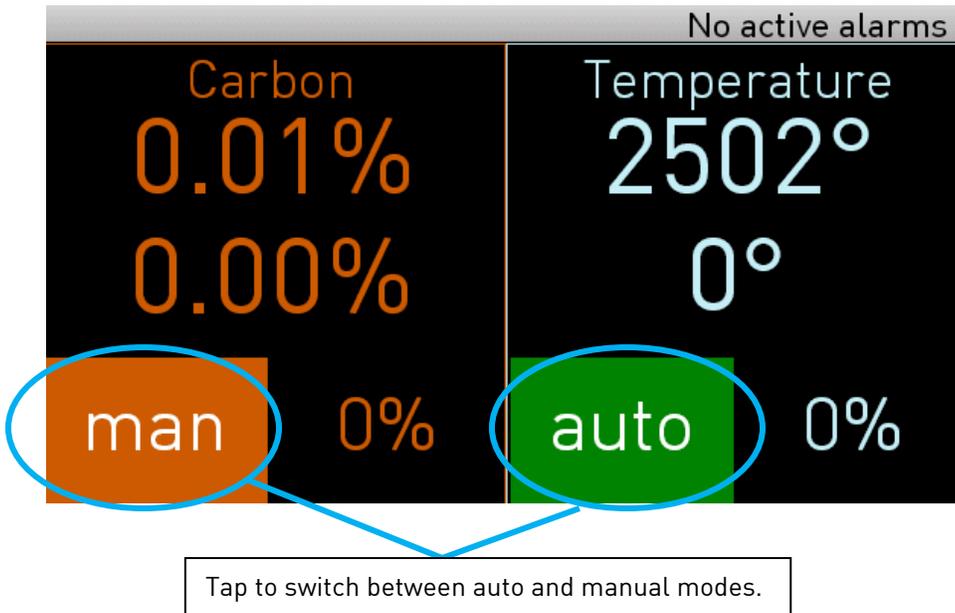
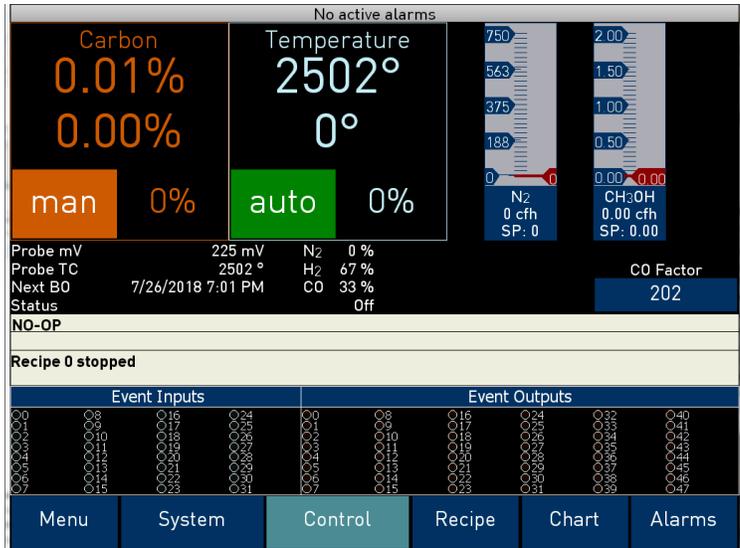
The **Control** button will display an overview of the current status information, as described above.

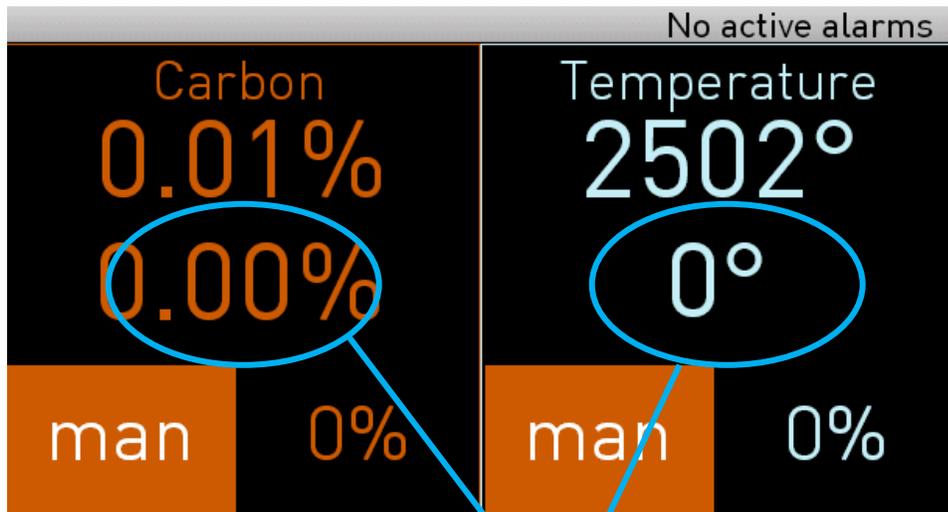
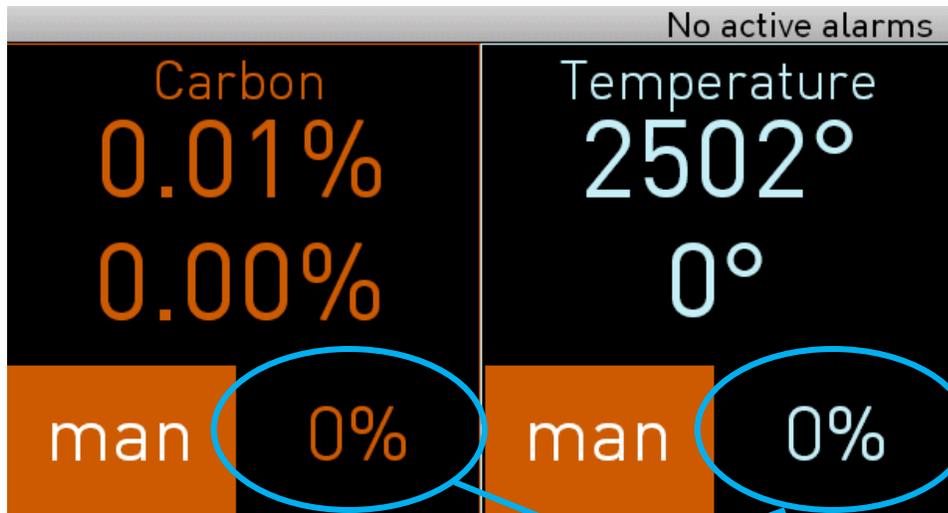
The **Recipe** button will switch to the Program Display. This is a companion display to the status screen and is described below.

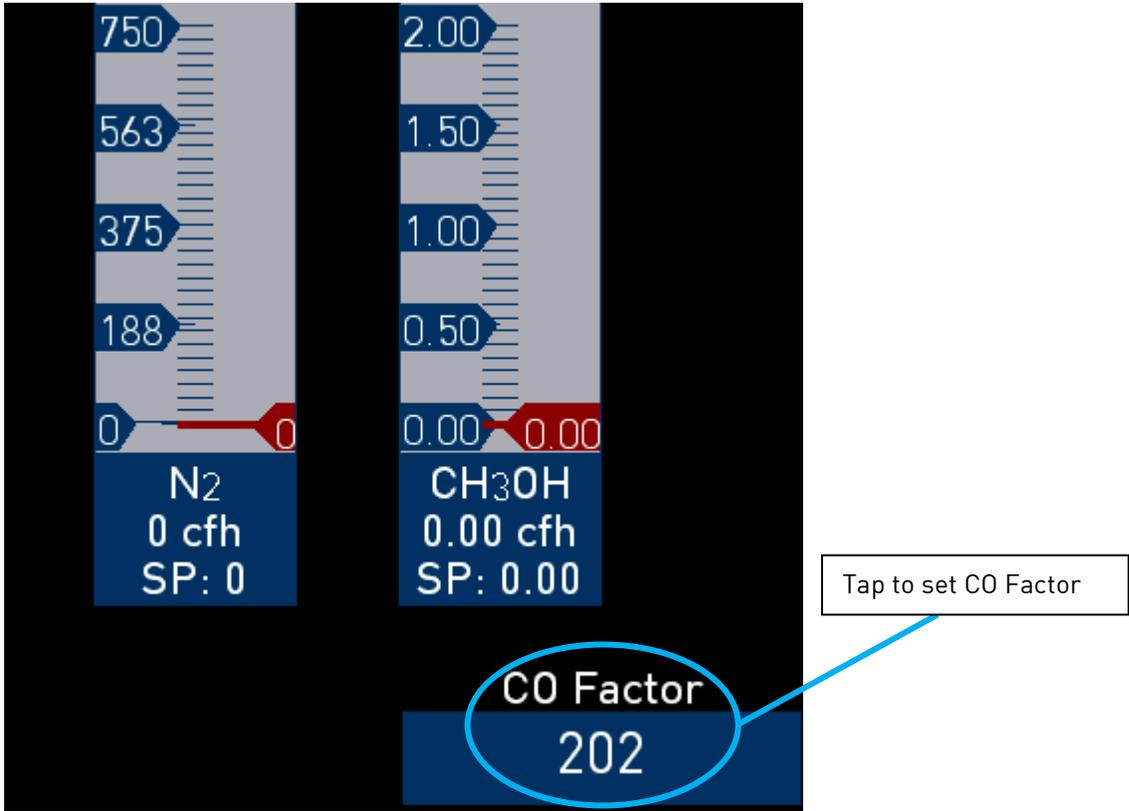
The **Chart** button will display the trend chart.

The **Alarm** button will display the Alarm log.

Additional functionality includes:

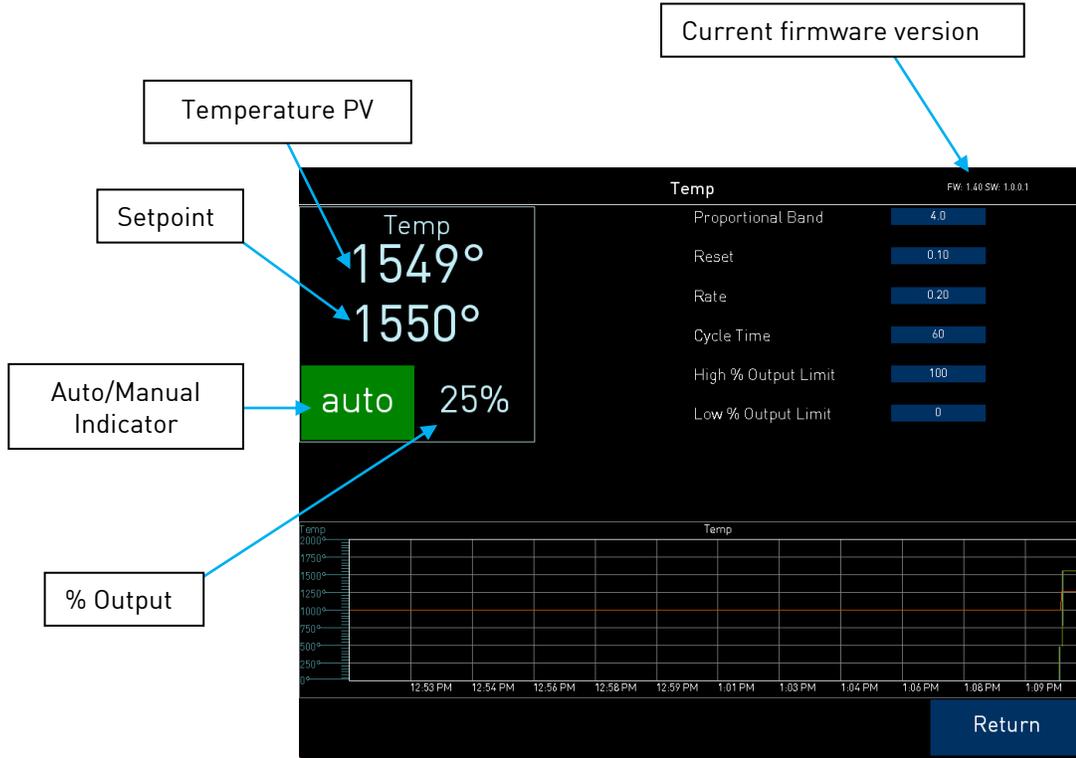






## Menu

The Menu screen includes the following options:



## Temperature

The Temperature screen displays the current temperature PV, the current SP, Auto/Manual mode indicator, and % output.

In addition, the trend chart along the bottom shows realtime data for as long as this screen is open and active. It does not maintain/display historical data.

The current firmware version is also displayed at top right.

The following options are also available from the Temperature screen:

**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 predictable lag.

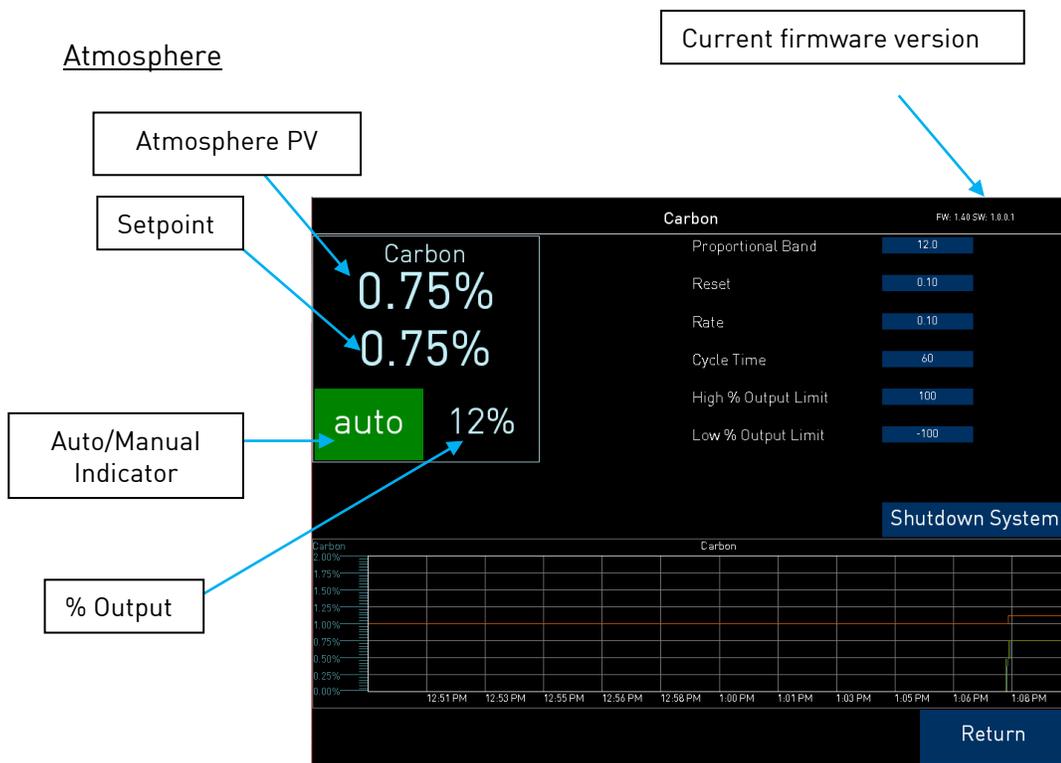
**Cycle time:** This field is typically set to the valve travel time multiplied by 1.5. The range is 0 – 500.

**High % Output Limit**

This is the high limit for the loop. The range is **-100 to 100**.

**Low % Output Limit**

This is the low limit for the loop. The range is **-100 to 100**.



The Atmosphere screen displays the current temperature PV, the current SP, Auto/Manual mode indicator, and % output.

In addition, the trend chart along the bottom shows realtime data for as long as this screen is open and active. It does not maintain/display historical data.

The current firmware version is also displayed at top right.

The following options are also available from the Atmosphere screen:

**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 % Output Limit

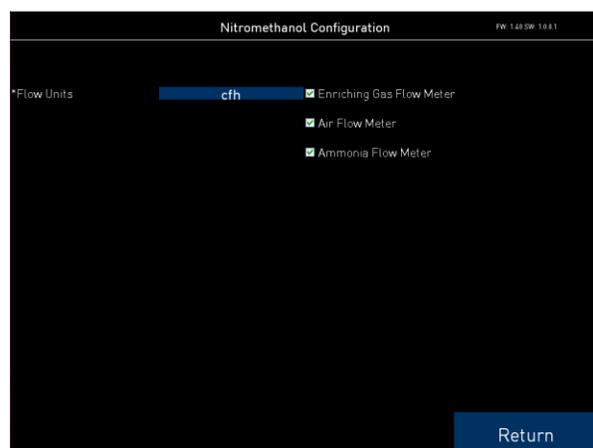
This is the high limit for the loop. The range is **-100 to 100**.

#### Low % Output Limit

This is the low limit for the loop. The range is **-100 to 100**.

### Nitromethanol Configuration

Brings up the Nitromethanol Configuration Page allows the user to select desired display flow units, as well as to select and deselect the various Flow Meters in the system.



## Matrix Menu

There are three levels of Matrix Menus in the NitroMeth Plus Controller.

- The first level is the *operator level*. These are functions or operations that are typically handled by the furnace operator. This menu is accessed without the need for a pass code.
- The second level is the *supervisor level*. This level requires the entry of a level 1 or a level 2-pass code.
- The third level is the *administrator level*. This requires the level 2-pass code ONLY.

As shipped, the *supervisor* and *administrator* level codes are set as 1 and 2 respectively. The pass codes can be changed at the Passcode and Alarm Screen. *Note: Any level can access a lower level screen. For instance, the Administrator level passcode can access all of the Supervisor and Operator level screens.*

The menu items are explained in detail in *Chapter 2 – Matrix Menus*.

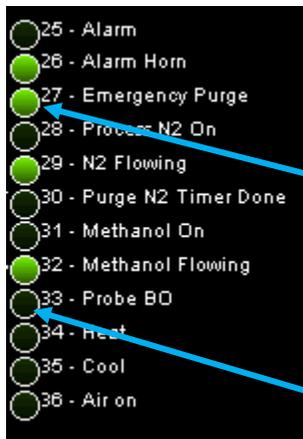
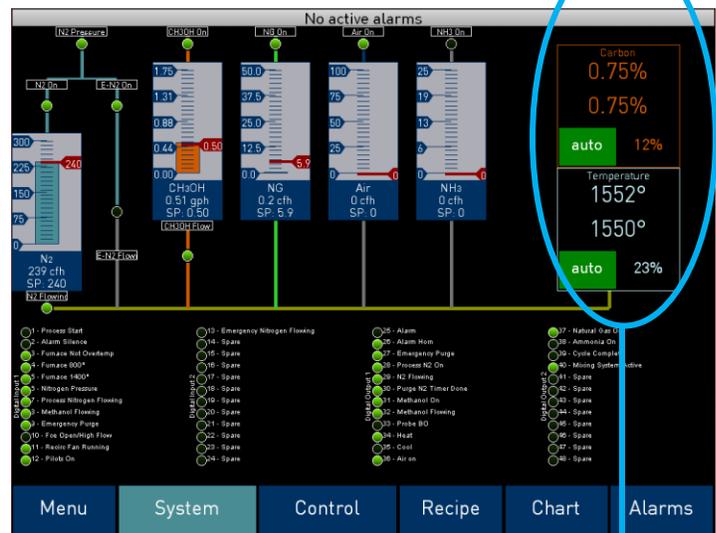
## Return

Returns the user to the System overview screen.

## System

The System Display shows an overview of the Nitromethanol Controller, including

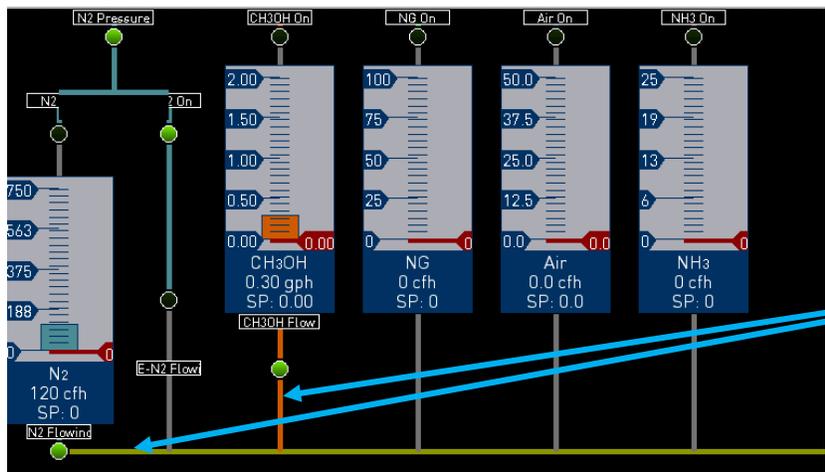
- Digital Inputs
- Digital Outputs
- All Flowmeters Connected to the system along with their process information
- Temperature process information
- Atmosphere process information
- Alarm banner
- Indication of active flowmeters, solenoids, pressure switches, and other mechanical devices



Green indicates an active state.

Black indicates an inactive state.

NOTE: Functionality for switching between auto/manual mode, setting %Output and setting Setpoint is identical to the Control Screen.

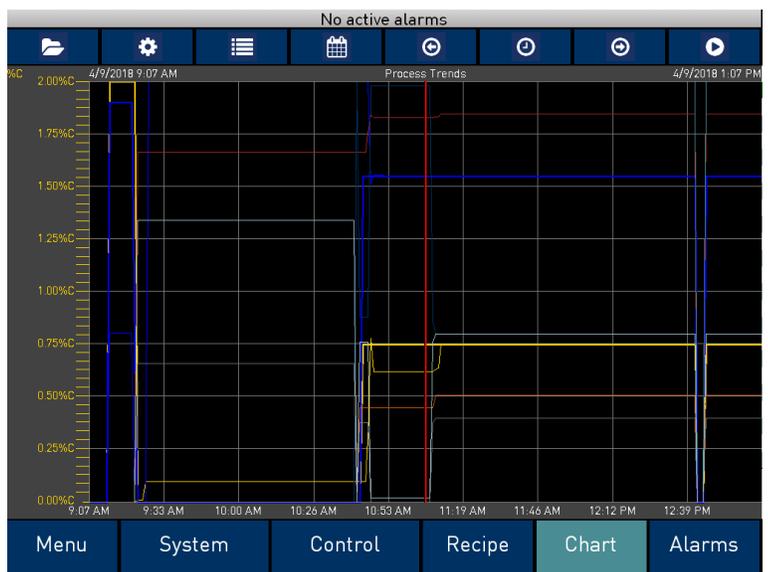


Colored bars indicate that gas is requested and flowing.

## 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 hard drive. The vertical timelines change as the time changes on the screen. Any trend charts that have been created through the Configuration menu are accessible here. See the Chapter 2 – section for more information on creating trend charts.

The function buttons run along the top of the screen.



The folder button -  - allows you to load files to view.



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



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



The Trendlines button -  - will bring up a menu where the user can select and deselect trendlines. From this screen, select the  $f_x$  button to display current values for Minimum, Maximum, number of datapoints, Average, and Std. Deviation.



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



The chart interval button -  - will determine the number of hours displayed on the trend chart. The options are: **15 Minutes, 30 Minutes, 1 Hour, 2 Hours, 4 Hours, 8 Hours, 12 Hours, or 24 Hours.**



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



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



### Chart Sub Menu

There is a sub-menu available by putting a finger or a stylus anywhere on the chart and holding it there for three 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.

## Recipe

Pressing the **Recipe** button on the main status screen displays the recipe screen, which will allow the user to load up an existing recipe and start it, or see the currently running recipe.

The recipe screen shows the last program loaded into the program run buffer and its status. If the program is running, the active step number is highlighted green. When the step is highlighted green, then the recipe is running on that step. When a step is highlighted yellow, the recipe is in hold on that step. *Note – the main status screen will also show the recipe running status, as well as run time and remaining time for the step as well as the entire recipe.*

No active alarms				
Load	Advance	Hold	Stop	Soak
1	SETPT	1550 °	0.75 %	
2	SOAK			0:30
3	JUMP			3
4	NO-OP			
5	NO-OP			
6	NO-OP			
7	NO-OP			
8	NO-OP			
9	NO-OP			
10	NO-OP			
11	NO-OP			
12	NO-OP			
13	NO-OP			
14	NO-OP			
15	NO-OP			
16	NO-OP			
17	NO-OP			
18	NO-OP			
19	NO-OP			
20	NO-OP			
21	NO-OP			
22	NO-OP			
23	NO-OP			
24	NO-OP			

Recipe 2 running at step 2, 0:09 remaining  
Run time: 1:21 remaining time: 0:39 approximately 4/9/2018 1:44 PM

Menu	System	Control	Recipe	Chart	Alarms
------	--------	---------	--------	-------	--------

The recipe screen has a total of five buttons that will allow the user to load up a recipe, as well as control the recipe and acknowledge an alarm.

- The **Load** button allows the operator to enter the recipe number to be run and to view the recipe before pushing the **Run** button. Pushing the **Run** button starts the recipe. If a recipe program is running and the operator enters a new recipe program it can be viewed and modified. The recipe does not become active until the **Run** button is pushed. Pressing **Run** places the program currently being viewed in the active memory and will begin to run the new recipe. To select the recipe to view or edit, click on the recipe number button in the top left corner of the screen. This will display a screen where the user will be able to load up a valid recipe (range 1 – 300). The program can be started in any step by clicking on the step number button next to the “Step” text and entering the new step number (range 1 – 24), and then pressing the **Run** key.

While reviewing the program that is about to be run, each step can be modified. Highlight a step number and click on the **Edit** button. The opcode can be changed with the drop down list at the top. This list can be sorted alphabetically by click on the “Alphabetical” checkbox. The parameters of the opcode can be modified on this screen as well. See the Chapter 4 – OPCODES section for details about each opcode. Click on the **OK** button to accept the changes; click on the **Cancel** button to ignore the changes. *Note – Any change to the recipe is a one-time edit, and will not affect the recipe that is saved on the NitroMeth Plus Controller.* Click on the **Cancel** button on the Load Recipe screen to cancel loading a recipe and return to the main recipe screen.

- The **Advance** button will advance the recipe to the next step in the recipe. The user will need to confirm the advance command.
- The **Hold** button places the displayed recipe program in hold. Once a decision is made that affects the recipe, it may be continued by pressing the **Resume** button. *Note – When a recipe is put into hold status, the text on the **Hold** button will change to “Resume”. When the step is started up again, the text on the button will change back to “Hold”. When a recipe step is in a hold status, the step will be highlighted yellow. The user will need to confirm the hold or resume command.*

- The **Stop** button stops the recipe program that is currently running. Stop means exactly that! It stops the program. It is NOT a hold button. See the description for the hold button above. To re-start the program if it has been stopped you must use the **Load** button, enter the recipe number, and then highlight the segment number of the recipe that you want to start with and start the recipe again. The user will need to confirm the stop command.
- The **Soak** button allows you to enter a new value for the time remaining in the current soak or ramp cycle only – future soak or ramp cycle times cannot be modified. The step must be a soak or ramp cycle for a change in soak/ramp time to be adjusted.

## Alarms

Use the Start and End time selectors to set up the start and end dates for historical alarm displays.

Use the appropriate checkbox to display only active alarms if desired.

A description of possible alarms, their cause, and possible solutions is listed below.

Alarm Log		
	Start Time	End Time
Show active alarms only		
	4/8/2018 1:07 PM	4/9/2018 1:07 PM
Alarm	Start	End
EMERGENCY PURGE ACTIVE	4/9/2018 10:38:2...	4/9/2018 10:38:3...
NITROGEN FLOW LESS THAN MINIMUM	4/9/2018 10:34:5...	4/9/2018 10:35:2...
NITROGEN FLOW LESS THAN MINIMUM	4/9/2018 9:21:36...	4/9/2018 9:23:09...
EMERGENCY PURGE NITROGEN ALARM	4/9/2018 9:18:06...	4/9/2018 9:23:09...
N2 PRESSURE ALARM	4/9/2018 9:17:09...	4/9/2018 9:17:56...
N2 REQUESTED BUT NOT FLOWING	4/9/2018 9:16:53...	4/9/2018 9:17:56...
METHANOL REQUESTED BUT NOT FLOWING	4/9/2018 9:16:40...	4/9/2018 9:17:56...
MIX GAS HIGH PRESSURE	4/9/2018 9:07:10...	4/9/2018 9:09:11...

### N2 REQUESTED BUT NOT FLOWING      Default Delay Time: 10 seconds

**Explanation:** The Mixing System is Active and requesting Nitrogen, however nitrogen is not flowing.

#### Troubleshooting:

- Verify that nitrogen is flowing, as indicated via the flowmeter and on the touchscreen
- Verify that nitrogen pressure is correct, per the panel mount pressure gauge
- Verify that nitrogen flow switch input is made (DI1-7)

### NITROGEN FLOW LESS THAN MINIMUM      Default Delay Time: 30 seconds

**Explanation:** Process nitrogen is on and flowing, but the actual flow is less than the minimum required to safe pressure in the equipment.

#### Troubleshooting:

- Verify that the actual nitrogen flow is greater than the Nitrogen Minimum Flow Setpoint in the NitroMeth Menu Options
- Verify that the nitrogen setpoint is greater than the Nitrogen Minimum Flow Setpoint in the NitroMeth Menu Options

### METHANOL REQUESTED BUT NOT FLOWING      Default Delay Time: 10 seconds

**Explanation:** The Mixing System is Active and requesting Methanol, however methanol is not flowing.

**Troubleshooting:**

- Verify that methanol is flowing, as indicated via the flowmeter and on the touchscreen
- Verify that methanol pressure is correct, per the panel mount pressure gauge
- Verify that methanol flow switch input is made (DI1-8)

**NO ATMOSPHERE PRESENT**      Default Delay Time: 30 seconds

**Explanation:** The furnace temperature is greater than 1400°F, however nitrogen is not flowing.

**Troubleshooting:**

- Verify that furnace temperature is greater than 1400°F
- Verify that 1400°F digital input is made (DI1-5)
- Verify that the Mixing System is active
- Verify that nitrogen is flowing

**TEMPERATURE < 800°F**      Default Delay Time: 5 seconds

**Explanation:** The Furnace temperature is less than 800°F.

**Troubleshooting:**

- Verify that furnace temperature is greater than 800°F
- Verify that 800°F digital input is made (DI1-4)

**EMERGENCY PURGE ACTIVE**      Default Delay Time: 5 seconds

**Explanation:** The emergency nitrogen purge is active.

**Troubleshooting:**

- Verify that the emergency Nitrogen Purge Button has been reset, and digital input is made (DI1-9)

**RECIRC FAN NOT RUNNING**      Default Delay Time: 300 seconds

**Explanation:** The Furnace temperature is greater than 800°F but the Furnace Recirculation Fan is Not Running.

**Troubleshooting:**

- Verify that furnace temperature is greater than 800°F, and digital input is made (DI1-4)
- Verify that the Furnace Recirculation Fan is running, and digital input is made (DI1-11)

**BURNOFF PILOT FAILURE**      Default Delay Time: 30 seconds

**Explanation:** The Door and/or Effluent Pilots are not ON.

**Troubleshooting:**

- Verify that door and/or Effluent Pilots are ON and OK.
- Verify that pilots on digital input are made (DI1-12)

## EMERGENCY PURGE NITROGEN ALARM

Default Delay Time: 10 seconds

**Explanation:** The emergency nitrogen purge is active.

### Troubleshooting:

- Verify that the Emergency Nitrogen Purge Button has been reset, and digital input is made (DI1-9)
- Verify that Nitrogen Pressure is OK, and digital input is made (DI1-6)
- Verify that Nitrogen Flowmeter Comms are OK (Nitrogen Flowmeter Coms Alarm NOT Active)
- Verify that Actual Nitrogen Flow Rate PV is OK and not below minimum (Nitrogen Flow Less than Minimum Alarm NOT Active)
- Verify that nitrogen is flowing and not in alarm (N2 Requested But Not Flowing Alarm is NOT Active)

## N2 PRESSURE ALARM

Default Delay Time: 15 seconds

**Explanation:** Nitrogen Pressure is lower.

### Troubleshooting:

- Verify that the Emergency Nitrogen Purge Button has been reset, and digital input is made (DI1-9)
- Verify that the Nitrogen Pressure is OK, and digital input is made (DI1-6)
- Verify that Nitrogen Flowmeter Comms are OK (Nitrogen Flowmeter Coms Alarm NOT Active)
- Verify that the Actual Nitrogen Flow Rate PV is OK and not below minimum (Nitrogen Flow Less than Minimum Alarm NOT Active)
- Verify that Nitrogen is flowing and not in alarm (N2 Requested But Not Flowing Alarm is NOT Active)

## NITROGEN FLOWMETER COMS

Default Delay Time: 10 seconds

**Explanation:** Communications between the NitroMeth Plus Controller (Matrix) and the Nitrogen Flowmeter have failed.

### Troubleshooting:

- Verify that the Nitrogen Flowmeter power is ON and is not displaying alarms
- Verify that the Communication Settings in the Nitrogen Flowmeter are correct:
  - Address: 5
  - Baud Rate: 19200

## METHANOL FLOWMETER COMS

Default Delay Time: 10 seconds

**Explanation:** Communications between the NitroMeth Plus Controller (Matrix) and the Methanol Flowmeter have failed.

### Troubleshooting:

- Verify that the Methanol Flowmeter power is ON and is not displaying alarms
- Verify that the Communication Settings in the Methanol Flowmeter are correct:
  - Address: 6
  - Baud Rate: 19200

#### **DILUTION AIR FLOWMETER COMS**      Default Delay Time: 10 seconds

**Explanation:** Communications between the NitroMeth Plus Controller (Matrix) and the Dilution Air Flowmeter have failed.

**Troubleshooting:**

- Verify that the Dilution Air Flowmeter power is ON and is not displaying alarms
- Verify that the Communication Settings in the Dilution Air Flowmeter are correct:
  - Address: 8
  - Baud Rate: 19200

#### **ENRICHING GAS FLOWMETER COMS**      Default Delay Time: 10 seconds

**Explanation:** Communications between the NitroMeth Plus Controller (Matrix) and the Enriching Gas Flowmeter have failed.

**Troubleshooting:**

- Verify that the Enriching Gas Flowmeter power is ON and is not displaying alarms
- Verify that the Communication Settings in the Nitrogen Flowmeter are correct:
  - Address: 7
  - Baud Rate: 19200

#### **AMMONIA FLOWMETER COMS**      Default Delay Time: 10 seconds

**Explanation:** Communications between the NitroMeth Plus Controller (Matrix) and the Ammonia Flowmeter have failed.

**Troubleshooting:**

- Verify that the Ammonia Flowmeter power is ON and is not displaying alarms
- Verify that the Communication Settings in the Ammonia Flowmeter are correct:
  - Address: 9
  - Baud Rate: 19200

## Data Logging using Flash Card



**NOTE: See Warnings with respect to removing the Flash Card.**

The Advantech touch screen Operator Interface utilizing a Compact Flash Card allows the unit to data log the parameters set up by a qualified SSi technician. Should a customer not take the data offline in a timely manner, the data will be over-written, the oldest data being over-written first. Here is how it works:

1. When the Operator Interface detects that there is less than 5% disk space left on the compact flash card, an alarm will be displayed on the main interface screen stating "x% disk space remaining (overwrite at 3%)". In the upper right corner, an ALM is indicated, but because it is not a communications alarm or a NitroMeth Plus Controller device alarm, the background remains green. This alarm will remain active until more than 5% of disk space is available for writing data log files.
2. If the user does not copy the log data from the disk, it will eventually fall to 2% disk space. At this point, the touch screen will select the oldest compressed file and delete it. It then checks to see if 3% remains. It repeats this procedure until 3% disk space remains. At this point the alarm message changes to "Overwriting data log data!" Because this allows the system to seesaw between 2% and 3%, it will continue to display "Overwriting data log data!" until somebody offloads the files.

Technical concerns and details:

1. If there are not enough compressed files to bring the free space up to 3%, the system will hunt down and kill hourly files. This should only happen if compression would not be running for some reason.
2. If all compressed files and hourly files have been removed and there is still not enough disk space (perhaps a problem with the compact flash card), the data logger will not write to the disk until the condition is remedied. (Alarms continue to display).
3. The data log data alarm is the lowest priority. The alarm priorities are touch screen communications, then NitroMeth Plus Controller/programmer, then disk space.

## Chapter 2 – Matrix Menus

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The Matrix Menus are entered through the **Menu** key that is part of the six buttons running along the bottom of the Default Display Screen.

Pressing the **Login** key at the bottom of the screen will allow the user to enter a login user and password.

*Note – users can be set up through the Security menu option in this menu.* User names and passwords are case sensitive. There are three levels of security for the menu system: **Operator**, **Supervisor**, and **Administrator**. Pressing the **Login** button will allow the user to enter a user name and password to log in. When the menu screen is first displayed, the operator-level menu options are visible.

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:

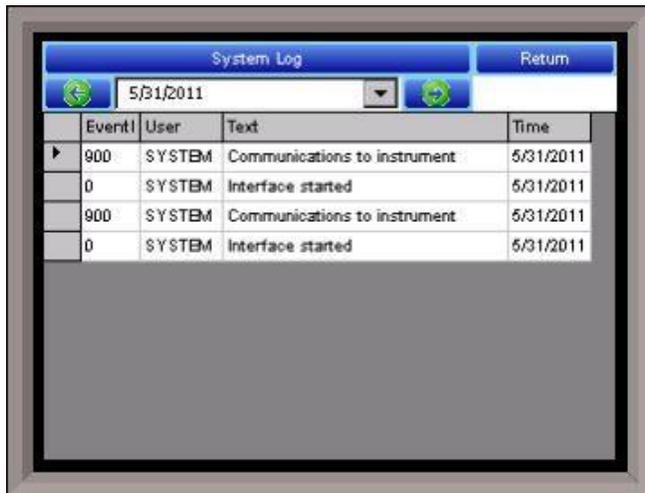
- Logs
- Board Status
- Burnoff
- Slave Instrument Status
- Shutdown
- Factors
- Load T/C
- Probe Burnoff Setup
- Manual Event Control
- PID
- Recipe Edit
- Trend Chart Edit
- Alarm Setup
- Alarm Group Setup
- Relay Assignments
- Programmer Configuration

- 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
- Nitromethanol Options

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 NitroMeth Plus 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

The screenshot shows a list of analog inputs with their current values:

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

At the bottom of the screen are two buttons: 'Edit' and '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
Last Impedance Test	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 NitroMeth Plus 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.

- 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

### 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

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 NitroMeth Plus Controller. When the operator interface is shutdown, the NitroMeth Plus 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 NitroMeth Plus 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



## 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

Two blue buttons with white text: "Edit" on the left and "Return" on the right.

## 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)

Off – T/C not enabled

## 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.

**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.

## Probe Burnoff Setup

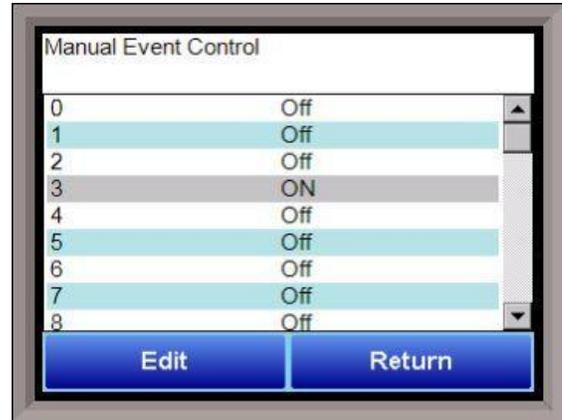
Burnoff Time	0 sec
Burnoff Rec. Wait Time	0 sec
Burnoff Minimum Millivolts	0 mV
Burnoff Maximum Temper...	0 °
Burnoff Minimum Millivolts...	0 mV
Burnoff Maximum Temper...	0 °
Active Probe Inputs	none
Burnoff Interval Probe 1	0 min
Burnoff Interval Probe 2	0 min
Burnoff Interval Probe 3	0 min
Burnoff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

Buttons: Edit, Return

## 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.

## Loop 7

loop name	Loop 7
process variable	-12.4
control setpoint	0.0
control loop percent output	0.0 %
Control mode	manual
Prop Band (0 for On/Off)	4.0
Reset	0.10
Rate	0.00
control loop mode	Single reverse
integral preset	0
Cycle time	60
...	...

At the bottom of the table are two blue buttons labeled "Edit" and "Return".

### PID

PID is the tuning parameters entered for each Process Variable loop.

Select the Loop from the dropdown menu at the top of the screen. Settings for the loops include:

#### Loop Name

Allows the user to set a loop name.

#### Process Variable

Displays the current Process Variable for the selected loop. This is not editable.

#### Control Setpoint

Allows the user to set the control setpoint for

the PID loop.

### Control loop percent output

Allows the user to set the control percent output for the PID loop.

### Control Mode

This is the mode of the loop. The values are: **Manual**, **Auto**, and **Hold**.

In auto mode, the output is controlled by the controller automatically using setpoint, proportional band, reset, and rate settings. Hold mode keeps the setpoint at a fixed output until another condition places it into an Auto mode. For example: if the system is not running, it will set the mode to Hold at a fixed (typically

user adjustable) output. Once the system is running or a condition is met, the loop will be placed into Auto mode.

### **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 **0 – 3276.0**.

### **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 **0 – 327.67**.

### **Rate**

Rate adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing overshoot but is most often useful when trying to improve control on systems with significant and predicable lag. The range **0 – 327.67**. NOTE: The rate is not typically used for carbon control.

### **Control Loop Mode**

This is the mode of the loop. The values are: **Dual Reverse, Single Reverse, Dual Direct, or Single Direct.**

Dual – This has two output relays which can increase and decrease to achieve the SP.

Single – This has one relay which works in only one direction to achieve the SP.

Direct - If the PV - SP equals a positive number and the output would bring the PV down toward setpoint that is direct.

Reverse – If the PV - SP equals a negative number and the output would bring the PV up toward setpoint then that is reverse

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

### **Integral Preset**

This field provides an offset for the starting point for PID control, also referred to as “Load Line” or “Manual Reset”. The range is **-100 to 100**.

### **Cycle Time**

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

### **PV Source**

The options for PV source are **Inputs 1-24, Calculated Values 1-8, Aux Inputs 1-40, load TC average, load TC minimum, load TC maximum, and Valves 1-8.**

### Setpoint Source

The options for Setpoint source are **Direct, Aux Inputs 1-24, Master SP 1-4, Cascade loops 1-16 %out, Valves 1-8.**

### Control Setpoint Offset

Allows the user to set a value that defines a sustained difference (or steady-state error) between Process Variable and Setpoint.

### Setpoint Change Limit

This is a smart time feature that allows Process Loop to use PB only without Reset until the Process Variable drops below the percent output set under this category.

It is used to eliminate overshoot.

The Output percentage selected under this category *must* be above the normal operating output percentage of the furnace at heat.

The options are: **OFF, 80%, 70%, 60%, 50%, 40%, 30%, or 20%.**

Example: If the furnace runs at 40% output at heat for the maximum load, the setpoint change limit should be set to 60%.

### Alarm Enable

Allows the user to enable or disable the alarm. Options are **Yes** or **No**.

### Alarm Type

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

Process alarms are defined as a set value. For example, the User may not want to allow the front door to open if the furnace is above 150 °F. The alarm is set as a Process High of 150. Disregarding hysteresis (see next point), this alarm will be active when the Loop 1 temperature PV exceeds 150 °F, regardless of temperature SP.

Band alarms are defined as a range around a set point. For example, the User may want to alarm when the furnace temperature deviates by more than 50F. The alarm is set as a Band, Normally Open of 50, Disregarding hysteresis (see next point), this alarm will be active while Loop 1 temperature PV is between 1475 °F – 1525 °F.

### Alarm Setpoint

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

### Smart

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 armed 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. 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.

**Percent output alarm low setpoint**

This sets the low setpoint for a percent output alarm. If the PID loop is in auto and the calculated percent output is below this value, an alarm condition occurs. An actual alarm state is not declared until the alarm condition is maintained for the delay time. Use the numeric keypad to set the desired setpoint.

**Percent output alarm high setpoint**

This sets the high setpoint for a percent output alarm. If the PID loop is in auto and the calculated percent output is above this value, an alarm condition occurs. An actual alarm state is not declared until the alarm condition is maintained for the delay time.

**Control Low Limit**

This is the low limit for the loop. The range is **-100** to **100**.

**Control High Limit**

This is the high limit for the loop. The range is **-100** to **100**.

**0 Setpoint Stops Control**

If the Setpoint is zero, then all outputs are turned off. The option is either **Yes** or **No**.

**Ctrl shutdown inputs**

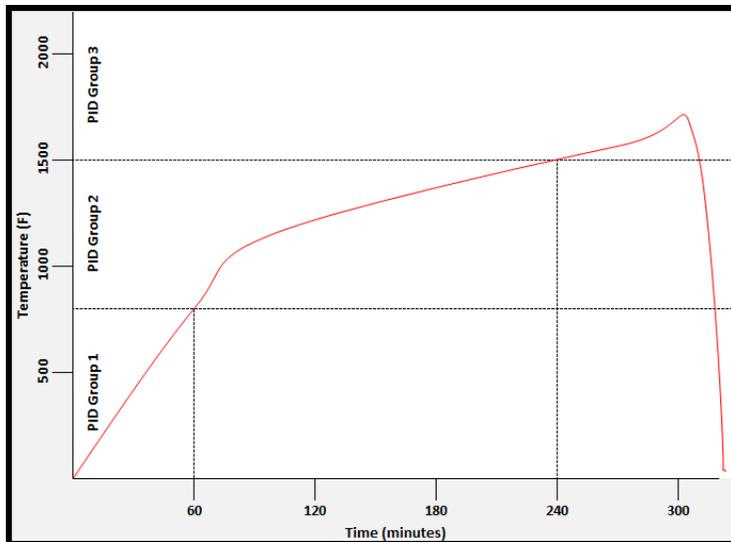
If any of the selected digital inputs are made, this will shut down the PID's control.

**PID Auto Switch**

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

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

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



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

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

The following settings must be made via the touch screen:

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

### PID 1 -> 2 Switch Point

This is the PID Switch Point field. This is used in conjunction with the PID Auto Switching feature. See the *PID Auto Switch* section for more information. The range is **-300 to 4000**. NOTE: PID switch points are based on Temperature PV by default, *not* Setpoint or Ramp Temperature. This can be adjusted using the PID Switch Variable feature.

### PID 2 -> 3 Switch Point

This is the PID Switch Point field. This is used in conjunction with the PID Auto Switching feature. See the *PID Auto Switch* section for more information. The range is **-300 to 4000**. NOTE: PID switch points are based on Temperature PV by default, *not* Setpoint or Ramp Temperature. This can be adjusted using the PID Switch Variable feature.

### **PID Auto Switch Source**

This is the parameter that triggers the PID switch. The options are **Process variable** and **Setpoint**. Note that PID Auto Switch must be set to Yes in order to use PID Switching.

### **Setpoint Lower Limit**

This is the lower limit of the setpoint. The range is **-300 to 9999**.

### **Setpoint Upper Limit**

This is the upper limit for the setpoint. The range is **-300 to 9999**.

### **Setpoint zero (src 29-40) and Setpoint span (src 29-40)**

The setpoint zero and span options are used with cascade control. Setpoint sources 29 to 40 are the percent outputs of PID loops 1 thru 12 respectively. The setpoint zero is the value in engineering units (same as PV) when the source loop percent output is zero. The setpoint span is the value in engineering units when the source loop percent output is 100%.

### **PID output rate of change limit**

This option causes the NitroMeth Plus controller to limit the rate at which the output changes in the furnace. For example, if the output rate change limit is 5% per second, the controller will increase the output at a rate no greater than 5% each second until the output reaches the level needed to reach setpoint. This limit can be useful in cases where (for example) a heating element should not (for operational and safety reasons) heat up to a high output immediately. If the output needs to reach 100% to achieve setpoint, the Output Rate Change Limit will apply the output incrementally, rather than allowing the output to climb to 100% as soon as the heat is turned on.

### **Overshoot Control Logic**

Overshoot control logic is activated when a large setpoint change occurs. If the logic is active and a large setpoint occurs, it sets a working setpoint at an appropriate distance from the desired setpoint to prevent the PV from overshooting the desired final setpoint. When the PV reaches or crosses this working setpoint, then the logic exponentially ramps the working setpoint to the desired final setpoint.

### **Ramp Detect Logic**

The Ramp Detect logic works in conjunction with the instrument recipe programmer. If the control loop is the temperature loop for the recipe programmer, and the OPCODE is a ramp, then the control loop does some special checks. If the Overshoot Control Logic is active, then the final setpoint of the ramp is used to determine the working setpoint band. However, the ramp setpoint is used until the band is reached. Also, once the band is reached, if the ramp is faster than the overshoot logic exponential ramp, then the program is temporarily put on hold as needed to sync the two ramps.

### **Ramp overshoot Level 1 Control and Ramp overshoot Level 2 Control**

Ramp Level 1 and 2 Control are only active if the Ramp Detect logic is active.

Ramp Level 1 Control changes the working PID settings to equivalent PI settings during the ramp until the overshoot logic band is reached.

Ramp Level 2 Control is only active if the Ramp Level 1 control is active.

Ramp Level 2 Control changes the working PID settings to equivalent Prop band only settings during the ramp until the overshoot logic band is reached.

### **Overshoot Ctrl Logic State**

This displays the current Working Setpoint that the Overshoot Control Logic is attempting to control to.

### Positive Output Accumulator

The Positive Output Accumulator is the sum of the positive outputs (given in percentages up to one decimal place) measured each second. Therefore, if the following outputs are recorded over five seconds:

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

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

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

### Negative Output Accumulator

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

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

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

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

### Deadband

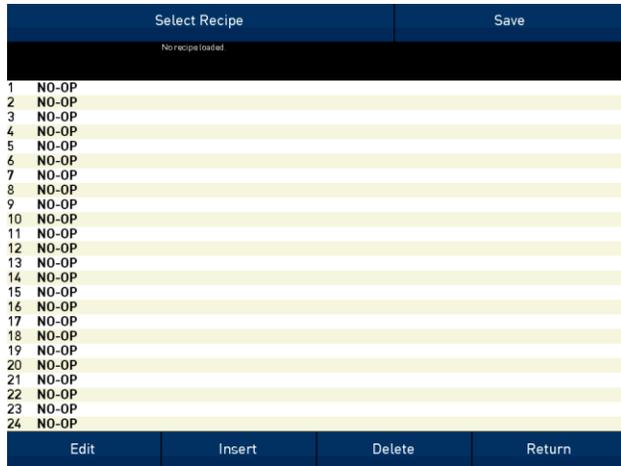
Deadband is a value around which no change in output will occur. Use the numeric keypad to enter the desired selection.

### Deadband Mode

This option adjusts the proportional band component of the PID. Increasing the proportional band slows the control action of the PID, which can provide fast initial control with a gentler control near the set point. The user options are:

- Normal – no adjustment to the control output within the defined deadband
- Proportional Band x2 – control within the defined deadband with the Proportional Band component of the PID doubled.

- Proportional Band x4 - control within the defined deadband with the Proportional Band component of the PID multiplied by 4.



## Recipe Edit

This option will allow the user to edit a recipe that is stored on the NitroMeth Plus Controller.

The **Select Recipe** button will allow the user to select which recipe to load (1 – 300). Once the recipe has been selected, the recipe will be displayed on the screen.

The higher recipe steps can be viewed by holding a finger or stylus on the screen and scrolling up or down.

To edit a specific step, highlight that step and press the **Edit** button. This will allow the user to select a different Opcode to use, or to change the information entered for the current Opcode. See Chapter 4 – OPCODES for more information on each

Opcode and its purpose.

To insert a step into the program, highlight the step number for the step, and press the **Insert** button. The user will have to confirm the insert. Once this has been confirmed, the user will be able to select the Opcode to use. *Note: Inserting a step will push every step after down one, so an Opcode at step 24 will be lost.*

To remove a step from the recipe, highlight the step number to remove, and press the **Delete** button. The user will have to confirm the delete. Once the delete has been confirmed, the step will be deleted and every step after will be moved up one step. Blank step numbers will be replaced with a NO-OP Opcode.

Press the **Save** button to save the changes that have been made. The recipe can be saved as any valid recipe number (1 – 300). If the desired recipe number already contains a recipe, the user will have to confirm the save before the old recipe will be overwritten.

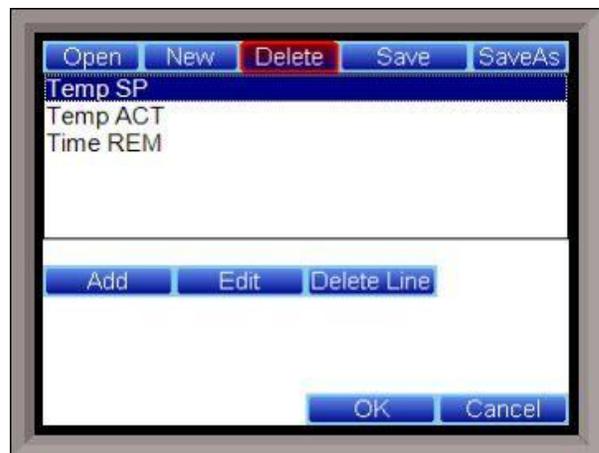
If the user wishes to delete an entire recipe, they have one of two options. First, they could load up the desired recipe and change every step to the NO-OP Opcode and save those changes; Or, they could save the 24-step “blank” (NO-OP) program that is loaded up when the *Recipe Edit* screen is first displayed as the desired program number. This will save the “blank” recipe to the desired recipe number location.

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.



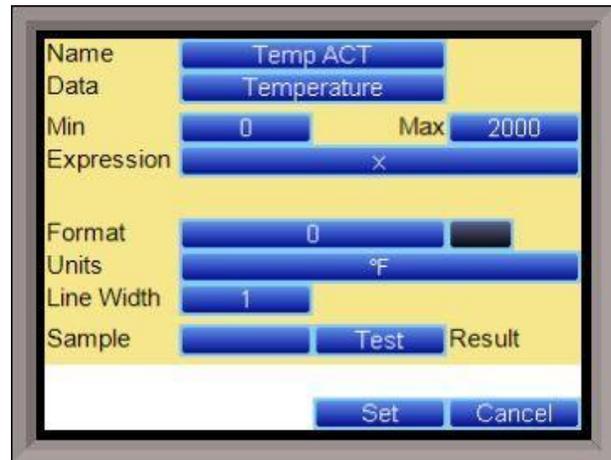
**New** will create a new trend chart file to begin adding trend lines to.  
**Delete** will delete a specified trend chart file.  
**Save** will save all changes to the current trend chart file that have been made.  
**Save As** will allow the user to save the current trend chart file as a new file 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 NitroMeth Plus Controller. Some of the points have a name, such as “Temperature” or “Temperature SP”, but others will just show the register in the NitroMeth Plus 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 NitroMeth Plus 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.

#### 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.

### 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

### Alarm Group Setup

### Alarm Group Setup

Allows the user to assign alarms to various loops or inputs. Select the desired option, then tap Edit. Use the checkboxes to make assignments as needed.

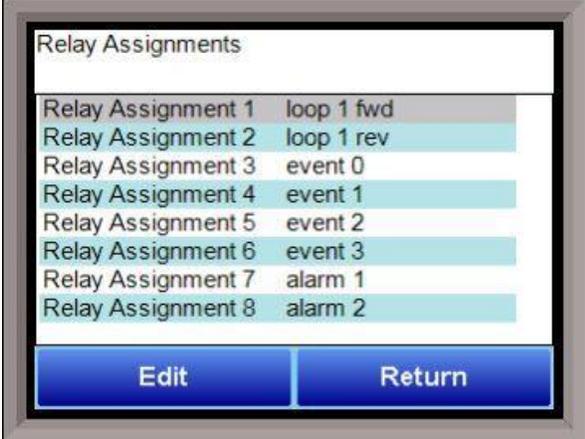
Control Loop Deviation Al...	4, 5, 6
Control Loop Deviation Al...	1, 2
Control Loop Deviation Al...	none
Analog Input High Proces...	8
Analog Input High Proces...	none
Analog Input High Proces...	none
Analog Input Low Process...	none
Analog Input Low Process...	none
Analog Input Low Process...	none
Calculated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



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

Below the table are two buttons: **Edit** and **Return**.

**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
Quench Event Invert Function	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 NitroMeth Plus Controller program to change set points on all instruments of a multi-zone furnace. The NitroMeth Plus 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.

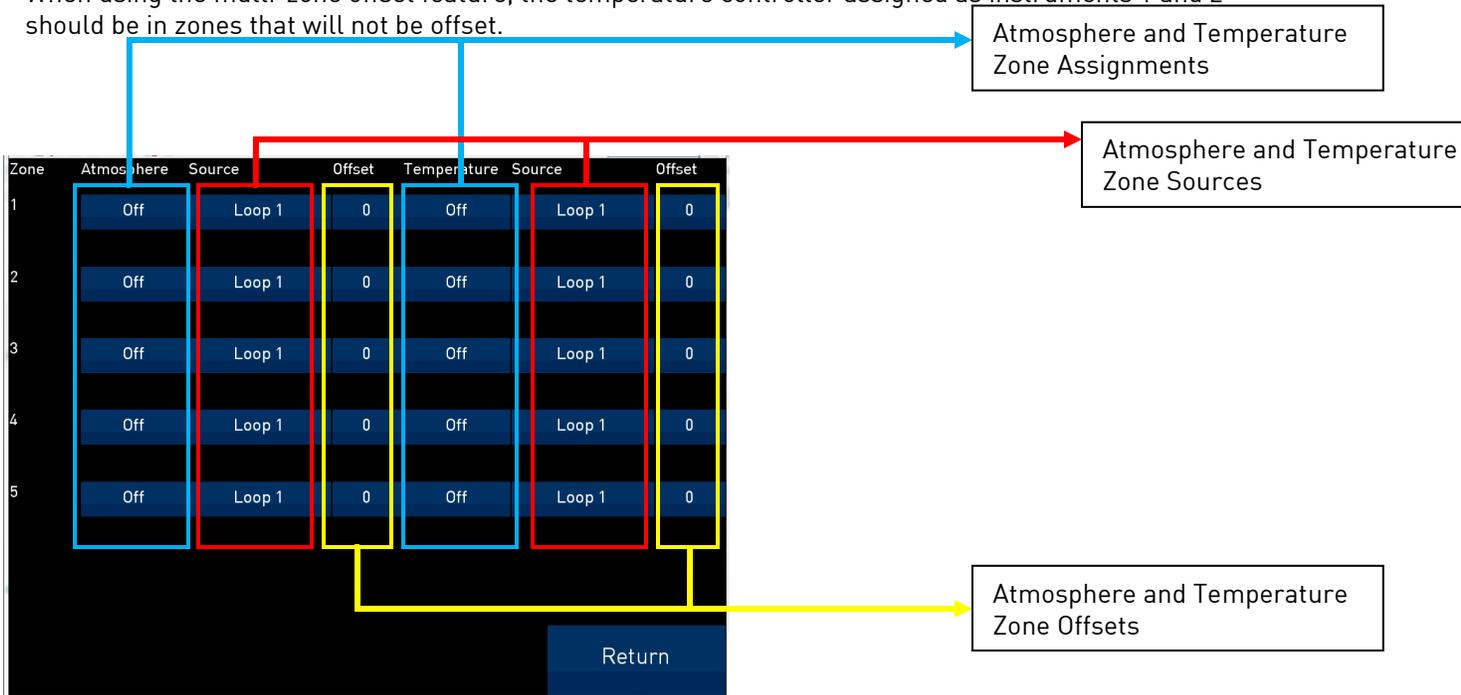
If the first three steps of a program are as shown below, then the bottom zone set point is 1775, the middle zone is 1750, and the top zone is 1800.

Step	Opcode	Temperature	Option
1	<i>ZONE_OFF</i>	25	Zone 1
2	<i>ZONE_OFF</i>	50	Zone 3
3	<i>SETPT</i>	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 in zones that will not be offset.



**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 NitroMeth Plus 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 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**.

## 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**

### PVT Type

The PVT type is the mode the device runs in. The mode selected determines the calculations and scaling for the Process Variable. There are six PVT choices for the NitroMeth Plus Controller:

not used (default)	Millivolts
%Carbon	Redundant Probe System
Dew Point	Vacuum

DO NOT ADJUST THIS SETTING WITHOUT CONTACTING SSI.

### 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 NitroMeth Plus 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 Manager manual, available at [www.supersystems.com](http://www.supersystems.com).

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](http://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](http://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 NitroMeth Plus Controller. To set up a slave instrument, highlight the instrument number and click on the **Edit** button.

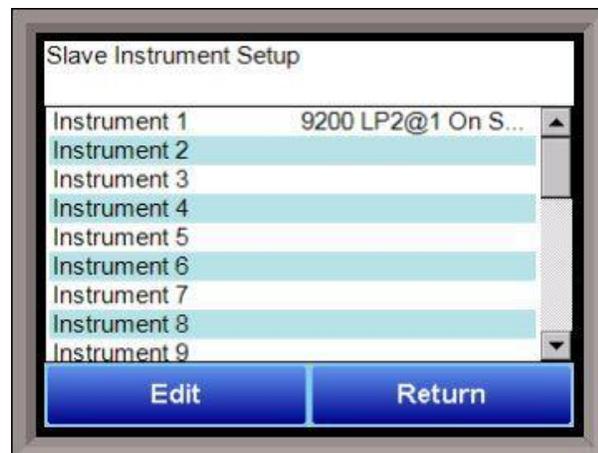
The list of available slave instruments will be shown on the screen. The list is color coded by type – Blue for Atmosphere, Red for Temperature, Yellow for Events, and White for User-Selected Instrument. Highlight an instrument to select it as the instrument to use.

User devices User 1 – 15 can also be selected.

**\*\* 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**.

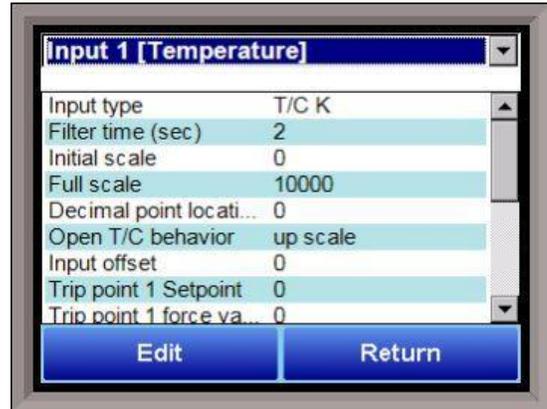
### Disable on open input

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 NitroMeth Plus 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 trip point 1 setpoint value. The range is **-32768** to **32767**.

### **Trip Point 1 Force Value**

This is the trip point 1 force value. The range is **-32768** to **32767**.

### **Trip Point 1 Direction**

This is the trip point 1 direction. The options are: **input above setpoint** or **input below setpoint**.

### **Trip Point 2 Setpoint**

This is the trip point 2 setpoint value. The range is **-32768** to **32767**.

### **Trip Point 2 Force Value**

This is the trip point 2 force value. The range is **-32768** to **32767**.

### **Trip Point 2 Direction**

This is the trip point 2 direction. The options are: **input above setpoint** or **input below setpoint**.

### **High Alarm Setpoint**

This is the setpoint for the high input limit.

### **High Alarm Hysteresis**

This is the hysteresis for the high input limit. 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**

NitroMeth Plus Controller Operations Manual Draft

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

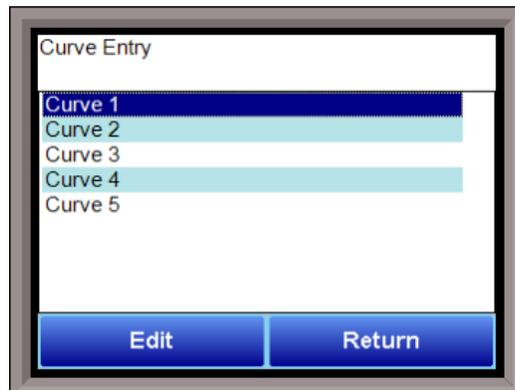
This is the hysteresis applied to the corresponding setpoint (described above).

### 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

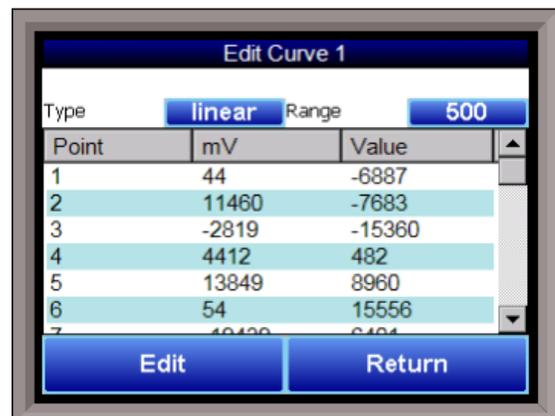


Most types of inputs that are used in SSI controllers are already setup with a curve built for most every type of thermocouple available, certain vacuum sensors, etc. However, if an application calls for an input without a standard curve, the curve can be built using this option. Voltages can be paired 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.



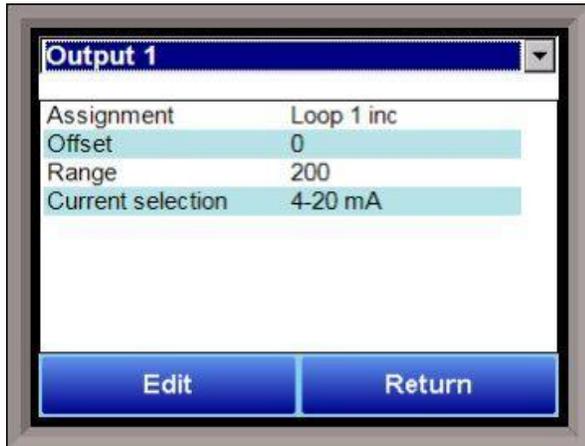
Point	mV	Value
1	44	-6887
2	11460	-7683
3	-2819	-15360
4	4412	482
5	13849	8960
6	54	15556
7	48420	8494

The screenshot shows the "Edit Curve 1" screen. At the top, it says "Type linear" and "Range 500". Below this is a table with three columns: "Point", "mV", and "Value". The table contains seven rows of data. At the bottom, there are two blue buttons labeled "Edit" and "Return".

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 NitroMeth Plus 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)

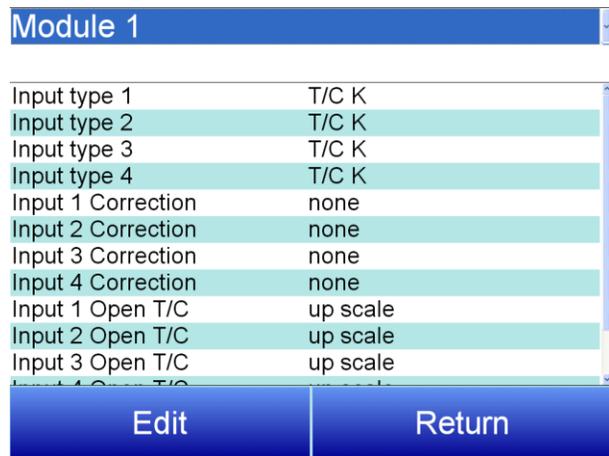
Range = 400

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.



### 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

<u>TC Type</u>	<u>Range in mV</u>
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 Retrains

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

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.

### IMPORTANT!

PID Auto Switching must be enabled in the PID Loop Setup menu for the specific Loop 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.

When PID Auto Switching is enabled, the Loop will now have 3 sets of PIDs that can be applied to the control, switching on user defined temperature switch points (found in the PID Loop Setup for the specific Loop). As the loop value passes the user defined switch point, the PIDs will switch to the newly defined switch points (working on increasing and decreasing values).

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

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<sub>N</sub>, super K<sub>N</sub>, 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

#### 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:**

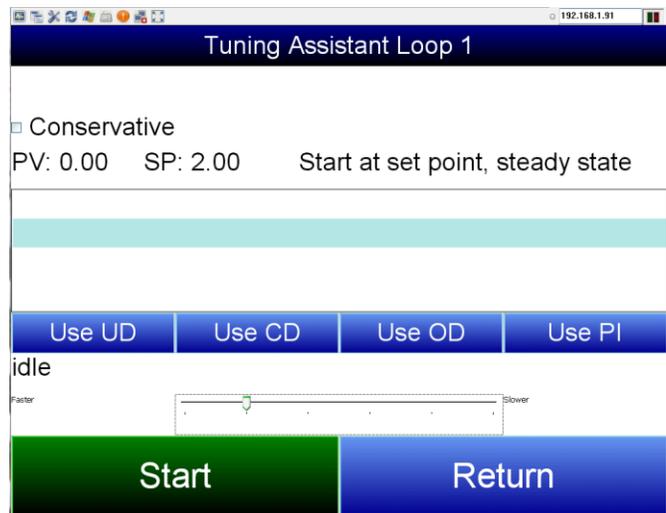
The calculation factor is different for different calculation types. See the table below.

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 NitroMeth Plus 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.

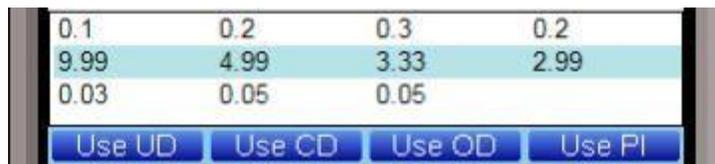
The current PV value, along with the setpoint, is listed above the PID settings list.

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.



0.1	0.2	0.3	0.2
9.99	4.99	3.33	2.99
0.03	0.05	0.05	
Use UD	Use CD	Use OD	Use PI

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 NitroMeth Plus 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

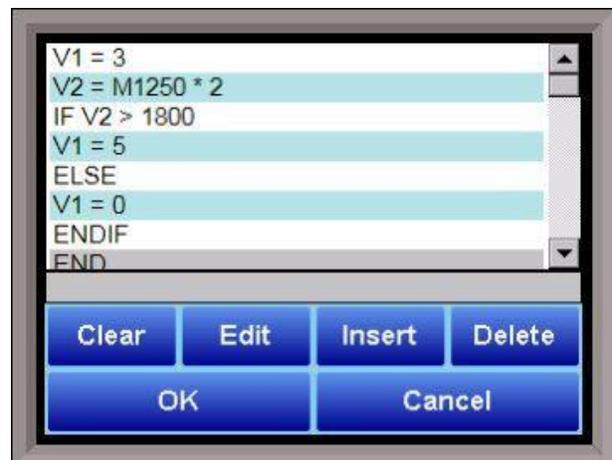
This option will display the screen where the calculations can be entered.

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.

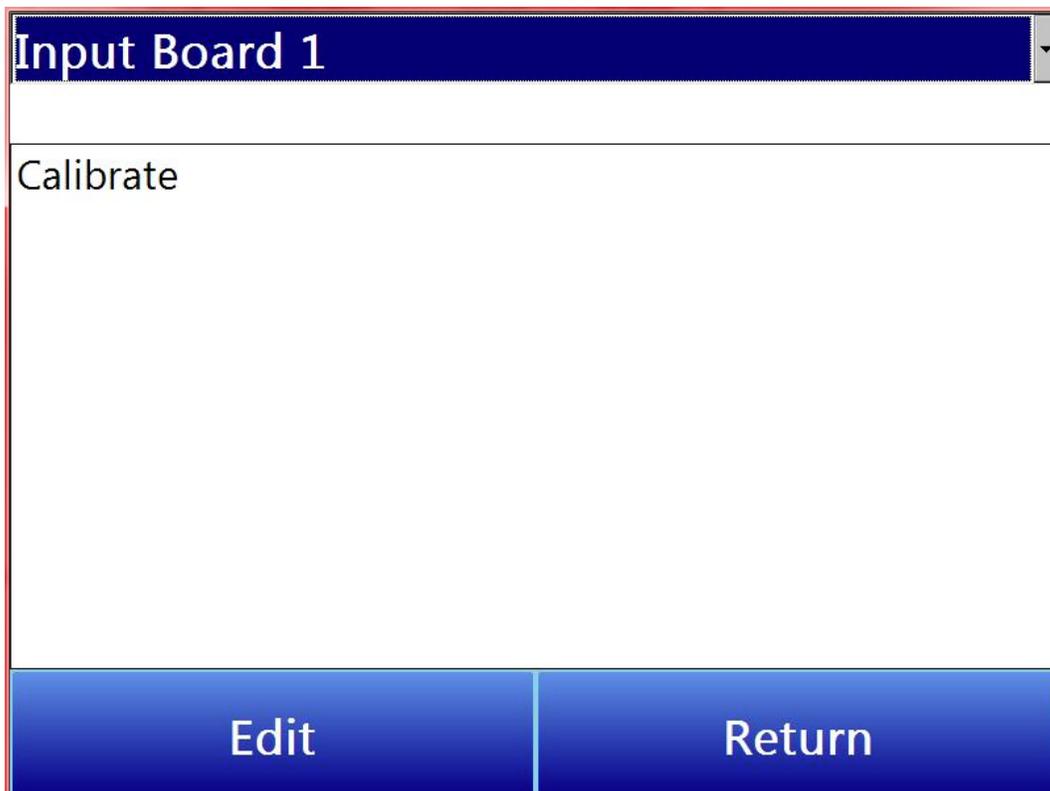
To erase a line, highlight the line and click on the **Clear** button.



## **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.

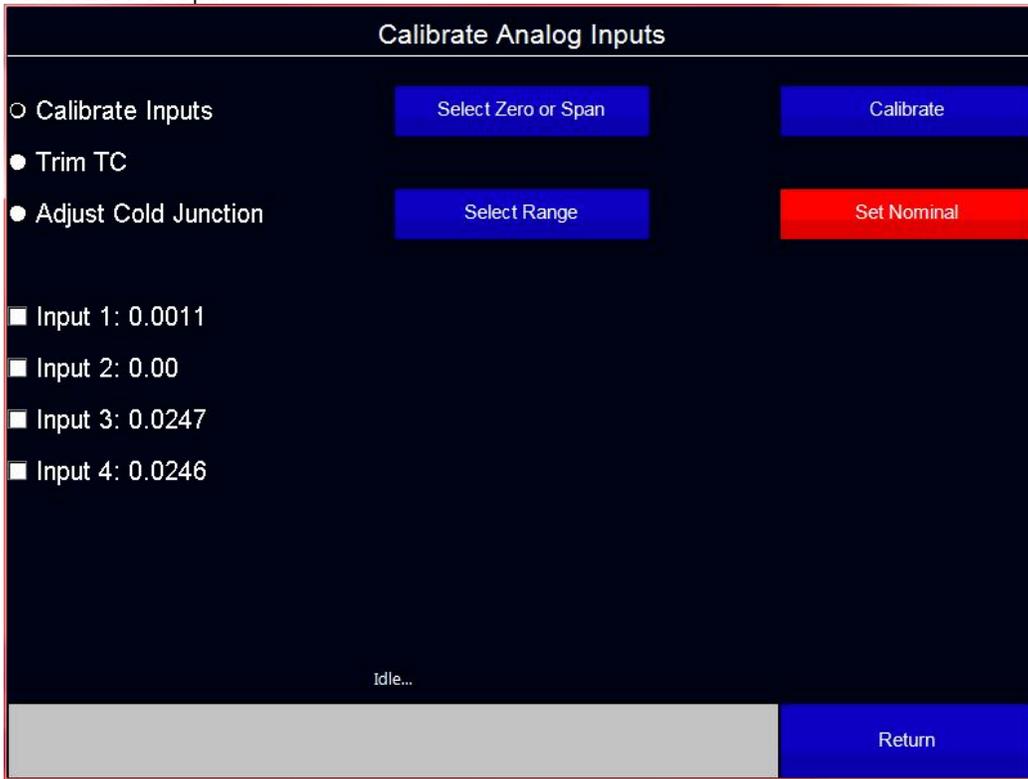
When this option is selected, a screen will appear in which you will select which input board calibration will be performed on. This screen is pictured below. Select the input board from the drop-down menu at the top of the screen. Tap Calibrate, and then tap Edit to continue.



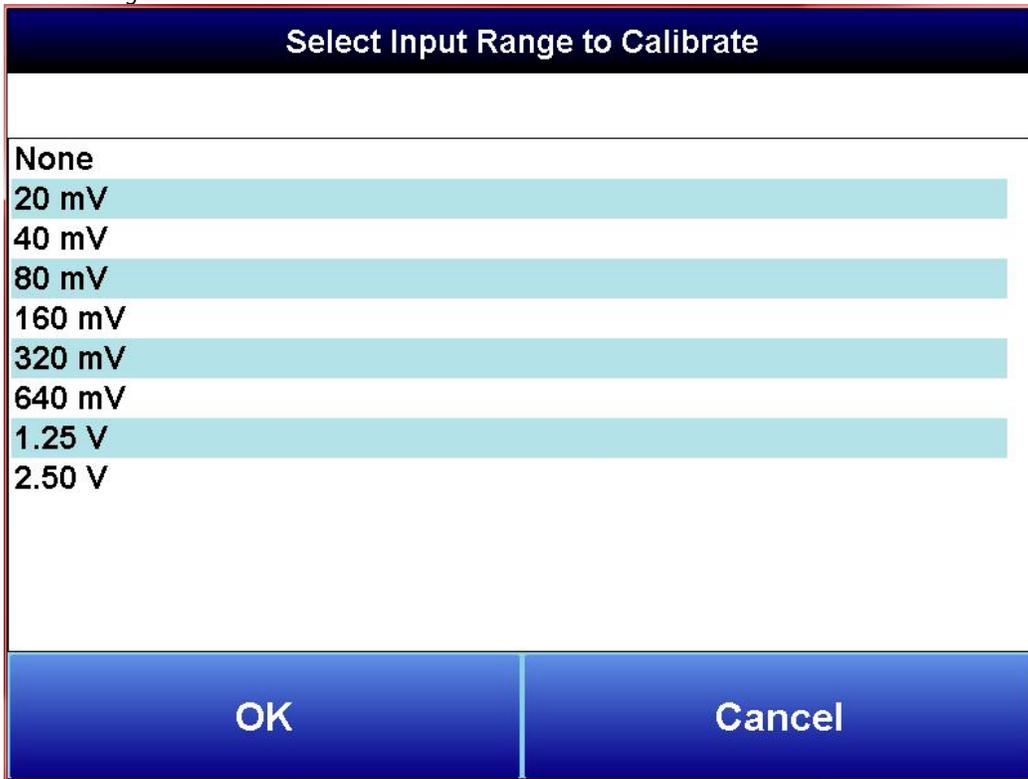
### **Zero/Span Calibration (Calibrate Inputs)**

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

1. Select Zero or Span.



2. Select range.



3. Check the inputs that will be receiving the signal (the inputs will be filtered based on the input range selected in step two so that only relevant inputs can be calibrated).

**Note:** The value to the right of the input label will update with the signal seen at the input.



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

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

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

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

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

The screenshot shows the 'Calibrate Analog Inputs' menu. The 'Adjust Cold Junction' option is selected with a radio button. A blue button labeled 'Select TC Type' is positioned to the right of the selected option, and a red button labeled 'Set Nominal' is to its right. Below these buttons, four input channels are listed with their current values: 'Input 1: 1.2500', 'Input 2: 1962.1', 'Input 3: 0.0396', and 'Input 4: 0.0396'. Each input line has a small square icon to its left. At the bottom right of the screen is a blue 'Return' button. The status 'Idle...' is visible at the bottom center.

2. Enter the known signal value.

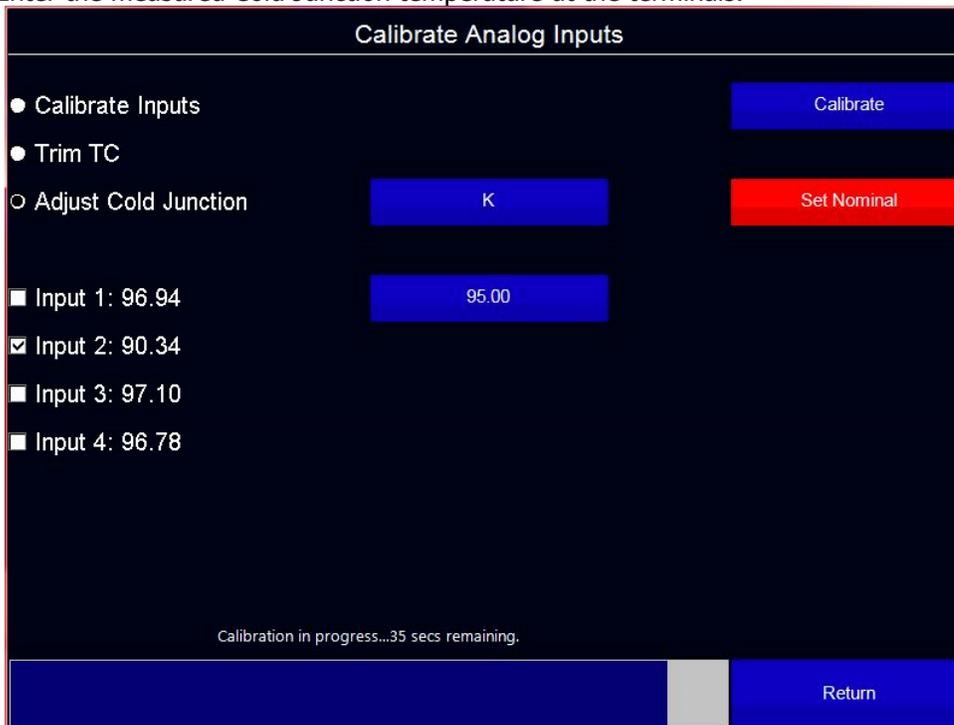
The screenshot shows the 'Calibrate Analog Inputs' menu. The 'Adjust Cold Junction' option is selected. The 'Select TC Type' button now displays 'K'. The 'Set Nominal' button is red. The 'Input 2: 1960.3' line is now checked with a checkbox on the left. The '1950.0' value has been entered into the 'Set Nominal' field, which is now a blue button. The 'Return' button is at the bottom right, and the status 'Idle...' is at the bottom center.

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.

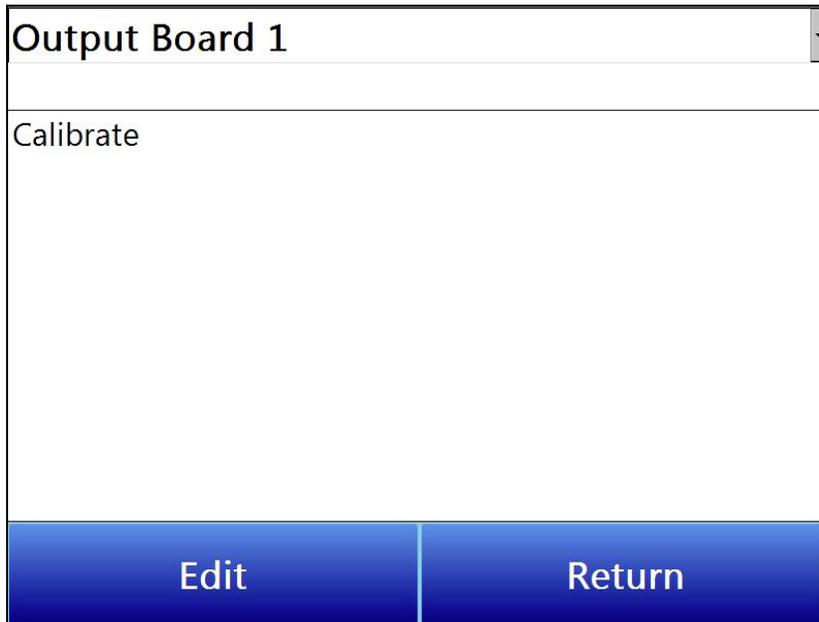
1. Select the TC type.
2. Enter the measured Cold Junction temperature at the terminals.



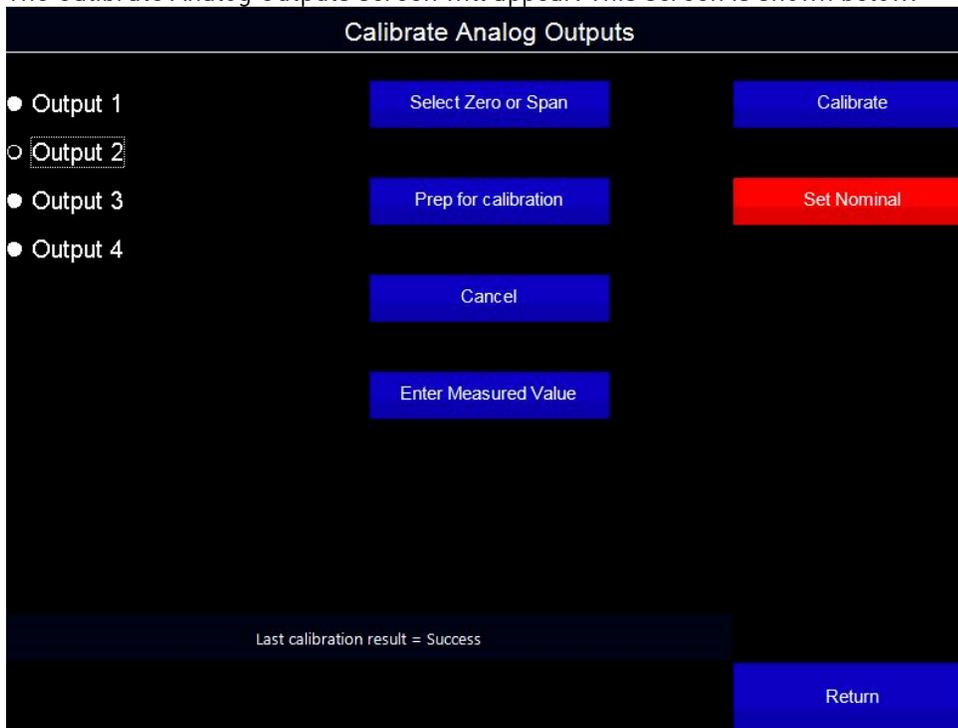
3. Tap Calibrate.

**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.

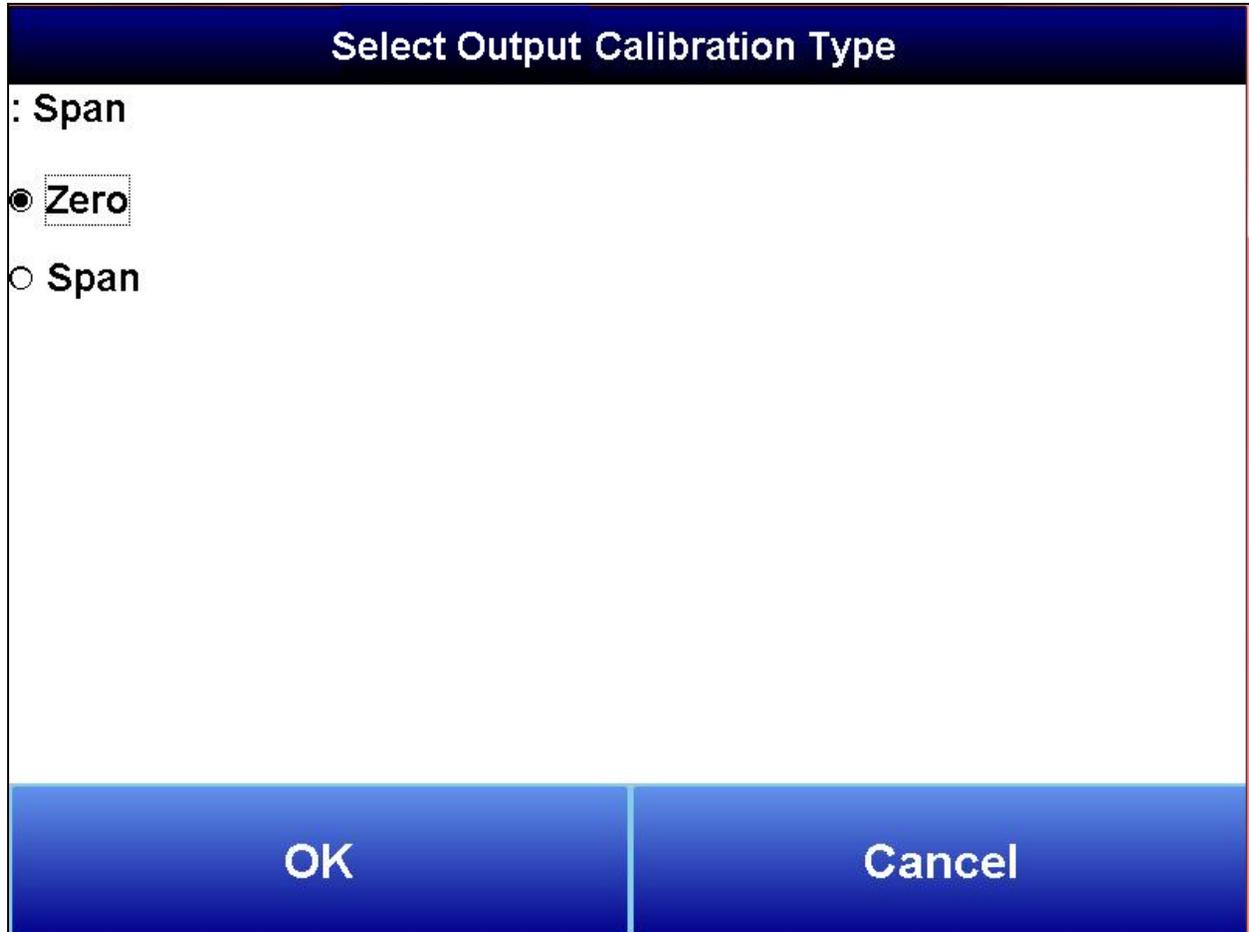


The Calibrate Analog Outputs screen will appear. This screen is shown below.



From the Calibration Analog Outputs screen, follow these steps:

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



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

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

Enter measured mA., Current Value:

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 NitroMeth Plus Controller. Each instrument is allotted a certain set of registers, starting with register 1000. To determine the beginning register, use the following calculation:  $(100 * \text{generic instrument's number (1 - 16)}) + 900$ . 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 NitroMeth Plus Controller, instrument 2's allotment is from register 1100 to 1199 on the NitroMeth Plus 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



### 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 NitroMeth Plus Controller that the instrument will read from. The range is **0 – 32767**.

#### Read 1 Count, Read 2 Count, Read 3 Count

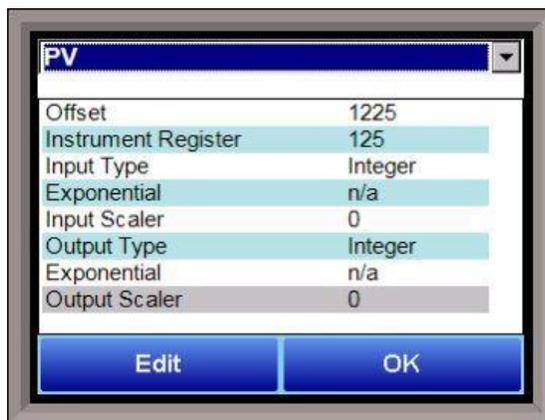
The Read *X* Count field will be the number of successive registers to read. The range is **0 – 100**.

#### 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



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 NitroMeth Plus 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**.

The Input Type field will determine what kind of type the

#### 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.

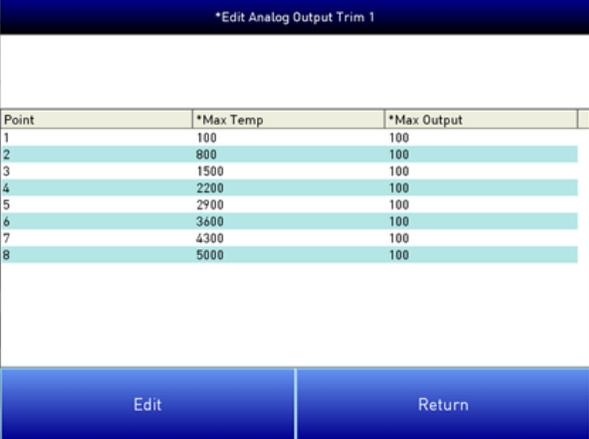
### Analog Output Trim

**Analog Output Trim** allows the user to limit the Controller's **Physical Analog Output**. The user can define up to 12 unique Analog Output Trim entries, each with 8 temperature ranges. This feature is commonly used to either reduce the control signal (4-20mA) to either restrict maximum output at lower temperatures or improve Temperature Uniformity within a multi zone furnace.

To create an Analog Output Trim, select the desired option and tap "Edit".

The user can enter a:

- **Max Temp** representing the upper value of the temperature range, and a
- **Max Output** representing the percentage of the Output to be delivered within that range.



Point	*Max Temp	*Max Output
1	100	100
2	800	100
3	1500	100
4	2200	100
5	2900	100
6	3600	100
7	4300	100
8	5000	100

The Analog Output Trim must be assigned to a Physical Analog Output (see **Analog Output Setup -> Output # -> Assignment**, and select **Trimmed Output #, Loop #**). When assigned to an Analog Output, the physical output will represent:

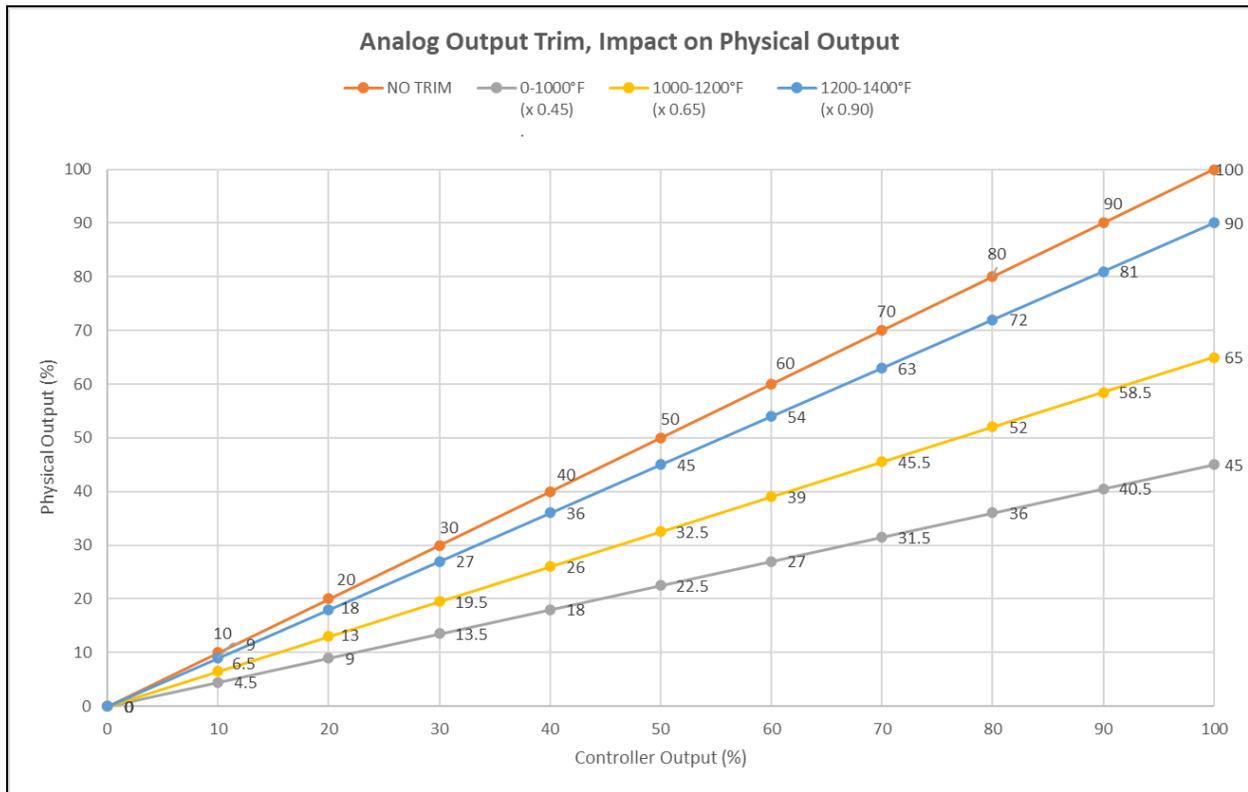
$$\text{Physical Output} = \text{Control Output} \times \text{Analog Output Trim}$$

**Example 1: Limiting Output:**

The controller has one Temperature control loop, sending a single 4-20mA signal to a simple combustion system. The user may wish to limit the burner output at lower temperatures. The user may create the following table:

Analog Output Trim 1		
Point	Max Temp	Max Output
1	1000	45
2	1200	65
3	1400	90
4	2000	100

This restricts the controller's output at lower temperatures:



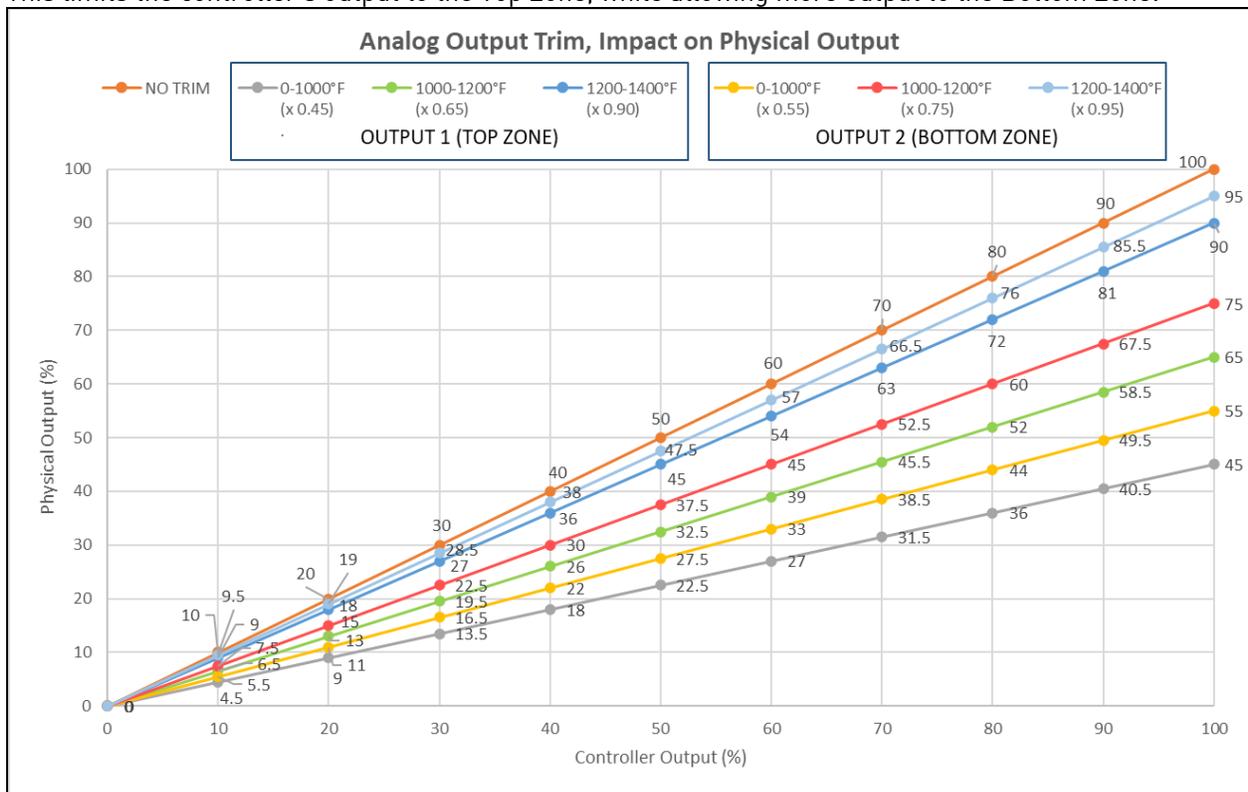
### Example 2: Multi-Zone Temperature Uniformity

The controller has one Temperature control loop with a Top- and Bottom zone of heating elements, each requiring a unique 4-20mA signal. Due to the design of the furnace, the Top Zone may require less power to maintain temperature, changing as the furnace temperature increases. The user may create the following table(s):

Analog Output Trim 1		
Point	Max Temp	Max Output
1	1000	45
2	1200	65
3	1400	90
4	2000	100

Analog Output Trim 2		
Point	Max Temp	Max Output
1	1000	55
2	1200	75
3	1400	95
4	2000	100

This limits the controller's output to the Top Zone, while allowing more output to the Bottom Zone:



As an example, if the controller requires 60% Output to maintain 1300°F, the Top Zone will receive 39% Output (or 10.24 mA), while the Bottom Zone will receive 45% Output (or 11.2 mA). This small difference may improve the Temperature Uniformity within the furnace.

Thermocouple Check Pair 1	
Enabled	No
*TC 1	Analog Input 1
*TC 2	Analog Input 1
*Tolerance Band	20 °
*TC 2 Offset	0 °

Edit
Return

### 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

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

#### Band (mV)

This is the millivolt difference that must be observed in order to change probes. For example, when the NitroMeth Plus is selecting the highest probe with probe 1 as 1055 mV and a band of 20 mV, and if probe 2

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

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
<div style="display: flex; justify-content: space-around;"> <span>Edit</span> <span>Return</span> </div>	

**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, NH<sub>3</sub>, misc, Endo, N<sub>2</sub>, and CO<sub>2</sub>**.

**Valve setpoint mode**

Determines what area of the system will be tracked to control the valve. Options are: **no action, track total flow, track NH<sub>3</sub>, 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 Control Direction**

(View only) If the controller has control of the valve (i.e. not using an Eflo to control the flow rates), this is the Direction Command (Open/Closed) for the valve if it us a Stepper style valve motor.

**Open Limit Switch Assignment and Close Limit Switch Assignment**

These options allow the user to set what factors will influence the opening and closing action of the valve. Options are:

<b>None</b>	<b>Alarm</b>	<b>Outputs 15-96</b>
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 B0	
Fce Open/High Flow	Heat	
Recirc Fan Running	Cool	
Pilots On	Air On	
Emergency Nitrogen Flowing	Natural Gas on	
Inputs 13-23	Ammonia on	

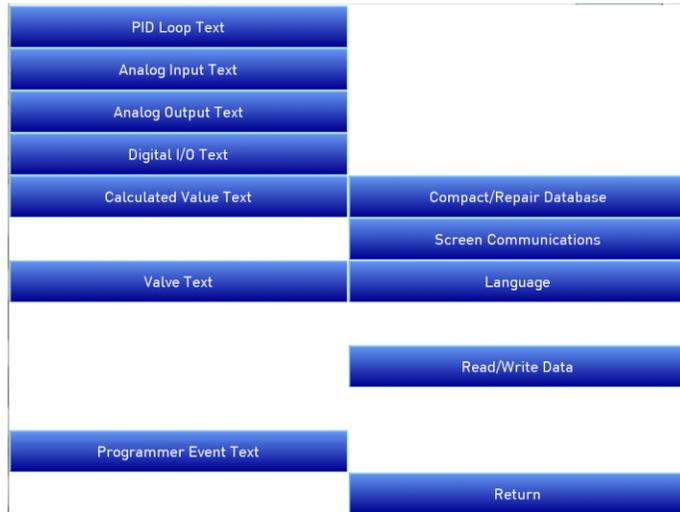
## Security

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
- Valve Text
- Probe Text
- Programmer Event Text



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.

## Nitromethanol Options

### **Furnace Volume**

This is the internal volume of the equipment. It is used to determine the total volume required for 5 volume exchanges on Purge In/Purge Out prior to atmosphere introduction or removal prior to shutdown, as required per NFPA86E.

### **Minimum N2 Flow**

This is the minimum flow of nitrogen required to maintain a safe pressure in the equipment. The setpoint cannot be lower than the furnace volume (EX: Furnace Volume = 200ft<sup>3</sup>, Minimum N2 Flow ≥ 200ft<sup>3</sup>). The setpoint cannot be higher than the nitrogen flowmeter full scale range (found in Valve Setup for the Nitrogen Flowmeter). The “Nitrogen Flow Less Than Minimum” alarm will activate if the actual flow is less than this setpoint value.

Nitromethanol Options	
Furnace Volume	0
Minimum N2 Flow	0
N2 High Flow SP	0
High Flow Timer	0 sec
N2 Purge SP	0
N2 Control SP	0
Control Mode	Calculated %CO
Ratio SP	0.00
%CO Target SP	0.0 %
Methanol SP	0

Edit
Return

### **N2 High Flow Setpoint**

This is the Nitrogen Flow SP if the High Flow timer is active. This is active if the Digital Input for High Flow is active. This timer will start once the digital input is inactive.

### **High Flow Timer**

This is the timer that will run if the “FCE Open/High Flow” input is Active (this input will otherwise be inactive). This time is in seconds. A value of 0 disables the timer and the nitrogen flow does not go to the “high flow” setpoint. Once the timer is complete, it returns to the Nitrogen Flow Setpoint

### **N2 Purge Setpoint**

This is the nitrogen flow setpoint if the furnace is going through a “purge in” or a “purge out”.

### **N2 Control Setpoint**

This is the setpoint at which nitrogen will maintain during normal operation (not during purge in, purge out, or high flow).

### Control Mode: 3 Methods

- **Ratio Setpoint-** This method sets the methanol flow setpoint based upon a ratio of Nitrogen and Methanol. It uses the nitrogen control setpoint as a fixed value, then divides flow by this ratio to calculate a methanol flow setpoint.
- **%CO Target Setpoint-** This adjusts the methanol flow setpoint based upon the setpoint nitrogen flow to achieve a calculated %CO atmosphere level in the furnace.
- **Fixed Setpoint-** This method allows the user to set a fixed methanol flow setpoint.

**Ratio Setpoint-** The ratio of Nitrogen-Methanol at which it is desired to operate. Only applies in Ratio Setpoint mode.

**%CO Setpoint-** The %CO level at which it is desired to maintain the atmosphere at. Only applies in %CO Setpoint mode.

**Methanol Setpoint-** The fixed methanol flow setpoint. Only applies in Fixed Setpoint mode.

## Chapter 3 - Slave Instrument Mapping

The following tables can be used as a reference for retrieving information such as the PV, setpoint, etc from a slave instrument. The slave instrument information will have a base offset based on the instrument number that is assigned. The base offset can be determined using the following formula:

$$\text{Base Offset} = (\text{Instrument Number} * 100) + 900$$

For example, the base offset for instrument 1 would be 1000 → (1 \* 100) + 900 – and the base offset for instrument 7 would be 1600 → (7 \* 100) + 900. The slave instruments will be split into three sections: Atmosphere Instruments, Temperature Instruments, and Events Instruments. The layout for each instrument will be the same:

- **Controller** – The type of controller the slave instrument is – i.e. AC20, Series 9200, etc.
- **Source Location** – The register *in the controller* where the specified value is located. *Note: These will be added on to the base offset of the instrument (see above section).* For example, the source location for %C actual for an AC20 is 11. For instrument 1, the register to find the %C actual would be 1011 → the base offset for instrument 1 is 1000, plus the source location of 11.
- **Write Register** – The register *within the slave instrument* where the value will be written.
- **Read Scale** – Any value read in from an instrument will be divided by this number for display purposes only.
- **Write Scale** – Any value written to an instrument will be multiplied by this number for display purposes only.
- **Description** – This will be a brief description of what the value is, i.e. %C actual, Setpoint, etc.

## Atmosphere Instruments

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
AC20	11	123	1	1	%C Actual
(Modbus Mode)	29	138	1	1	%C Setpoint
	13	125	1	1	Probe Temperature
	10	122	1	1	Probe Millivolts
	20	130	10	10	%C Percent Output
	34	142	1	1	CO Factor or Equivalent
	35	143	1	1	H Factor or Equivalent
	12	124	1	1	Dew Point
	36	144	10	10	O <sub>2</sub>

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Yoko 750	2	2	1	1	%C Actual
(Modbus Mode)	3	100	1	1	%C Setpoint
	20	19	1	1	Probe Temperature
	10	122	1	1	Probe Millivolts
	4	4	10	10	%C Percent Output
	0	0	1	1	CO Factor or Equivalent
	0	0	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
UDC 3300's	1	0	1	1	%C Actual
(Modbus Mode)	3	2	1	1	%C Setpoint
	6	5	10	10	Probe Temperature
	5	4	10	10	Probe Millivolts
	4	3	10	10	%C Percent Output
	43	39	10	10	CO Factor or Equivalent
	43	39	10	10	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Loop 1	21	20	1	1	%C Actual
(Modbus Mode)	7	6	1	1	%C Setpoint
	18	17	8	8	Probe Temperature
	19	18	8	8	Probe Millivolts
	41	40	41	41	%C Percent Output
	4	3	1	1	CO Factor or Equivalent
	5	4	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Loop 2	21	20	1	1	%C Actual

(Modbus Mode)	8	7	1	1	%C Setpoint
	18	17	8	8	Probe Temperature
	19	18	8	8	Probe Millivolts
	42	41	41	41	%C Percent Output
	4	3	1	1	CO Factor or Equivalent
	5	4	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Loop 1	20	20	1	1	%C Actual
(MMI Mode)	6	6	1	1	%C Setpoint
	17	17	8	8	Probe Temperature
	18	18	8	8	Probe Millivolts
	40	40	41	41	%C Percent Output
	3	3	1	1	CO Factor or Equivalent
	4	4	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Loop 2	20	20	1	1	%C Actual
(MMI Mode)	7	7	1	1	%C Setpoint
	17	17	8	8	Probe Temperature
	18	18	8	8	Probe Millivolts
	41	41	41	41	%C Percent Output
	3	3	1	1	CO Factor or Equivalent
	4	4	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm 2404	1	1	1	1	%C Actual
(Modbus Mode)	5	5	1	1	%C Setpoint
	72	11073	1	1	Probe Temperature
	61	11062	1	1	Probe Millivolts
	4	4	1	1	%C Percent Output
	0	0	1	1	CO Factor or Equivalent
	0	0	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm 2500	1	1	1	1	%C Actual
(Modbus Mode)	5	5	1	1	%C Setpoint
	72	11073	1	1	Probe Temperature
<i>Assumes Loop 1 = Atmosphere</i>	61	11062	1	1	Probe Millivolts
	4	4	1	1	%C Percent Output
	68	11069	1	1	CO Factor or Equivalent
	68	11069	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Carbpro 3.5	6	28	1	1	%C Actual

(MMI Mode)	1	1	1	1	%C Setpoint
	5	25	8	8	Probe Temperature
	4	24	8	8	Probe Millivolts
	11	117	1	1	%C Percent Output
	13	7	1	1	CO Factor or Equivalent
	14	8	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Carbpro 3.0	6	28	4	4	%C Actual
(MMI Mode)	1	1	1	1	%C Setpoint
	5	25	8	8	Probe Temperature
	4	24	2	2	Probe Millivolts
	11	117	1	1	%C Percent Output
	13	7	1	1	CO Factor or Equivalent
	14	8	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Carbpc	20	20	1	1	%C Actual
(MMI Mode)	6	6	1	1	%C Setpoint
	17	17	8	8	Probe Temperature
	18	18	8	8	Probe Millivolts
	64	64	41	41	%C Percent Output
	3	3	1	1	CO Factor or Equivalent
	4	4	1	1	H Factor or Equivalent

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Series 9200 Loop 1	3	126	1	1	%C Actual
	5	128	1	1	%C Setpoint
	22	145	1	1	Probe Temperature
	21	144	10	10	Probe Millivolts
	7	130	10	10	%C Percent Output
	19	142	1	1	CO Factor or Equivalent
	20	143	1	1	H Factor or Equivalent

### Temperature Instruments

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Series 20 (Modbus Mode)	11	123	1	1	Temperature Controller Actual
	30	138	1	1	Temperature Controller Setpoint
	18	130	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Yoko 750 (Modbus Mode)	2	2	1	1	Temperature Controller Actual
	3	100	1	1	Temperature Controller Setpoint
	4	4	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
UDC 3300's (Modbus Mode)	1	0	10	10	Temperature Controller Actual
	3	2	10	10	Temperature Controller Setpoint
	4	3	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Loop 1 (Modbus Mode)	18	17	8	8	Temperature Controller Actual
	7	6	1	1	Temperature Controller Setpoint
	41	40	41	41	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Loop 2 (Modbus Mode)	18	17	8	8	Temperature Controller Actual
	8	7	1	1	Temperature Controller Setpoint
	42	41	41	41	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Loop 1	17	17	8	8	Temperature Controller Actual
(MMI Mode)	6	6	1	1	Temperature Controller Setpoint
	40	40	41	41	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Loop 2	17	17	8	8	Temperature Controller Actual
(MMI Mode)	7	7	1	1	Temperature Controller Setpoint
	41	41	41	41	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm 2404	1	1	1	1	Temperature Controller Actual
(Modbus Mode)	2	2	1	1	Temperature Controller Setpoint
	3	3	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm 2500	26	1025	1	1	Temperature Controller Actual
(Modbus Mode)	27	1026	1	1	Temperature Controller Setpoint
<i>Assumes Loop 2 is Temperature</i>	29	1028	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Unipro 3.5	3	25	8	8	Temperature Controller Actual
(MMI Mode)	1	1	1	1	Temperature Controller Setpoint
	5	118	1	1	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Unipro 3.0	3	25	8	8	Temperature Controller Actual
(MMI Mode)	1	1	1	1	Temperature Controller Setpoint
	5	118	1	1	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Carbpro 3.5 Slave	9	46	1	1	Temperature Controller Actual
(MMI Mode)	3	18	1	1	Temperature Controller Setpoint
	12	53	41	41	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Carbpro 3.0 Slave	9	46	1	1	Temperature Controller Actual
(MMI Mode)	3	18	1	1	Temperature Controller Setpoint
	12	53	41	41	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
10Pro Slave or E Slave	2	2	1	1	Temperature Controller Actual
(MMI Mode)	3	3	1	1	Temperature Controller Setpoint
	4	4	1	1	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Input C	19	19	8	8	PV
	5	5	1	1	Setpoint Loop 1
	40	40	41	41	Percent Output Loop 1

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Series 9200 Loop 1	3	126	1	1	Temperature Controller Actual
	5	128	1	1	Temperature Controller Setpoint
	7	130	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Series 9200 Loop 2	8	131	1	1	Temperature Controller Actual
	10	133	1	1	Temperature Controller Setpoint
	12	135	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Series 9200 Loop 3	13	136	1	1	Temperature Controller Actual
	15	138	1	1	Temperature Controller Setpoint
	17	140	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Series 9100 Loop 2	1	104	1	1	Temperature Controller Actual
	36	139	1	1	Temperature Controller Setpoint
	28	131	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm Loop 1 (Modbus Mode)	1	1	1	1	Temperature Controller Actual
	2	2	1	1	Temperature Controller Setpoint
	3	3	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm Loop 2 (Modbus Mode)	26	1025	1	1	Temperature Controller Actual
	27	1026	1	1	Temperature Controller Setpoint
	29	1028	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm Loop 3 (Modbus Mode)	51	1049	1	1	Temperature Controller Actual
	52	1050	1	1	Temperature Controller Setpoint
	53	1052	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
9500 Valve Controller Valve 1	30	130	1	1	Flow Actual
	56	156	1	1	Flow Setpoint
	54	154	1	1	Flow Percent of Full Scale

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
9500 Valve Controller Valve 2	31	131	1	1	Flow Actual
	66	166	1	1	Flow Setpoint
	64	164	1	1	Flow Percent of Full Scale

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
9500 Valve Controller Valve 3	32	132	1	1	Flow Actual
	76	176	1	1	Flow Setpoint
	74	174	1	1	Flow Percent of Full Scale

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
9500 Valve Controller Valve 4	33	133	1	1	Flow Actual
	86	186	1	1	Flow Setpoint
	84	184	1	1	Flow Percent of Full Scale

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
SSi 7SL Limit Controller	4	123	1	1	Limit Controller Actual
	8	177	1	1	Limit Controller Alarm Threshold (SP)
	11	310	1	1	Limit Controller Main Setpoint

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Flow Meter	1	16	1	1	Flow
	3	18	1	1	Setpoint
	0	0	1	1	<i>No Value Available</i>

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
UMC 800 Loop 1	0	64	1	1	PV Actual
<i>All Values are Floating Point</i>	4	68	1	1	Working Setpoint
	6	70	1	1	Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
SSi Quad DAC Ch. 0	10	10	1	1	DAC Out
	10	10	1	1	DAC Out
	16	16	1	1	<i>No Value Available</i>

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
SSi Quad DAC Ch. 1	11	11	1	1	DAC Out
	11	11	1	1	DAC Out
	16	16	1	1	<i>No Value Available</i>

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
SSi Quad DAC Ch. 2	12	12	1	1	DAC Out
	12	12	1	1	DAC Out
	16	16	1	1	<i>No Value Available</i>

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
SSi Quad DAC Ch. 3	13	13	1	1	DAC Out
	13	13	1	1	DAC Out
	16	16	1	1	<i>No Value Available</i>

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Yoko UT350/320	2	2	1	1	Temperature Controller Actual
(Modbus Mode)	3	300	1	1	Temperature Controller Setpoint
	4	4	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Yoko UP750/550 Loop 2	18	18	1	1	Temperature Controller Actual
(Modbus Mode)	19	101	1	1	Temperature Controller Setpoint
	20	20	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Yoko UP350	2	2	1	1	Temperature Controller Actual
(Modbus Mode)	3	138	1	1	Temperature Controller Setpoint
	4	4	10	10	Temperature Controller Percent Output

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Honeywell DCP551	4	259	10	10	Temperature Controller Actual
	5	702	10	10	Temperature Controller Setpoint
	0	0	10	10	Temperature Controller Percent Output

## Events Instruments

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
AC20	50	310	1	1	Events Actual
(Modbus Mode)	50	310	1	1	Events Setpoint
	49	300	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Yoko 750	49	310	1	1	Events Actual
(Modbus Mode)	49	310	1	1	Events Setpoint
	49	310	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
ModMux	97	97	1	1	Events Actual
(Modbus Mode)	97	97	1	1	Events Setpoint
	98	98	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Events	59	178	1	1	Events Actual
(Modbus Mode)	49	168	1	1	Events Setpoint
	59	178	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Dualpro Events	82	178	1	1	Events Actual
(MMI Mode)	72	168	1	1	Events Setpoint
	82	178	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Carbpro 3.5 Events	8	43	1	1	Events Actual
(MMI Mode)	2	17	1	1	Events Setpoint
	8	43	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Carbpro 3.0 Events	8	43	1	1	Events Actual
(MMI Mode)	2	17	1	1	Events Setpoint
	8	43	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm 2500	19	19	8	8	PV
(Modbus Mode)	5	5	1	1	Setpoint Loop 1
	40	40	1	1	Percent Output Loop 1

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
SSi_8_8	5	100	1	1	Events Actual
	3	98	1	1	Events Setpoint
	6	101	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Series 9200	5	176	1	1	Events Actual
	2	109	1	1	Events Setpoint
	4	175	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Micrologix Modbus	10	110	1	1	Events Actual
RS-232	0	100	1	1	Events Setpoint
	15	115	1	1	Events Input

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
MCMModule Modbus	10	110	1	1	Events Actual
RS-232	0	100	1	1	Events Setpoint
	15	115	1	1	Events Input

<b>Controller</b>	<b>Source Location</b>	<b>Write Register</b>	<b>Read Scale</b>	<b>Write Scale</b>	<b>Description</b>
PLC5DF1	10	110	1	1	Events Actual
RS-232	0	100	1	1	Events Setpoint
	15	115	1	1	Events Input

<b>Controller</b>	<b>Source Location</b>	<b>Write Register</b>	<b>Read Scale</b>	<b>Write Scale</b>	<b>Description</b>
SLKDF1	10	110	1	1	Events Actual
RS-232	0	100	1	1	Events Setpoint
	15	115	1	1	Events Input

## Chapter 4 – OPCODES

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Temperature Value Column	Atmosphere Value Column	Option Value Column
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### AB\_SOAK

N/A	N/A	Soak Time
-----	-----	-----------

This sets a soak time for an autobost step in a recipe. It must be monitored externally by SSi's realtime carbon diffusion modeling software which will adjust the soak times based on a predefined target model for the specified work.

### ABD\_Model

N/A	N/A	Model
-----	-----	-------

This opcode instructs the Real Time Carbon Diffusion (RTCD) program what model to use when the autobost or autodiffuse is encountered.

### AD\_SOAK

N/A	N/A	Soak Time
-----	-----	-----------

This sets a soak time for an autodiffuse step in a recipe. It must be monitored externally by SSi's realtime carbon diffusion modeling software which will adjust the soak times based on a predefined target model for the specified work.

### ALARM

N/A	N/A	User Alarm Number
-----	-----	-------------------

The alarm function is used to notify the operator that an operation is complete or that a manual action is required. By use of the *Settings* menu screen, up to **99** User Alarms can be assigned, with a short text on each that is displayed during an active alarm condition. The program waits until the alarm is acknowledged to proceed. User Alarm 0 is used to turn off a user alarm. Its function is the same as the acknowledge button.

### ATM\_INQ

N/A	ATM Level	Wait, Wait Up, Wait Down
-----	-----------	--------------------------

The atmosphere inquiry is used to wait for the actual atmosphere to reach the set point. The default band can be set under the Configuration Menu and is typically 10 (i.e. 0.10 percent carbon).

- The *SET\_WAIT* opcode will change the band limit
- The *LIMIT* opcode immediately following this opcode sets a time limit on the wait.
- A *BRANCH* opcode immediately following this opcode can be used to change the program flow based on the inquiry results.

### BO\_start

N/A	N/A	Start, start+wait, check+wait
-----	-----	-------------------------------

This opcode will allow the start of a burnoff from the controller.

### BRANCH

True Step Number	False Step Number	N/A
------------------	-------------------	-----

The Branch opcode can change program flow based upon an inquiry opcode. The True Step Number is the program step to go to if the inquiry is evaluated as true; and the False Step Number is the program step to go to if the inquiry is evaluated as false.

The True Step Number ranges from **1 – 24**.

The False Step Number ranges from 1 – 24.

#### CC\_SP\_L

Setpoint Lower Limit                      Setpoint Upper Limit                      N/A

The Cascade Setpoint Limit opcode will allow the use to set the upper and lower limits for the cascade setpoint. The temperature data is the lower limit, and the atmosphere data is the upper limit.

#### DELAY

N/A    N/A    Delay Time

This opcode is used when a short delay is needed. The option value is the delay time in seconds, from 1-500 seconds.

#### DEV\_AL

Temperature Dev/Band                      Atmosphere Dev/Band                      Loop

The deviation alarm opcode is used to turn the temperature or vacuum deviation alarms ON or OFF.

The Temperature Dev/ Band will determine the deviation band for the temperature deviation alarm. The Loop will determine which type of deviation alarm to use.

The Temperature Dev/Band ranges from -301 (Disable) – 30000.

The Loop options are: **Off**, **T. Bnd** (Temperature Band), **A. Bnd** (Atmosphere Band), **A. Bnd, T. Bnd** (Atmosphere Band and Temperature Band), **T. + Dev** (Temperature + Deviation), **T. – Dev** (Temperature – Deviation), **A. Bnd, T. + Dev** (Atmosphere Band and Temperature + Deviation), **A. Bnd, T. – Dev** (Atmosphere Band and Temperature – Deviation), **A. + Dev** (Atmosphere + Deviation), **A. + Dev, T. Bnd** (Atmosphere + Deviation and Temperature Band), **A. + Dev, T. + Dev** (Atmosphere + Deviation and Temperature + Deviation), **A. + Dev, T. – Dev** (Atmosphere + Deviation and Temperature – Deviation), **A. – Dev** (Atmosphere – Deviation), **A. – Dev, T. Bnd** (Atmosphere – Deviation and Temperature Band), **A. – Dev, T. + Dev** (Atmosphere – Deviation and Temperature + Deviation), **A. – Dev, T. – Dev** (Atmosphere – Deviation and Temperature – Deviation). There is also an option for **Smart Temp** and **Smart Atm**.

The band limit can be changed by the *SET\_WAIT* opcode.

#### DOW\_INQ

N/A    N/A    Day

This opcode checks the real time clock for the day of the week. This is useful for performing operations on a weekly basis on a specific day.

The Day is the day of the week, i.e. **Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, or Saturday**.

#### EVT\_IN

Temperature Setpoint                      Atmosphere Setpoint                      Event

This opcode waits for an input event to be turned ON or OFF depending on the Event value selected.

If the Temperature Setpoint is specified, it is considered a set point and will be sent to the appropriate controller.

The Temperature Setpoint ranges from -301 (Disable) – 30000.

The Atmosphere Setpoint ranges from -0.01 to 99.99.

The Event options are: **Event 0 ON/OFF – Event 31 ON/OFF**.

#### EVT\_OUT

Temperature Setpoint    N/A    Event

This opcode waits for an output event to be turned ON or OFF depending on the Event value selected.

If the Temperature Setpoint is specified, it is considered a set point and will be sent to the appropriate controller.

The Temperature Setpoint ranges from -301 (Disable) – 30000.

The Event options are: **Event 0 ON/OFF – Event 15 ON/OFF**.

#### G\_SOAK

N/A    Wait Limit    Soak Time





The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is **-301 (disable) – 30000**.

The Atmosphere setpoint is the setpoint to send for the atmosphere process variable. The range is **-0.01 to 99.99**.

The Time is the total time for the program to reach the desired setpoint(s), in Hours:Minutes format. The Hours range from **0 – 166**, and the Minutes range from **0 – 59**.

The band limit can be changed by the *SET\_WAIT* opcode.

#### **GTCINQDEL**

<b>Delay Time</b>	<b>T/C</b>	<b>Option</b>
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This is a guaranteed TC inquiry short delay opcode. It is used to verify that all active thermocouples are within the set wait limits around the setpoint for the user defined time period.

The Delay Time is the time in seconds before checking the T/Cs. The range is **0 – 500**.

The T/C is the Control T/C or Load T/C to use. The options are: **Control T/C, T/C 1 – T/C 24**.

The Option will allow the user to wait for the T/Cs to come within the set wait limits around the setpoint.

The options are: **Wait, Wait Up, or Wait Down**.

#### **GZ\_SOAK**

<b>N/A</b>	<b>N/A</b>	<b>Soak Time</b>
------------	------------	------------------

This is a guaranteed soak opcode for a zone. The temperature process value must be within the deviation band to allow the soak timer to run. If the temperature process value goes out of the deviation band, then the soak timer will stop and wait until the temperature process value comes back into the deviation band before starting up again.

The Soak time is the total time, in Hours:Minutes format, for the soak to run. The Hours range from **0 – 166**, and the Minutes range from **0 – 59**.

The band limit can be changed by the *SET\_WAIT* opcode.

#### **GZDELAY**

<b>N/A</b>	<b>N/A</b>	<b>Delay Time</b>
------------	------------	-------------------

This is a guaranteed short delay opcode for a zone. The temperature process value must be within the deviation band to allow the delay timer to run. If the temperature process value goes out of the deviation band, then the soak timer will stop and wait until the temperature process value comes back into the deviation band before starting up again.

The Delay Time is from **1 – 500** seconds.

#### **GZRAMP**

<b>Temperature Setpoint</b>	<b>Atmosphere Setpoint</b>	<b>Time</b>
-----------------------------	----------------------------	-------------

This is a guaranteed ramp opcode for a zone. The process value must be within the deviation band to allow the ramp timer to run. If the temperature process value goes out of the deviation band, then the ramp timer will stop and wait until the temperature process value comes back into the deviation band before starting up again.

The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is **-301 (disable) to 30000**.

The Time is the total time for the program to reach the desired setpoint(s), in Hours:Minutes format. The Hours range from **0 – 166**, and the Minutes range from **0 – 59**.

The band limit can be changed by the *SET\_WAIT* opcode.

#### **HIGH\_AL**

<b>Temperature Setpoint</b>	<b>Atmosphere Setpoint</b>	<b>N/A</b>
-----------------------------	----------------------------	------------

This opcode is used to enable a high limit alarm on the temperature or atmosphere process. This alarm remains active until the program ends.

The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is **-301 (disable) to 30000**.

The Atmosphere Setpoint is the setpoint to send for the atmosphere process variable. The range is **-0.01** (disable) to **99.99**.

#### HIGH\_PO

<b>Temperature PO Value</b>	<b>Atmosphere PO Value</b>	<b>N/A</b>
-----------------------------	----------------------------	------------

This opcode is used to enable a high limit alarm on the temperature or atmosphere percent output. The Temperature PO Value is the high limit point for the temperature percent output. The range is **-101** (disable) – **100**.

The Atmosphere PO Value is the high limit point for the atmosphere percent output. The range is **-101** (disable) – **100**.

This alarm remains active until the program ends.

#### ID\_INC

<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
------------	------------	------------

This opcode increments the integer ID number by one.

#### ID\_INQ

<b>ID Number Value</b>	<b>N/A</b>	<b>Option</b>
------------------------	------------	---------------

This opcode is used to compare the ID value to the value in the temperature data. The *LIMIT* opcode immediately following this opcode sets a time limit on the wait. A *BRANCH* opcode immediately following this opcode can be used to change the program flow based on the inquiry results.

The ID Number Value is the ID to compare. The range is **-301** (disable) – **30000**.

The Option will determine how to compare the ID value against the value in the temperature data. The options are: **Equal, High, or Low**.

#### ID\_SET

<b>ID Number Value</b>	<b>N/A</b>	<b>N/A</b>
------------------------	------------	------------

This opcode is used to set the ID number to the value specified in the temperature data. The ID number is provided as a feature to track loads or jobs, and it is not used by any controller.

The ID Number Value is the value to set. The range is **-301** (disable) – **30000**.

#### IN\_INQ

<b>Input Value</b>	<b>Input</b>	<b>Option</b>
--------------------	--------------	---------------

This opcode will check a specific input against a specified value and can hold until the input matches the value.

The Input Value is the value to check against. The range is **-301** (disable) – **30000**.

The Input is the specific input to check. The range is **1 – 3**.

The options are: **Wait, Wait Up, or Wait Down**.

#### JUMP

<b>N/A</b>	<b>N/A</b>	<b>Recipe Number</b>
------------	------------	----------------------

The JUMP opcode is used to go to another program when no return is needed. The difference between a *JUMP* and a *GOSUB* is that *GOSUB* will return to the original program when the called program completes. A *JUMP* will not return to the original program.

The Recipe Number is the recipe number to go to. The range is **1 – 300**.

#### LIMIT

<b>N/A</b>	<b>N/A</b>	<b>Time Limit</b>
------------	------------	-------------------

This option is used to place a time limit on a wait or inquiry step. The pass step number is the next step executed if the condition is satisfied before the LIMIT timeout occurs and the fail step is the next step executed if the limit time is exceeded. Optionally, a user alarm value may be provided which will activate the specified programmer user alarm in the event of a limit failure.

The Time Limit is the total time, in Hours:Minutes format, for the program to wait. The Hours range from 0 – 8, and the Minutes range from 0 – 59.

#### LOW\_AL

**Temperature Setpoint**                      **Atmosphere Setpoint**                      **N/A**

This opcode is used to enable a low limit alarm on the temperature or atmosphere. This alarm remains active until the program ends.

The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is -301 (disable) – 30000.

The Atmosphere Setpoint is the setpoint to send for the atmosphere process variable. The range is -0.01 (disable) to 99.99.

#### LOW\_PO

**Temperature PO Value**                      **Atmosphere PO Value**                      **N/A**

This opcode is used to enable a low limit alarm on the temperature or atmosphere percent output.

The Temperature PO Value is the high limit point for the temperature percent output. The range is -101 (disable) to 100.

The Atmosphere PO Value is the high limit point for the temperature percent output. The range is -101 (disable) to 100.

This alarm remains active until the program ends.

#### LTC\_SET

**T/C Map**    **T/C Map**    **Load TC Enable**

This opcode sets the active load T/C map for the furnace. Checking the box next to the T/C number selects the T/C. The options are off, on, or on + alarms.

This Opcode is the same as Zone/Load TC Setup via the Menu options (see sections on Zone/Load TC Setup) except that it selects thermocouples from the recipe. This may be helpful when certain recipes require three Load TCs and other require six Load TCs.

#### MEVT\_IN\_0

**Temperature Setpoint**                      **Event Mask**    **Event ON/OFF Bitmap**

This opcode waits for multiple input events 0 through 15.

The Temperature Setpoint is an optional setpoint to send down. The range is -301 (disable) – 30000.

The Event Mask is the events to enable, which is the events affected. The options are: 0 – 15.

The Event ON/OFF Bitmap field will allow the user to select the bitmap for the event ON/OFF, which will set the final condition of the events in the event mask. The opcode ignores the bits not in the enabled events and waits on the bits specified in the bitmap. The options are: 0 – 15.

#### MEVT\_IN\_1

**Temperature Setpoint**                      **Event Mask**    **Event ON/OFF Bitmap**

This opcode waits for multiple input events 16 through 31.

The Temperature Setpoint is an optional setpoint to send down. The range is -301 (disable) – 30000.

The Event Mask is the events to enable, which is the events affected. The options are: 0 – 15. *Note – Even though the events listed are 0 – 15, they correspond to 16 – 31.*

The Event ON/OFF Bitmap field will allow the user to select the bitmap for the event ON/OFF, which will set the final condition of the events in the event mask. The opcode ignores the bits not in the enabled events and waits on the bits specified in the bitmap. The options are: 0 – 15. *Note – Even though the events listed are 0 – 15, they correspond to 16 – 31.*

#### MEVT\_OUT\_0

**Temperature Setpoint**                      **Event Mask**    **Event ON/OFF Bitmap**

This opcode will set multiple output events **0** through **15**.

The Temperature Setpoint is an optional setpoint to send down. The range is **-301** (disable) – **30000**.

The Event Mask is the events to enable, which is the events affected. The options are: **0 – 15**.

The Event ON/OFF Bitmap field will set the final condition of the events in the event mask. The opcode will ignore the bits not in the mask and either set or reset the bits depending upon their states in the bitmap.

The options are: **0 – 15**.

### **MV\_INQ**

<b>N/A</b>	<b>Millivolt Level</b>	<b>Option</b>
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The millivolt inquiry is used to wait for the probe millivolts to reach the value specified in the atmosphere data. The range is -1 to 9999.

The *LIMIT* opcode immediately following this opcode sets a time limit on the wait.

A *BRANCH* opcode immediately following this opcode can be used to change the program flow based on the inquiry results.

### **NO-OP**

<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
------------	------------	------------

This is a no operation code, and it does nothing. It is used as a place holder on programs that are less than 24 steps.

### **PIDLOAD**

<b>Loop 2</b>	<b>Loop 1</b>	<b>Loop 3</b>
---------------	---------------	---------------

This opcode will load an alternate PID set from the controller memory.

The Loop 1 field is the alternate PID loop to use for loop 1. A value of **0** will disable the loop PID. The range is **0 – 16**.

The Loop 2 field is the alternate PID loop to use for loop 2. A value of **0** will disable the loop PID. The range is **0 – 16**.

The Loop 3 field is the alternate PID loop to use for loop 3. A value of **0** will disable the loop PID. The range is **0 – 16**.

The alternate PID loops can be set up on the *Alternate PID Setup* screen. See the *Alternate PID Setup* section for more information.

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

### **PLC\_SET\_VAL**

<b>Value</b>	<b>Write Location</b>	<b>Option</b>
--------------	-----------------------	---------------

This opcode will set specially configured values in a slave PLC. Registers to be written to must be described via the Configurator's Recipe Management Group Opcode Control interface. The temperature data is the value to write. The atmosphere data is the Write location. This can be:

- Quench SP**
- Endo SP**
- Ammonia SP**
- N2 SP**
- Methanol SP**
- Quench Sec**
- Drain Sec**
- T.C. Endo SP**
- T.C. N2 SP**
- FNC NH3 SP**
- T.C. Time**

PLC Quench SP  
Quench Type

The options are: **Wait**, **Wait up**, or **Wait Down**.

**PO\_INQ**

<b>Temperature PO Value</b>	<b>Atmosphere PO Value</b>	<b>Option</b>
-----------------------------	----------------------------	---------------

The percent output inquiry is used to test the actual percent output of the temperature controller. The Temperature PO Value is the temperature percent output to test against. The range is **-101** (disable) – **100**.

The Atmosphere PO Value is the atmosphere percent output to test against. The range is **-101** (disable) – **100**.

The Option value will determine how the test will conclude. The options are: **Wait** (Reach within band), **Wait Up** (Reach or Exceed the specified values), or **Wait Down** (Reach or Be Less than the specified values).

The LIMIT opcode immediately following this opcode sets a time limit on the wait.

A BRANCH opcode immediately following this opcode can be used to change the program flow based on the inquiry results.

**PROGST**

<b>N/A</b>	<b>N/A</b>	<b>Recipe Number</b>
		<b>Recipe Step</b>
		<b>Recipe Programmer</b>

This opcode direct the controller to begin a new recipe, at the selected step, in the current NitroMeth Plus Controller's second programmer. If the PROGST option is the same program number that is executing the PROGST opcode then PROGST behaves the same as a RESET. The **Recipe Number** (range=1-300), **Recipe Step** (range=1-24), and **Programmer** (range=2 to the number of programs supported by the NitroMeth Plus Controller) are numerical values representing the corresponding numbers of the recipe, step, and programmer to which the recipe and step apply.

**Q\_TT\_AL\_SP**

<b>N/A</b>	<b>Transfer Time (Seconds)</b>	<b>N/A</b>
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This option will set the quench transfer time alarm setpoint.

The Transfer time is entered in seconds. The range is **0.0** – **3276.7**.

**QTCSET**

<b>Temperature Setpoint</b>	<b>N/A</b>	<b>N/A</b>
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This is the quench setpoint opcode. The Temperature Setpoint is the setpoint for a quench cycle. The range is **-301** (disable) – **30000**.

**QUENCH**

<b>Temperature</b>	<b>Time</b>	<b>Speed</b>
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This opcode is used to start a quench cycle. The quench cycle is independent of any program that is running. A new recipe can be started while the quench timer is active.

The Temperature is the quench temperature controller set point. The quench temperature controller must be defined as a slave instrument in the Slave Instrument Setup menu and configured in the Furnace Setup menu as **Instrument # 4**. The range is **-301** (disable) – **30000**.

The quench cycle starts when the opcode is executed. The set point is sent to the quench temperature controller, the timer is started, and the high-speed event is turned on if it is selected. Once the quench timer has timed out, the quench speed changes to an idle speed, and the end of quench cycle event pulses on and off.

The Time is the quench time in minutes. The range is **-1** (disable) – **9999**.

The Speed is used to trigger an Event (#6, by default, which can be changed in the Furnace Setup menu).

While this quench cycle is active, there are three events that can be triggered:

- Quench speed event (Default: #6)
- Quench run event (Default: #0)
- End of quench event (Default: #7)

All of these events must be configured in the Furnace Setup menu.

#### Quench Speed Event

While the quench timer is active, if a high speed was selected, the quench speed event will be on. This Event can control the agitator speed, high or low. This Event will remain off if the quench speed is set to low.

#### Quench Run Event

While the quench timer is active, the Quench Run Event is on.

#### End of Quench Event

When the End of Quench Alarm is activated at the end of the quench cycle, the user must acknowledge the alarm. While the End of Quench Alarm is active, the End of Quench Event will be on.

### RAMP

Temperature Setpoint	Atmosphere Setpoint	Time
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This opcode changes the temperature set point linearly over time.

The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is -301 (disable) to 30000.

The Atmosphere setpoint is the setpoint to send for the atmosphere process variable. The range is -0.01 to 99.99.

The Time is the total time for the program to reach the desired setpoint(s), in Hours:Minutes format. The Hours range from 0 – 166, and the Minutes range from 0 – 59.

The band limit can be changed by the *SET\_WAIT* opcode.

### RAMPR

Temperature Setpoint	Option Decimal	Rate
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This opcode changes the temperature set point at a rate of degrees per minute.

The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is -301 (disable) – 30000.

The Option Decimal will alter the decimal point in the rate. The range is -1 (disable) – 2.

The Rate will be the rate of degrees per minute to change the temperature until the setpoint is reached.

The range is 0.01 – 300.00.

### REG\_INQ

Value	Register	Option
-------	----------	--------

This opcode will check a specific register against a specified value and can hold until the input matches the value.

The Value is the value to check against. The range is -301 (disable) – 32767.

The Register is the specific register to check. The range is -1 (disable) – 32767.

The options are: **Equal**, **> Or Equal** (Greater than or equal to), or **< Or Equal** (Less than or equal to).

### RESET

Recipe Number	Recipe Step	N/A
---------------	-------------	-----

This opcode is used to clear all stacks and timers and start a program. The RESET is useful in a weekend shut down program to restart the normal operating program.

The Recipe Number is the program number to start once everything has been reset. The range is 1 – 300.

The Recipe Step is the step number in the program to start at. The range is 1 – 24.

## RUN\_SLAVE

Recipe Number	Recipe Step	Slave Instrument
---------------	-------------	------------------

This opcode will start a recipe on the specified slave SSI recipe programmer instrument.

The Recipe Number is the program number to start on the slave instrument. The range is **1 – 300**.

The Recipe Step is the program step to start on in the slave instrument. The range is **1 – 24**.

The Slave Instrument is the slave instrument to select to start the recipe on (SSI recipe programmers only).

The options are: **1 – 25**.

## SET\_AUX

Setpoint Value	N/A	Slave Instrument
----------------	-----	------------------

This opcode sends a setpoint down to an auxiliary instrument.

The Setpoint Value is the setpoint to send down. The range is **-301 (disable) – 30000**.

The Slave Instrument is the slave instrument to send the setpoint down to (SSI recipe programmers only).

The options are: **1 – 25**.

## SET\_FACT

N/A	CO/H Factor	N/A
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This opcode is used to set the CO factor or the H<sub>2</sub> factor of the atmosphere controller. If the atmosphere type for the loop is set to dew point then the H<sub>2</sub> factor is set; otherwise the CO factor is set. The temperature data is not used. The atmosphere data is used as the factor with decimal places ignored.

The range for the CO/H factor is **-1 to 9999**.

## SET\_FCM

N/A	N/A	Mode
-----	-----	------

This opcode sets the gas flow control mode. There are four options: Individual trim, Flow control adjusts two valves, Ratio control – Maintains constant ratio between NH<sub>3</sub> +, Auto switch – Switches between Options 1 & 2 based on the DA switch point.

- **Individual Trim will adjust the Gas flow of a valve if Trim is enabled.**
- **Flow Control adjusts the flows of all enabled valves by the same percentage.**
- **Ratio Control maintains a constant total flow of gas into the furnace by adjusting only the Ammonia and Dissociated Ammonia flows. This does not apply to the Nitrogen or Aux Valves.**

## SET\_GEN\_FLOW

Multiplier (optional)	Air/Gas Ratio (optional)	Total Endo Flow
-----------------------	--------------------------	-----------------

This opcode will set the flow rate.

The Multiplier is the multiplier for the flow. The range is **-3.01 (disable) – 3.20**.

The Air/Gas Ratio is the ratio for the air and gas. The range is **-0.01 (disable) – 0.10**.

The Total Endo Flow is the total flow rate. The range is **0 – 32000**.

## SET\_LP3

Setpoint	N/A	N/A
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This opcode will set the Loop 3 setpoint, if applicable. The temperature data is the setpoint. Set Loop 3 functionality is similar to the SET\_BP opcode, except that there is no decimal place applied on Set Loop 3.

## SET\_SL\_VAL

Value	Register	Instrument
-------	----------	------------

This option will send a value from a register to a specific instrument.

The Value is the value to send. The range is **-32768 – 32767**.

The Register is the register to send to. The range is **0 – 32767**.

The Instrument is the slave instrument to send the value to. The options are: **1 – 25**.

## SET\_VALVE

### Setpoint

### Trim Range

### Valve

This opcode will set one of four valves. The temperature data is the setpoint. The atmosphere data is the trim range. Setting the trim range to any positive number will enable the trim for the selected valve.

Setting the trim range to a **0** will disable the trim for the selected valve. *Note: leaving the trim disabled will make no changes to the current trim configuration.* The option data is the valve section. The valve can be:

**Nitrogen, Ammonia, Disassociated Ammonia, or Endo.**

## SET\_WAIT

### Temperature Setpoint

### Atmosphere Setpoint

### Speed

This opcode sets the temperature and/or atmosphere band limits for the wait option or inquiry opcodes.

The Temperature Setpoint specifies the temperature band (i.e. +/- the value). The range is **-301** (disable) to **30000**.

The Atmosphere setpoint specifies the atmosphere band (i.e. +/- the value). The range is **-0.01** to **99.99**.

The Speed is the speed to use: **Ctrl + Load (T/C), Control (T/C), or Load (T/C)**.

## SETOUTPT

### Output Level

### N/A

### Output

This opcode is used to set an analog output to the specified value. The output must be assigned as a Programmer DAC when SETDAC is called in a recipe. The Programmer DAC assignment is done in the Analog Output Setup menu on the NitroMeth Plus Controller touch screen or in Configurator. The Analog Output Setup menu contains Offset and Range settings, which will be proportionally applied to the 4-20mA output range.

The range for output level is **-301 (disable) to 32767**.

The range for output is **1 to 6**.

## SETPT

### Temperature Setpoint

### Atmosphere Setpoint

### Option

This opcode is used to set the temperature and/or atmosphere setpoints. Either or both of the setpoints can be specified.

The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is **-301** (disable) to **30000**.

The Option will wait for the setpoints to be reached: **Blank** (Don't Wait), **Wait**, **Wait Up**, or **Wait Down**. *Note – The Blank option is an actual blank line, not the word "Blank".*

## SL\_PV\_INQ

### Process Variable

### Slave

### Option

This opcode will check a slave instrument for a specific process variable value, and wait until the PV from the slave instrument matches.

The Process Variable is the PV to check. The range is **-301** (disable) – **32000**.

The Slave is the slave instrument to check. The range is **1 – 12**.

The Option is the wait options for the opcode. The options are: **Wait**, **Wait Up**, or **Wait Down**.

## SOAK

### N/A

### N/A

### Soak Time

This opcode is an unconditional soak for the time (in hours and minutes) specified. The programmer will hold for the time specified, and nothing except the operator pausing the recipe will put the program in a hold state.

The Soak time is the total time, in Hours:Minutes format, for the soak to run. The Hours range from **0 – 166**, and the Minutes range from **0 – 59**.

## TC\_CHK

### Source 1

### Source 2

### Source 3

This opcode will check a TC

Source 1 will determine the first source to check. The options are: **Not Used, Instrument 1 – Instrument 25, and Input 1 – Input 3.**

Source 2 will determine the second source to check. The options are: **Not Used, Instrument 1 – Instrument 25, and Input 1 – Input 3.**

Source 3 will determine the third source to check. The options are: **Not Used, Instrument 1 – Instrument 25, and Input 1 – Input 3.**

#### TC\_INQ

<b>Temperature Level</b>	<b>N/A</b>	<b>Option</b>
--------------------------	------------	---------------

The temperature inquiry is used to wait for the actual control temperature to reach the value specified.

The Temperature Level is the specified level to wait for. The range is **-301 (disable) to 30000.**

The Option is the wait options: **Wait, Wait Up, or Wait Down.**

The default band can be set under the Configuration Menu and is typically 15 degrees. The band limit can be changed by the *SET\_WAIT* opcode.

The *LIMIT* opcode immediately following this opcode sets a time limit on the wait.

A *BRANCH* opcode immediately following this opcode can be used to change the program flow based on the inquiry results.

#### timeEVT

<b>N/A</b>	<b>Delay Time</b>	<b>Option</b>
------------	-------------------	---------------

This opcode will turn ON or OFF a specified event for the specified amount of time.

The Delay Time is the time in seconds. The range is: **0 – 500.**

The Option is the event to turn ON or OFF. The options are: **Event 0 ON or OFF – Event 31 ON or OFF.**

#### TOD\_INQ

<b>N/A</b>	<b>N/A</b>	<b>Time</b>
------------	------------	-------------

This opcode is a time of day inquiry that would be used to start a process or subroutine at a specific hour and minute.

The Time is the time to check, in Hours:Minutes format. The Hours range from **0 – 23**, and the Minutes range from **0 – 59.**

#### TZ\_INQ

<b>Temperature Level</b>	<b>N/A</b>	<b>Option</b>
--------------------------	------------	---------------

The zone temperature inquiry is used to wait for the actual control zone temperature to reach the value specified.

The Temperature Level is the specified level to wait for. The range is **-301 (disable) – 30000.**

The Option is the wait options: **Wait, Wait Up, or Wait Down.**

The default band can be set under the Configuration Menu and is typically 15 degrees. The band limit can be changed by the *SET\_WAIT* opcode.

The *LIMIT* opcode immediately following this opcode sets a time limit on the wait. A *BRANCH* opcode immediately following this opcode can be used to change the program flow based on the inquiry results.

This opcode is identical to the *TC\_INQ* opcode, except that it will deal with zones.

#### Valve Something or another.

#### Z\_SETPT

<b>Temperature Setpoint</b>	<b>Atmosphere Setpoint</b>	<b>Option</b>
-----------------------------	----------------------------	---------------

This opcode is used to set the temperature or atmosphere set point for a zone.

The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is **-301 (disable) to 30000.**

The atmosphere Setpoint is the setpoint to send for the atmosphere process variable. The range is **-0.01 to 99.99.**

The Option will wait for the setpoints to be reached: **Blank** (Don't Wait), **Wait**, **Wait Up**, or **Wait Down**. *Note – The Blank option is an actual blank line, not the word "Blank".*

## **ZONE\_OFF**

**Temperature Value                      Atmosphere Value                      Zone**

The Zone Offset opcode is used to set a temperature or atmosphere offset to be added to the set point sent to a specific zone. The same loop (furnace) can have different offsets for each zone. The zones must be defined in the zone configuration.

For example, a pit furnace has three zones: top, middle, and bottom.

The zones could be defined as:

- top = zone 1
- middle = zone 2
- bottom = zone 3

If the *ZONE\_OFF* opcode is used in a program with Temperature Value = 50 and Zone = 1 and a setpoint of 1700, then:

- A set point of 1750 would be sent to the top zone (Zone 1)
- A set point of 1700 would be sent to the middle zone (Zone 2)
- A set point of 1700 would be sent to the bottom zone (Zone 3)

The Temperature value is the offset value to send to the specified zone. The range is **-301** (disable) – **30000**.

The Atmosphere value is the offset value to send to the specified zone. The range is **-0.01** to **99.99**.

The Zone is the specific zone to send the offsets to. The options are: **Zone 1 – Zone 5**.

## 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.

## Appendix A – Guide to Building a Recipe

The SSi NitroMeth Plus Controller is a multi-loop programmable recipe controller. The NitroMeth Plus Controller can control multiple loops (temperature, carbon, flows) and has several assignable relay outputs (Events, End Of Cycle, Alarms, etc...) that can be setup in a recipe to process work.

Things to understand before creating recipes:

- 1) Know how the furnace works. Have an understanding of not only what is happening to the work but also how the furnace operates.
- 2) Know the limitations of the furnace.
- 3) Know what should be accomplished with the recipe.

Sample Recipe Structure for a NitroMeth Plus Controller

	Opcode	Description			Option	Comment
1	SET_AUX	set aux instrument setpoint	1725		3	
2	SETPT	set point	1700 °F	0.65 %C		
3	TC_INQ	temperature inquiry	1700 °F		wait	
4	SOAK	soak			2:30	
5	SETPT	set point	1550 °F	0.65 %C		
6	TC_INQ	temperature inquiry	1550 °F		wait	
7	SOAK	soak			0:30	
8	EVT_OUT	event output			6-ON	
9	ALARM	user alarm			user alarm 1	
10	NO-OP	no opcode				

The Recipes in the NitroMeth Plus Controller's operate from the top to the bottom. This means that if something happens in Step 4, but the recipe is in Step 2, the operation for Step 4 will not turn on until that point is reached. This also means that if the recipe is in Step 4, anything from Step 1 through to Step 4 is currently active, on, or present, unless it has been turned off in the recipe, or manually.

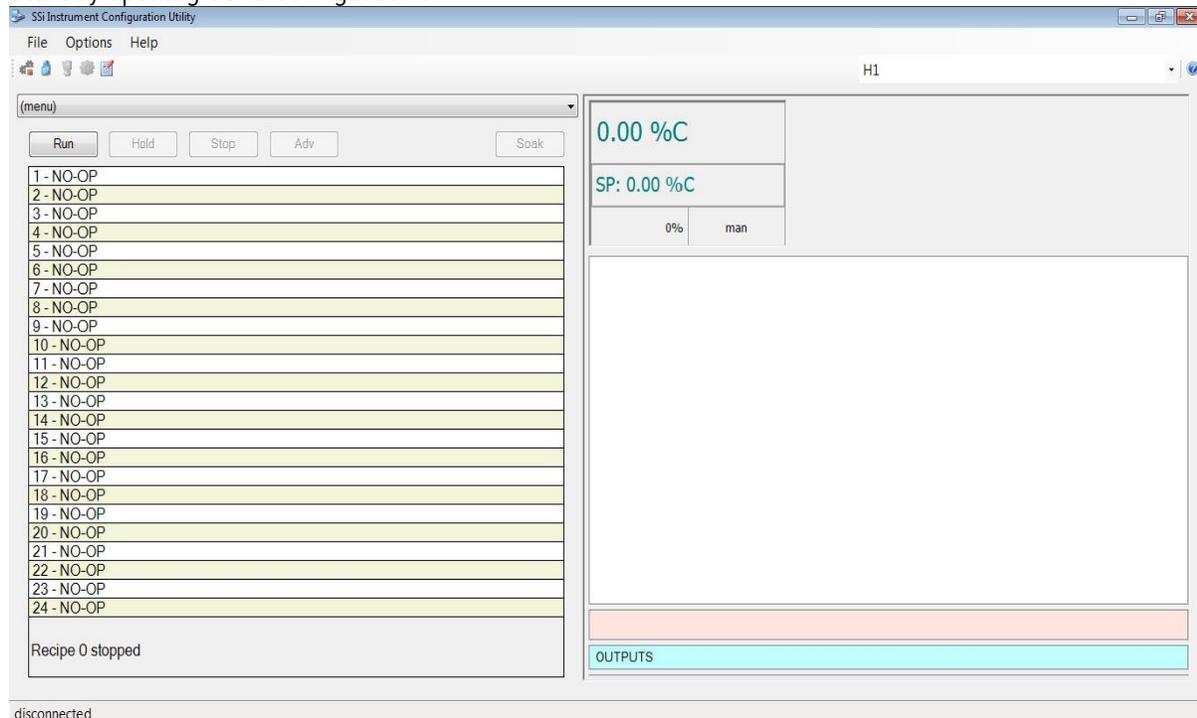
What is going on in this recipe?

- 1) Most likely, the furnace is already soaking at a temperature and perhaps a certain atmosphere level as well. This particular unit has a process alarming setpoint that will be set in every recipe. In Step 1, the process alarm is set so that the furnace temperature does not go higher than 25°F above the highest setpoint. The recipe continues to Step 2.
- 2) In Step 2, the recipe is setting the Temperature and Atmosphere level. The recipe continues to Step 3.
- 3) In Step 3, the recipe is doing a TC\_INQ (Thermocouple Inquiry). The recipe is checking to make sure that the actual furnace temperature is at Setpoint or within a certain band (Set in the Default Wait Limits in Configurator). Since it is best to drive the temperature down when loading a cold load into a furnace, the recipe should not advance to the soak timer until the actual furnace temperature is back to setpoint. The recipe will hold in this step until the furnace has reached this temperature band. Once the furnace's actual temperature has reached the temperature band, the recipe will progress to Step 4.
- 4) The controller is now starting its Soak Timer in Step 4. The work will soak for 2 hours and 30 minutes. Once the Soak Timer has completed, the recipe will continue to Step 5.

- 5) At Step 5 in the recipe, the recipe is setting new Temperature and Atmosphere setpoints. The recipe will continue to Step 6.
- 6) In Step 6, the recipe is doing a TC\_INQ (Thermocouple Inquiry). The recipe is waiting for the furnace's actual temperature to come down to the 1550°F setpoint that was set in Step 5. The recipe will hold in this step until the actual furnace temperature is within its band around setpoint.
- 7) The controller is now starting its Soak Timer in Step 7. The work will soak for 30 minutes. Once the Soak Timer has completed, the recipe will continue to Step 8.
- 8) The Controller has one of its outputs assigned as an Event Output 6. This output most likely annunciates a Work Bell, starts an automatic transfer to quench, or any other option that this particular unit might do. The recipe advances to Step 9.
- 9) In Step 9, the recipe has a Programmer/User Alarm. This could also be annunciating a work bell, starting an automatic cycle, or simply holding the recipe until the operator comes over to Acknowledge where the recipe is. In this particular case, the work will not transfer until the operator presses a button on the electrical panel. So, the User Alarm is holding the Event Output 6 on (from Step 8) to allow the transfer to happen. Once the operator has pressed the transfer button on the electrical panel, they can then press the Acknowledge button on the operator interface screen to allow the recipe to end.

## Building a Recipe

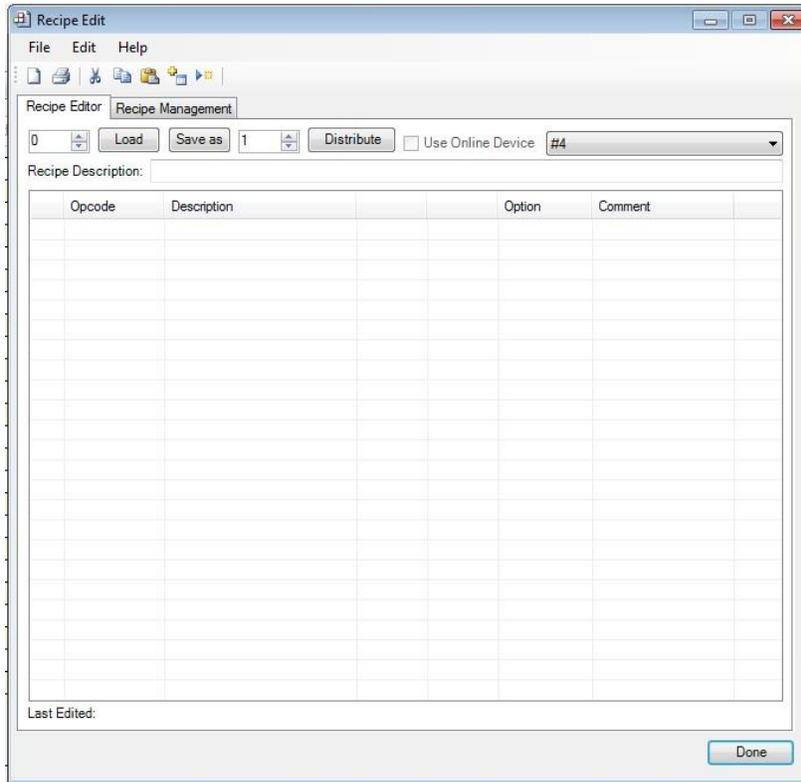
Start by opening SSI's Configurator.



From there, Log in with the appropriate username and password, by clicking the padlock icon  in the upper left hand corner of the screen. After logging in, the padlock icon will change color, signifying a successful login.

To start to build or modify recipes, click the Recipe Editor icon  in the upper left hand corner of the screen.

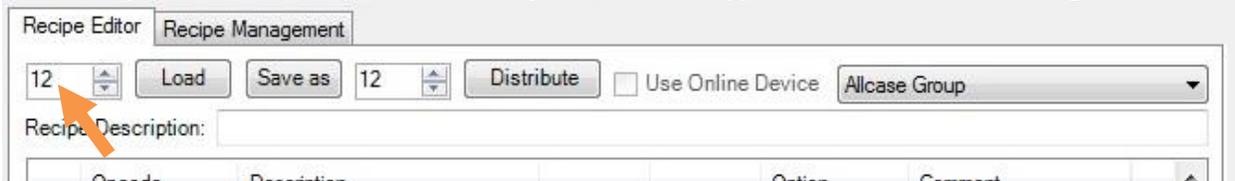
The Recipe Editor will open.



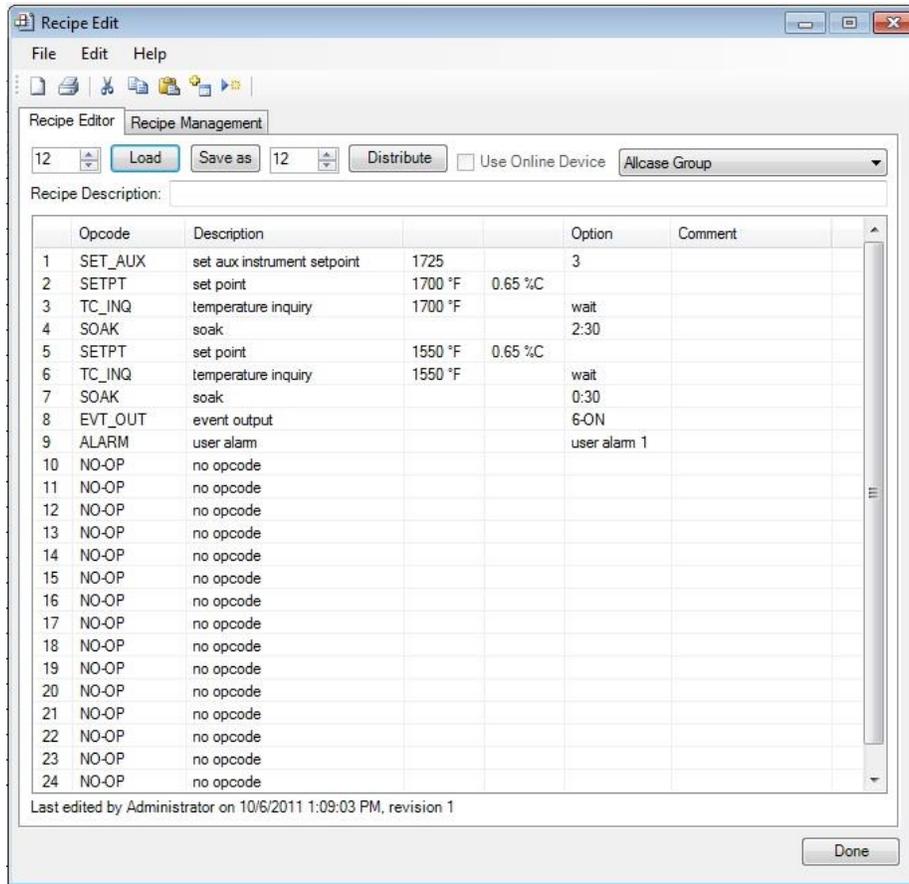
First, start by choosing the correct Recipe Group. To do this, click the drop down box near the upper right hand corner of the screen.



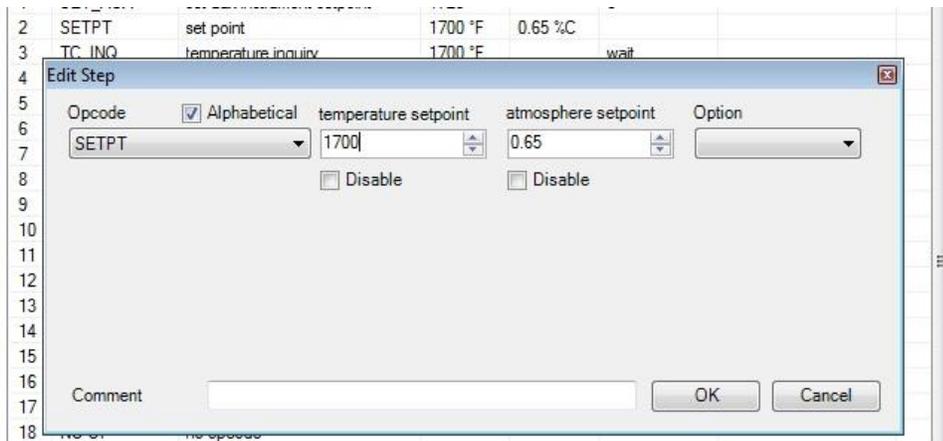
Once the correct recipe group has been selected, type or click the Up or Down arrows in the Load Entry Box, near the upper left hand corner to change the number.



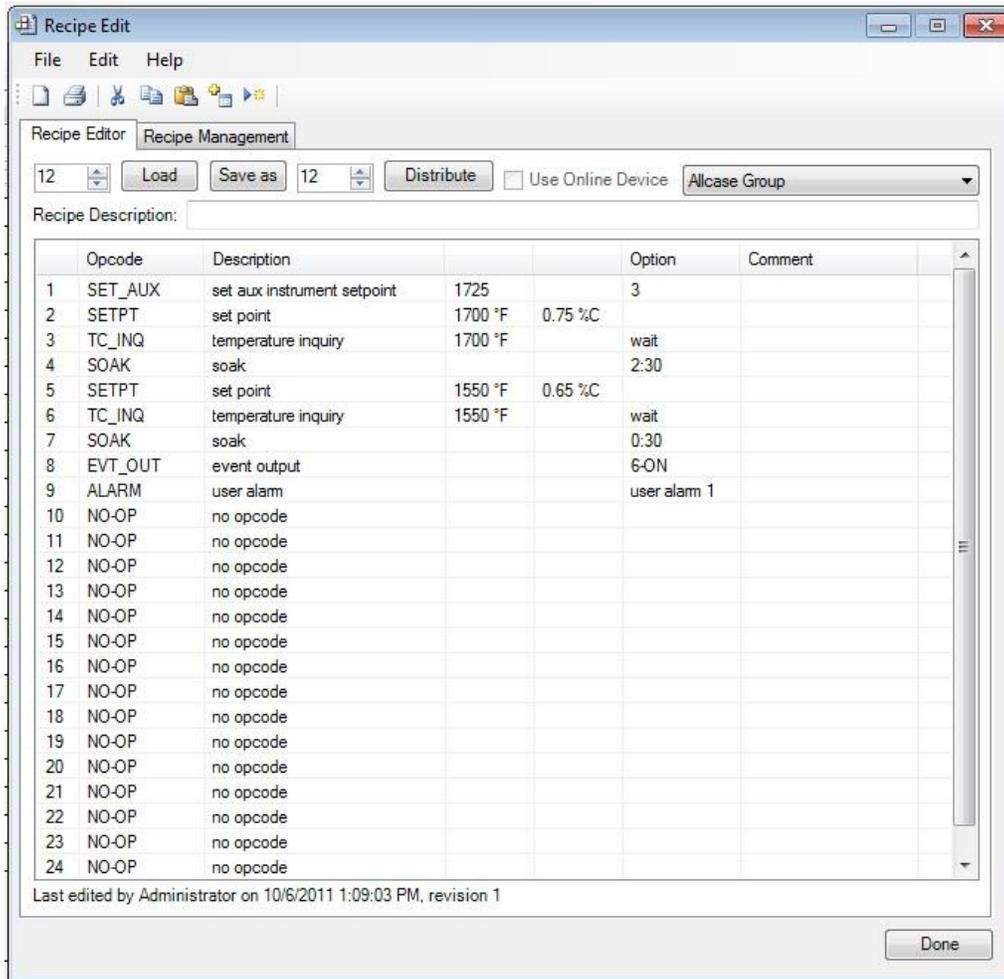
Once the correct recipe number is selected, click the Load button. If a recipe has already been created under that recipe number, it will appear in the Recipe Box. If a recipe has not yet been created, the Recipe Box will remain empty. In the example seen below, a recipe has already been created for Recipe #12.



Before adjusting the recipe, the operator must first understand what needs to be modified. For example, if the atmosphere level needs to be adjusted at the beginning of the recipe, double click on the line for SETPT. The SETPT Edit Step box will appear.



Under the Atmosphere Setpoint text in the upper middle portion of the Edit Step box, there is a numeric entry box. To modify this setpoint, either the Up or Down arrows can be pressed, or the desired atmosphere level can be entered into the box from a keyboard. Once the correct setpoint has been entered, press the OK button in the bottom right corner of the Edit Step box.

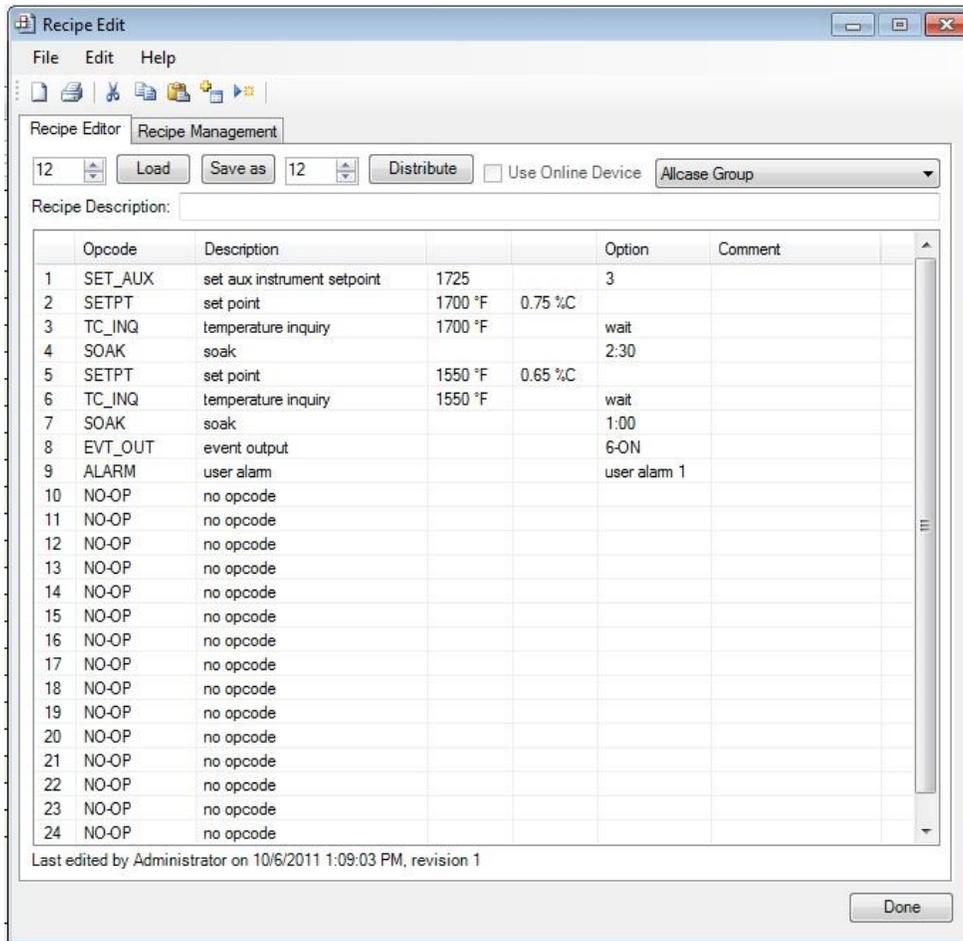


Here, the Atmosphere setpoint has been modified.

If the SOAK time is not long enough, this time can be increased. To do this, double click on the line with the SOAK Op\_Code. The Edit Step box will appear.



Under the Soak Time in the upper left hand corner, there are two numeric entry boxes. The left most numeric entry box is for time in hours. The right most numeric entry box is for time in minutes. To modify these times, either the Up or Down arrows can be pressed, or the desired time can be entered into the boxes from the keyboard. Once the correct time has been entered, press the OK button in the bottom right corner of the Edit Step box.



Here, SOAK time has been modified.

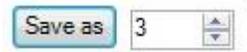
If this Recipe is now correct, it is time to save this recipe. There are two options on doing this.

- 1) To permanently save Recipe #12 with the modifications, click the Save As button. A pop up box will appear.



To permanently modify Recipe #12, click the Yes button.

2) To save the modified recipe as a new recipe number, in the Save As numeric entry box,



press the Up or Down arrows, or enter in the desired recipe number. Once the appropriate recipe number has been selected, click the Save As button. The mouse pointer on the screen will change to a Busy pointer  as the recipe is saving.

Once the mouse pointer returns to normal, click the Done button at the bottom right hand corner of the



Recipe Editor box.

Now that the recipe has been modified completely, or a new recipe has been built, the operator can Log Out by again clicking the padlock icon. After successfully logging out, the padlock icon will change back to a blue color. Exit Configurator by clicking the Red EXIT button at the top right corner of the screen, or by clicking File → Exit at the top left corner of the screen.

## Revision History

Rev.	Description	Date	MCO #
-	Initial Release	4/20/2020	2285