SuperSystems incorporated

Matrix Controller 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.

We are constantly improving and updating this product. Certain features may be added or removed as a part of these updates. In addition, the user interface may change slightly from what is displayed in this manual. If you have questions about a feature or functionality not covered here, or inconsistent with what you see on your device, please contact SSi at 513-772-0060 for technical support.

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Table of Contents

Installation Safety Requirements

Safety Symbols

Various symbols are displayed 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

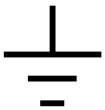
Installation must only be carried out by technically qualified personnel.

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 damaging 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 Matrix 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”.

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.

Environmental Specifications

- Storage Temperature ⟶ -4° F to 158° F (-20° C to 70° C)
- Ambient operating temperature ⟶ 32° F to 131° F (0° C to 55° C)
- Ambient humidity ⟶ 5% to 95% relative humidity (non-condensing)

	Degrees F.	
TC Type	Min	Max
B	32	3308
C	32	4208
E	-328	1832
J	-346	2192
K	-328	2502
N	-328	2372
NNM	0	1409
R	-58	3214
S	-58	3214
T	-328	752

Thermocouple range listed by thermocouple

NOTE: SSi's Matrix is designed to be flexible and adaptable for a variety of situations, uses, and processes. This manual contains information on the entire Matrix product line. Therefore, your system may not include all the features, functionalities, and menu options documented herein.

NOTE: SSi's Matrix comes configured to display and program recipes either in Step form or Segment form. Both interfaces are explained in this manual. However, some screenshots intended to highlight other processes may display a different interface than that found on your system. In these cases, the difference in appearance does not affect the function being addressed.

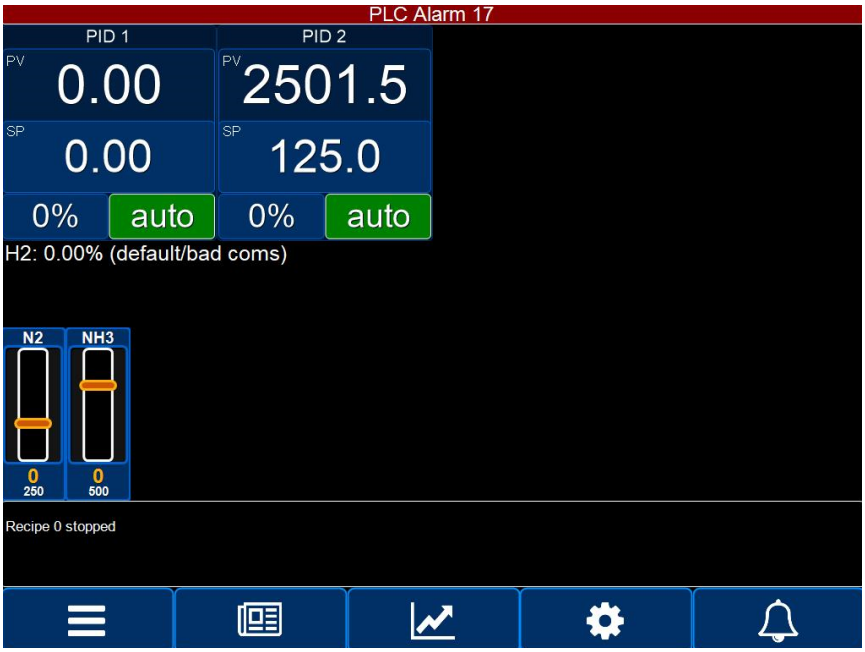
Matrix Operation

16215 (Nitriding) Control Screen

Note: Layout of the Control Screen will vary slightly depending on the details of your Matrix Unit. Basic functionality is the same across models.

The Control Display shows an overview of the current status information: set points and process variables; control modes; communication status; current recipe step/segment and status; current alarms.

In addition, there are five active buttons along the bottom of the Status Display:



Menu,

Recipe,

Chart,

Programmer Events

and **Alarms**

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

The **Recipe** button will switch to the Recipe Display.

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

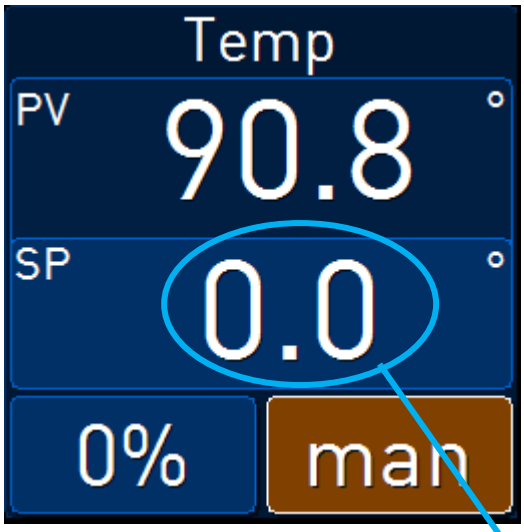
The **Programmer Events** button will bring up the Programmer Events screen.

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

Additional functionality includes:

Tap to switch between auto and manual modes.

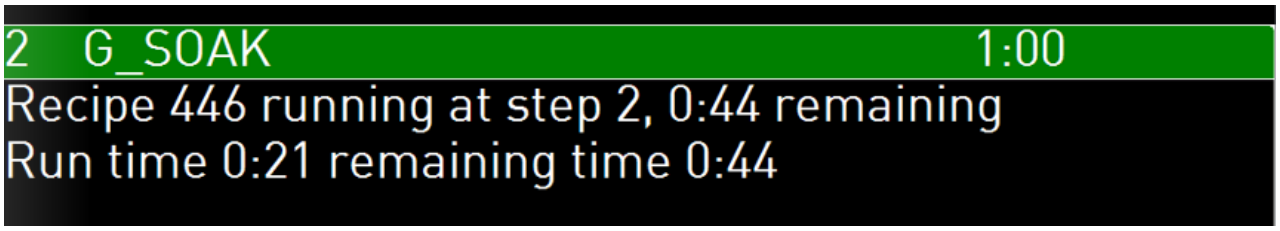
Tap to set %Output (in manual mode only)

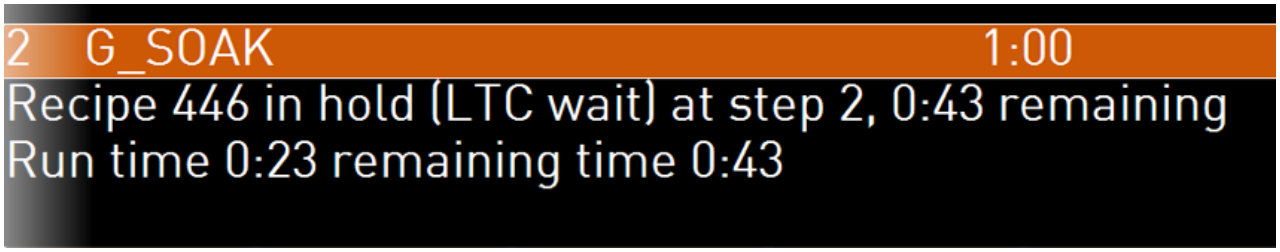


Tap to set Setpoint (in manual mode only)

The Control screen will also display the current step/segment of a running recipe along with timing information for that step/segment.

In Step mode, Green will indicate a step in process, Orange will indicate a Hold.





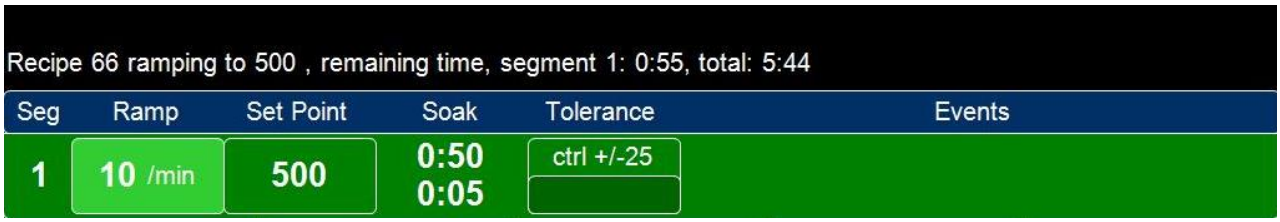
In Segment mode, Green indicates a segment in process, with lighter green indicating the current action. In the example below, light green indicates that the controller is performing a ramp at a rate of 10°/min. This is also explained in the text description above the segment.

The Soak column indicates that there are 50 minutes remaining in the ramp time before the 5 minute soak begins.

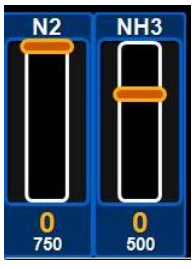
The Tolerance column shows a Band of +/- 25° for the Control TC.

There are no output events associated with this segment.

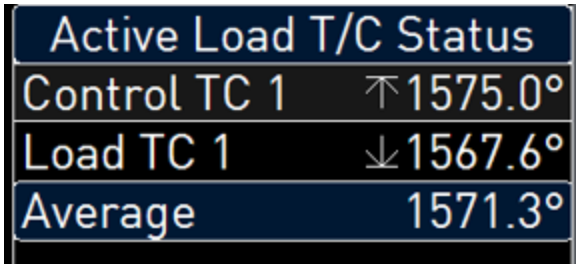
If the segment is displayed in Yellow, the recipe is in a hold.



The slider bar visualizer displays set points and is adjustable. Tap the number below the slider to change the set point.



Finally, the Control screen will display information about any active Load T/Cs:



Matrix Menu

There are three levels of Matrix Menus in the Matrix 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.*

Chart

The Chart Display shows between 15 minutes 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. Process trends can be selected and deselected using checkboxes under the menu bar.

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 **X** 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 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 include: **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.

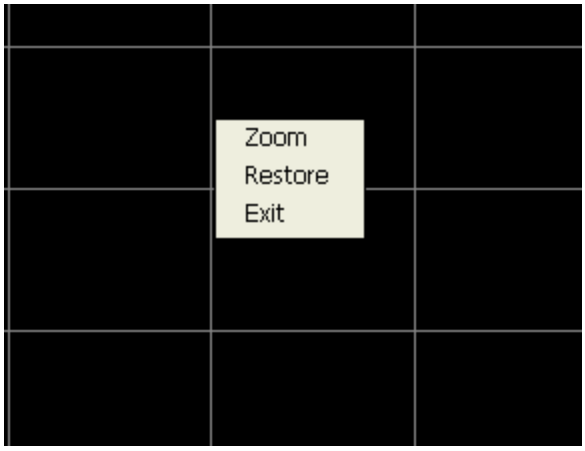


Chart Sub Menu

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**.

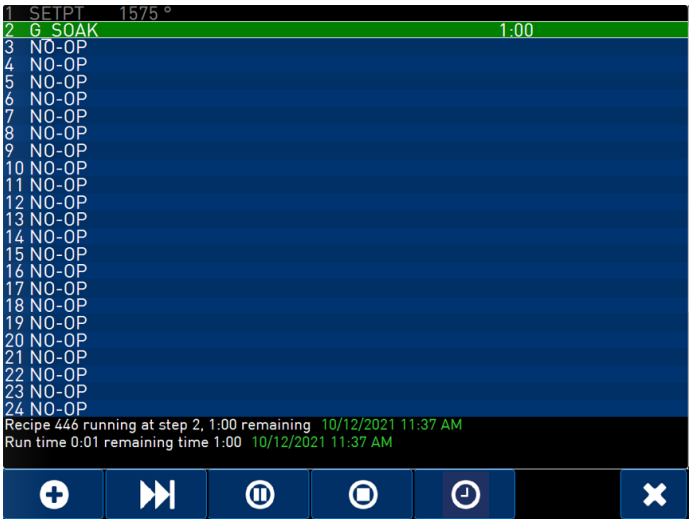
The **Zoom** option will allow the user to zoom in on a particular part of the screen. Once this has been selected, the user can take a stylus or a finger and create a box around the desired data. Once the user releases the stylus or finger, a zoom is no longer possible, and the user will need to re-select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

Tapping the recipe button will display the currently loaded recipe. To load a different recipe or make adjustments to the current recipe, tap the  button.



At this point, the current recipe is still displayed.

Tap "Select" to load a different recipe. Depending on settings elsewhere in the controller, this could be by number, name, or from a database.

Tap  to move to the next step.

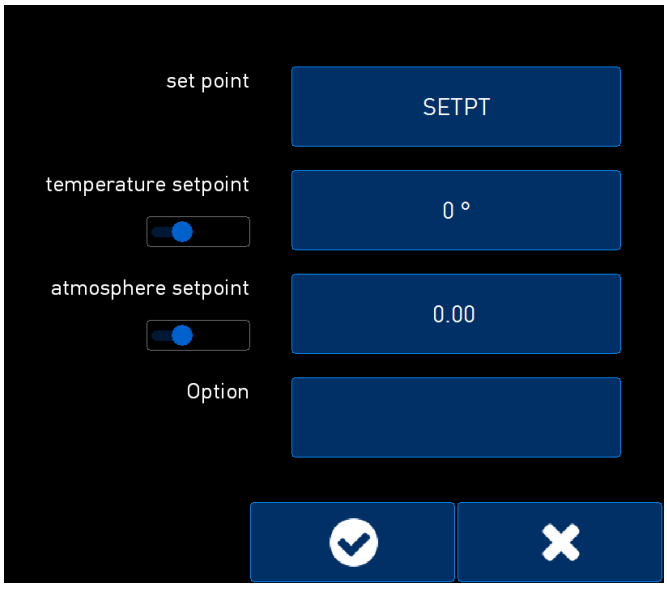
If the recipe is running, tapping  will pause the recipe. If the recipe is paused, this button will become a "Play" button. Tap to restart the recipe.

Tap  to stop the recipe completely. If you do this, you will need to reload the recipe in order to start it again.

If the step is a soak, the clock button will allow you to adjust the soak.

You cannot change, delete, or add Opcodes to the recipe steps from this screen, but you can adjust timing, settings, and options by double-clicking on a step.

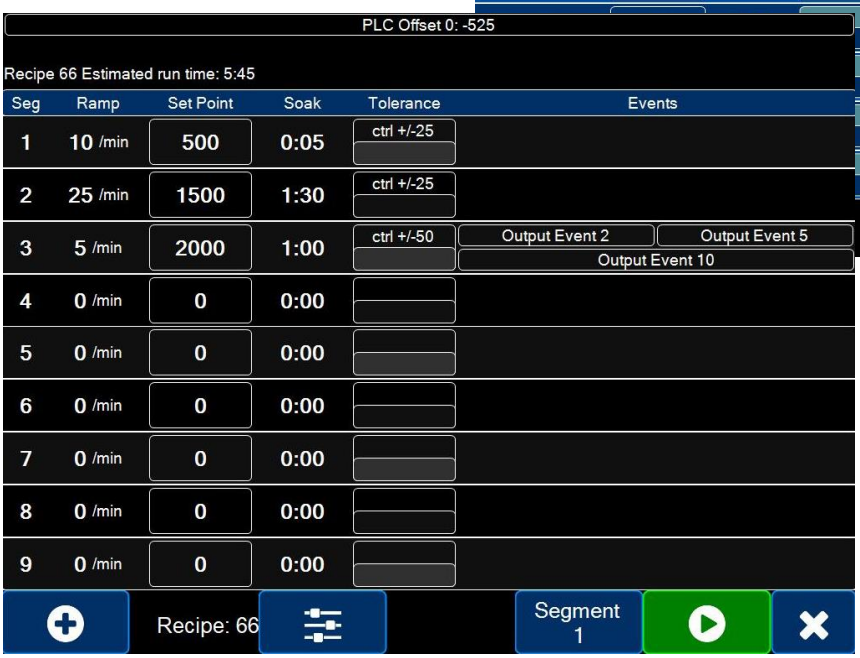
From this screen, tap a button to make changes. If a setting is not editable, the button will have no effect. Tap check to accept changes, and X to exit without saving.



Recipe – Segment Mode

Tapping the recipe button  will bring up the Recipe Screen.

To load a recipe, tap the  button and use the numeric keypad to select a recipe. When loaded, the recipe segments will be displayed as below.



Tap  to select or deselect Load T/Cs for this recipe.

The "Segment #" button displays what the starting Segment of the recipe will be. Tap the button to choose a starting segment using the numeric keypad.

Tap  to run the recipe.

Tap X to return to the Main Control Display.

Recipe - Segment Runtime Display Info

Green indicates a segment in process, with lighter green indicating the current action. In the example above, light green indicates that the controller is performing a ramp at a rate of 10°/min. This is also explained in the text description above the segment.

The Soak column indicates that there are 46 minutes remaining in the ramp time before the 5 minute soak begins.

The Tolerance column shows a Band of +/- 25° for the Control T/C.

There are no output events associated with this segment.

If the segment is displayed in Yellow, the recipe is in a hold.

Tap to load a new recipe (the current recipe will be stopped).

Tap to advance to the next segment.

Tap to put the current recipe into a hold.

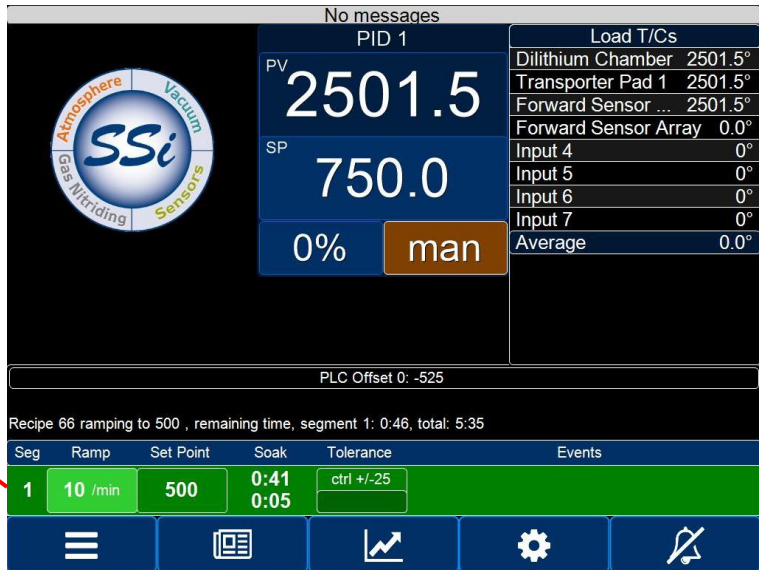
Tap to stop the current recipe.

Tap to see a graphical representation of the current recipe, with the current segment and status displayed.

From the graphical display, tap to return to the segment display.

Tap to silence any active alarms.

Tap X to return to the main Control display – if a recipe is running, it will continue to run. The current segment and status will be displayed as shown:



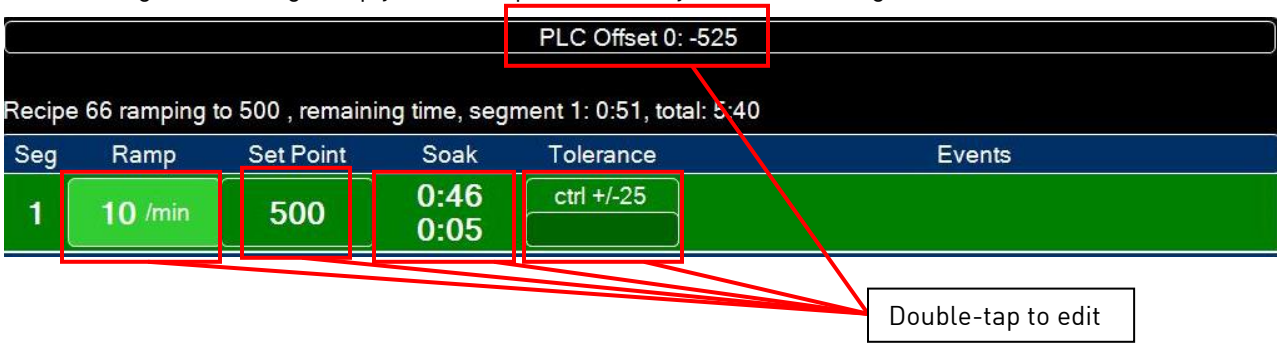
Current segment of running recipe

One-Time Recipe Edits

From the Main Recipe screen, a loaded or running recipe cannot be permanently edited – this must take place in the Recipe Edit menu option (explained earlier). However, it is possible to make *one-time* adjustments to a loaded or running recipe from this screen. These changes will only affect the current run of the recipe, and these changes will not be saved.

In the above example, the settings that can be edited in real-time are PLC Offset, Ramp, Set Point, Soak, and Tolerance. Events settings cannot be edited here.

To edit a segment setting, simply double-tap on the area you wish to change.



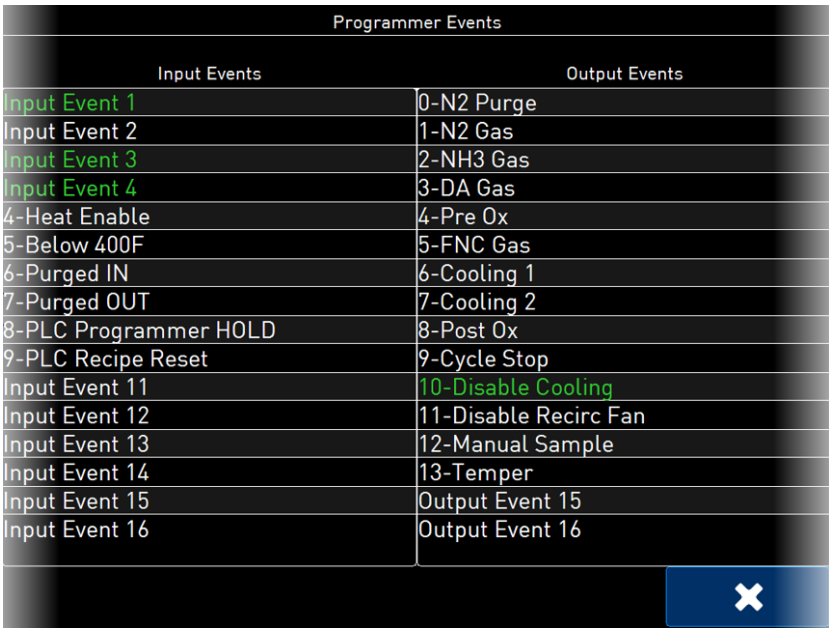
The editing functionality is identical to that found in the Recipe Edit menu option.

NOTE: Any PLC offsets entered here will be sent *immediately* to the PLC.

Tap ✔ to save any changes, or tap X to exit without saving.

Programmer Events

The Programmer Events screen allows you to view the current Input and Output Events. These can be set in the Matrix menus.

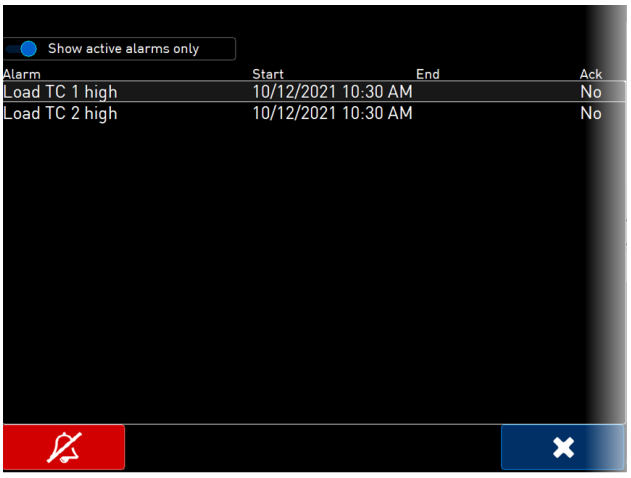


Alarms

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.

Tap X to return to the main display screen.



16220 (Vacuum) Control Screen

Note: Layout of the Control Screen will vary slightly depending on the details of your Matrix Unit. Basic functionality is the same across models.

The Control Display shows an overview of the current status information: set points and process variables; control modes; communication status; current recipe step/segment and status; current alarms.

In addition, there are five active buttons along the bottom of the Status Display:

Menu,

Recipe,

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Programmer Events

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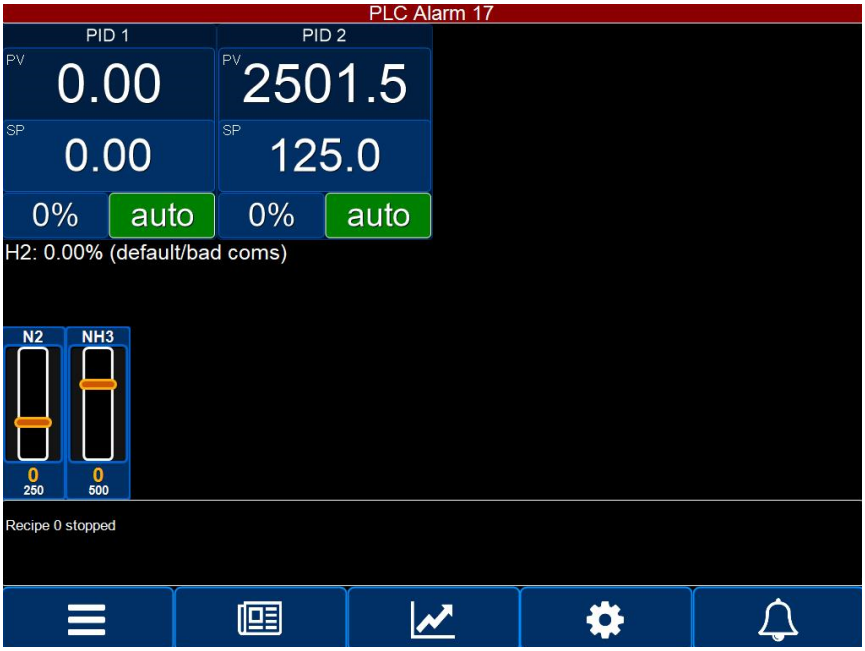


The **Menu** button will display the menu options.

The **Recipe** button will switch to the Recipe Display.

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

The **Programmer Events** button will bring up the Programmer Events screen.

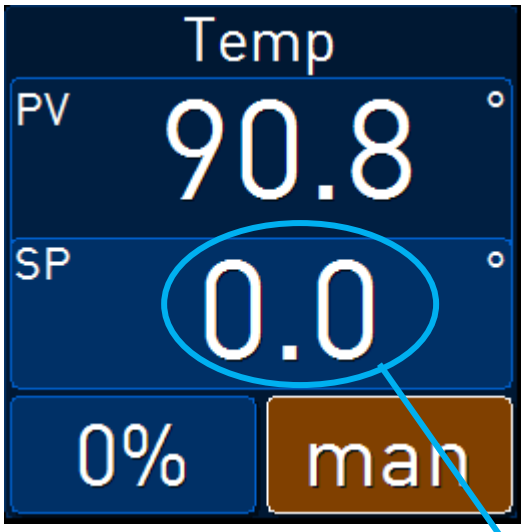
The **Alarm** button will display the Alarm log.

The Gauge name can be customized on the Configuration Screen, and the units can be customized in the Vacuum Gauge Setup Menu.

Additional functionality includes:

Tap to switch between auto and manual modes.

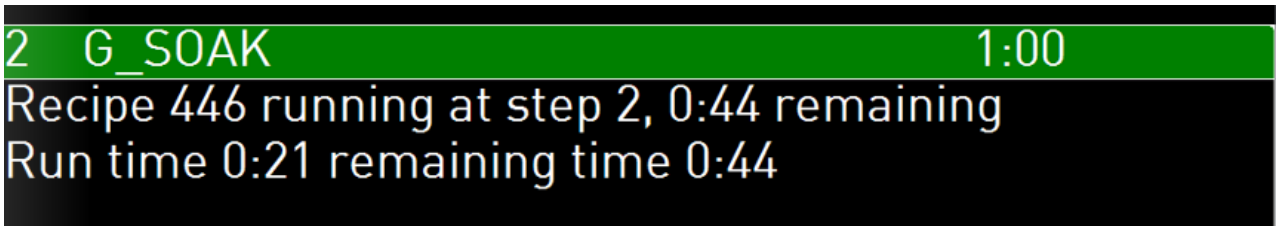
Tap to set %Output (in manual mode only)

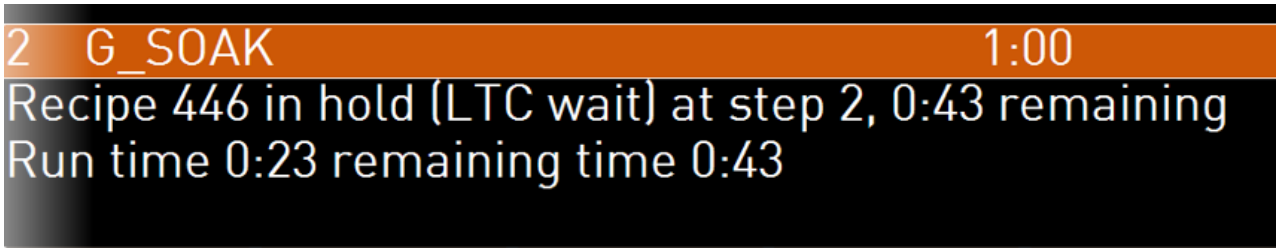


Tap to set Setpoint (in manual mode only)

The Control screen will also display the current step/segment of a running recipe along with timing information for that step/segment.

In Step mode, Green will indicate a step in process, Orange will indicate a Hold.





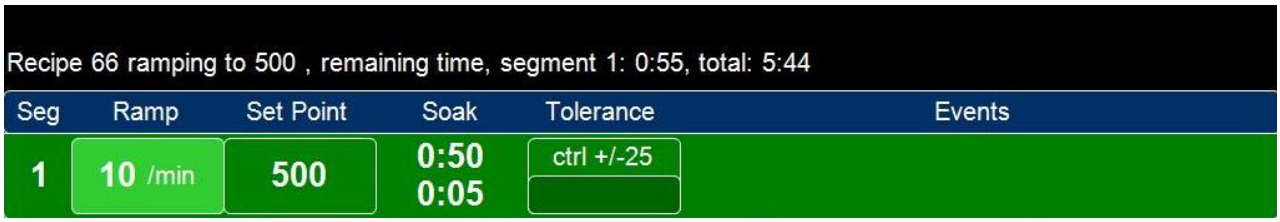
In Segment mode, Green indicates a segment in process, with lighter green indicating the current action. In the example below, light green indicates that the controller is performing a ramp at a rate of 10°/min. This is also explained in the text description above the segment.

The Soak column indicates that there are 50 minutes remaining in the ramp time before the 5 minute soak begins.

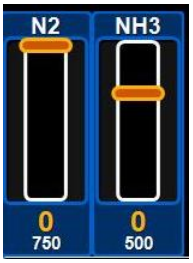
The Tolerance column shows a Band of +/- 25° for the Control TC.

There are no output events associated with this segment.

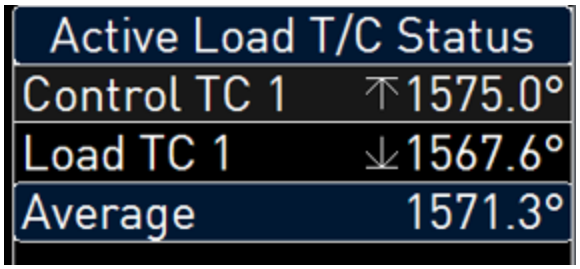
If the segment is displayed in Yellow, the recipe is in a hold.



The slider bar visualizer displays set points and is adjustable. Tap the number below the slider to change the set point.



Finally, the Control screen will display information about any active Load T/Cs:



Matrix Menu

There are three levels of Matrix Menus in the Matrix 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.*

Chart

The Chart Display shows between 15 minutes 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. Process trends can be selected and deselected using checkboxes under the menu bar.

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 **X** 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 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 include: **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

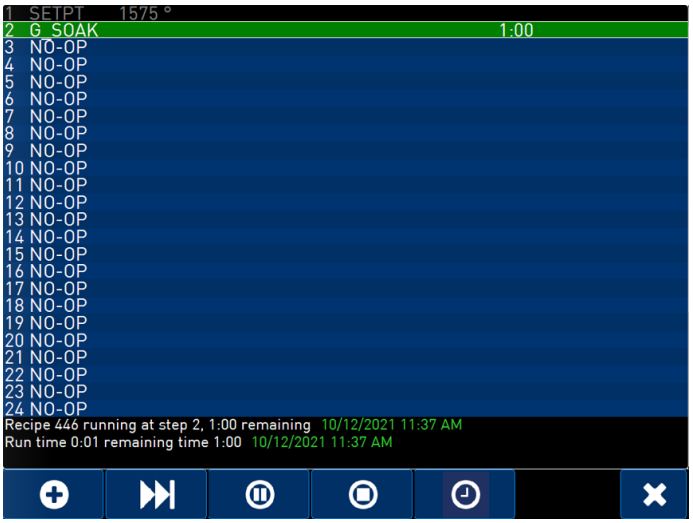
There is a sub-menu available by putting a finger or a stylus anywhere on the chart and holding it there for three seconds. The sub-menu will have the following options available: **Zoom**, **Restore**, and **Exit**.

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 – Step Mode



Tapping the recipe button will display the currently loaded recipe. To load a different recipe or make adjustments to the current recipe, tap the button.

At this point, the current recipe is still displayed.

Tap "Select" to load a different recipe. Depending on settings elsewhere in the controller, this could be by number, name, or from a database.

Tap to move to the next step.

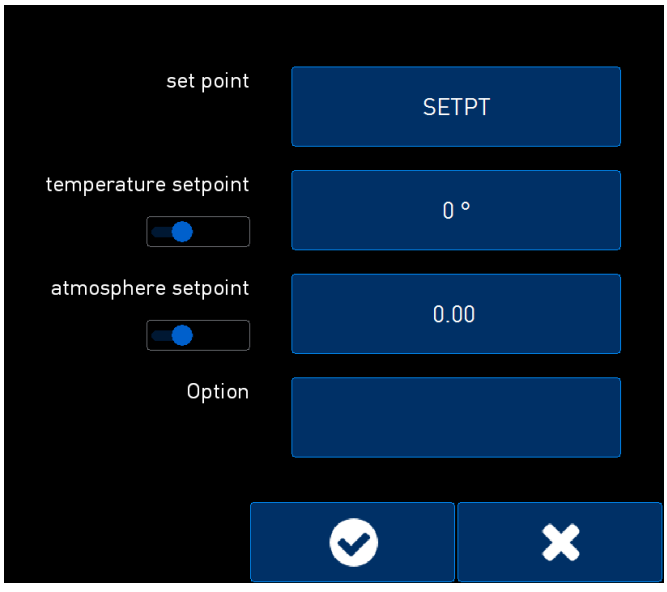
If the recipe is running, tapping will pause the recipe. If the recipe is paused, this button will become a "Play" button. Tap to restart the recipe.

Tap to stop the recipe completely. If you do this, you will need to reload the recipe in order to start it again.

If the step is a soak, the clock button will allow you to adjust the soak.

You cannot change, delete, or add Opcodes to the recipe steps from this screen, but you can adjust timing, settings, and options by double-clicking on a step.

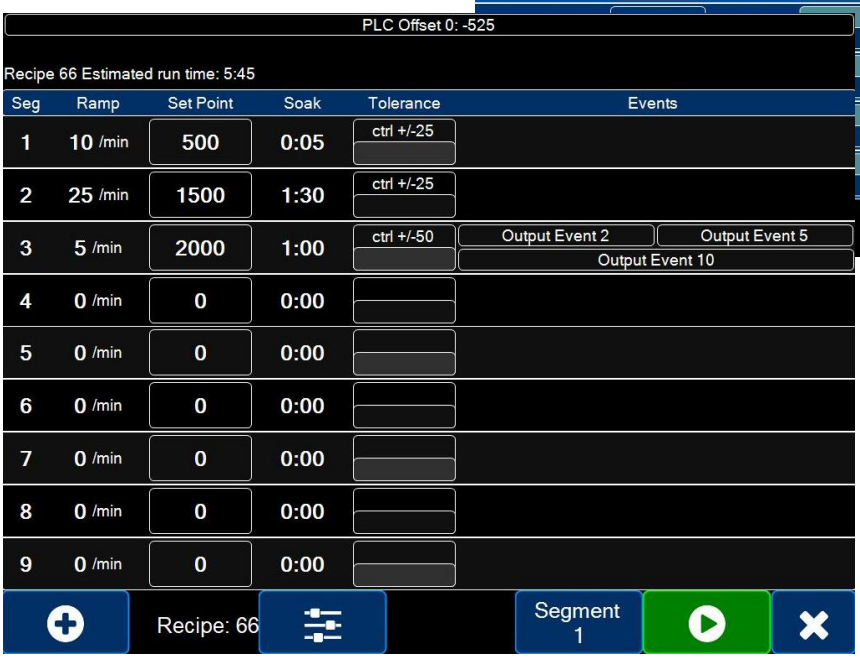
From this screen, tap a button to make changes. If a setting is not editable, the button will have no effect. Tap check to accept changes, and X to exit without saving.



Recipe – Segment Mode

Tapping the recipe button  will bring up the Recipe Screen.

To load a recipe, tap the  button and use the numeric keypad to select a recipe. When loaded, the recipe segments will be displayed as below.



Tap  to select or deselect Load T/Cs for this recipe.

The "Segment #" button displays what the starting Segment of the recipe will be. Tap the button to choose a starting segment using the numeric keypad.

Tap  to run the recipe.

Tap X to return to the Main Control Display.

Recipe - Segment Runtime Display Info

Green indicates a segment in process, with lighter green indicating the current action. In the example above, light green indicates that the controller is performing a ramp at a rate of 10°/min. This is also explained in the text description above the segment.

The Soak column indicates that there are 46 minutes remaining in the ramp time before the 5 minute soak begins.

The Tolerance column shows a Band of +/- 25° for the Control T/C.

There are no output events associated with this segment.

If the segment is displayed in Yellow, the recipe is in a hold.

Tap to load a new recipe (the current recipe will be stopped).

Tap to advance to the next segment.

Tap to put the current recipe into a hold.

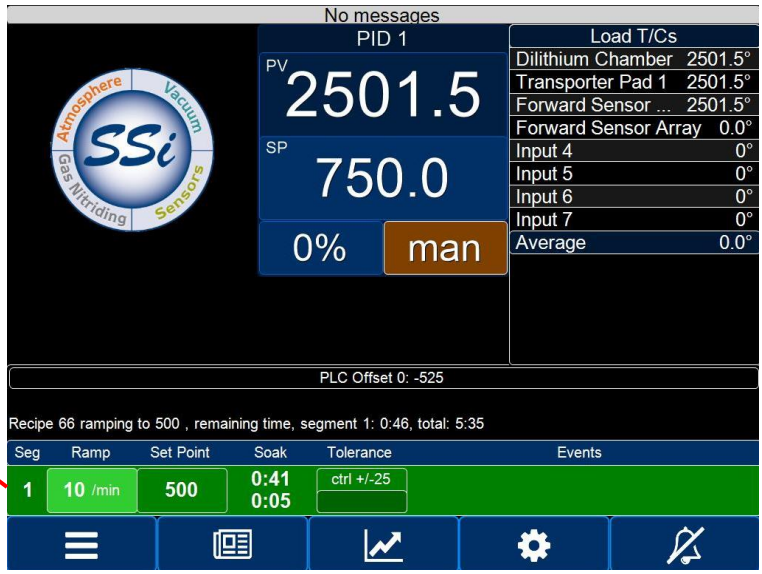
Tap to stop the current recipe.

Tap to see a graphical representation of the current recipe, with the current segment and status displayed.

From the graphical display, tap to return to the segment display.

Tap to silence any active alarms.

Tap X to return to the main Control display – if a recipe is running, it will continue to run. The current segment and status will be displayed as shown:



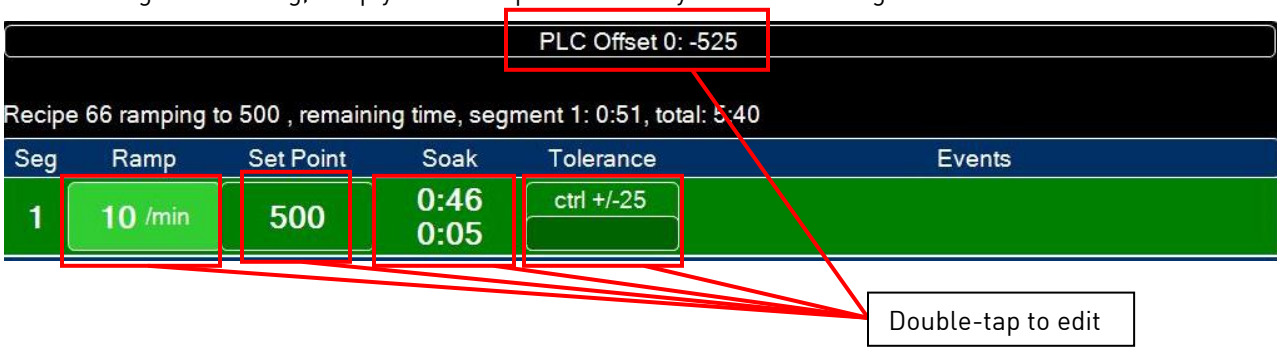
Current segment of running recipe

One-Time Recipe Edits

From the Main Recipe screen, a loaded or running recipe cannot be permanently edited – this must take place in the Recipe Edit menu option (explained earlier). However, it is possible to make *one-time* adjustments to a loaded or running recipe from this screen. These changes will only affect the current run of the recipe, and these changes will not be saved.

In the above example, the settings that can be edited in real-time are PLC Offset, Ramp, Set Point, Soak, and Tolerance. Events settings cannot be edited here.

To edit a segment setting, simply double-tap on the area you wish to change.



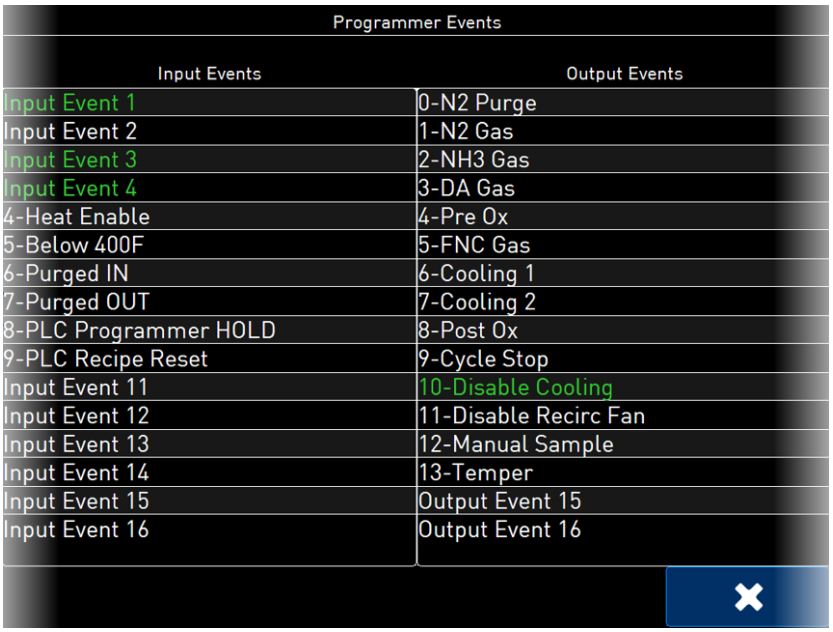
The editing functionality is identical to that found in the Recipe Edit menu option.

NOTE: Any PLC offsets entered here will be sent *immediately* to the PLC.

Tap to save any changes, or tap X to exit without saving.

Programmer Events

The Programmer Events screen allows you to view the current Input and Output Events. These can be set in the Matrix menus.

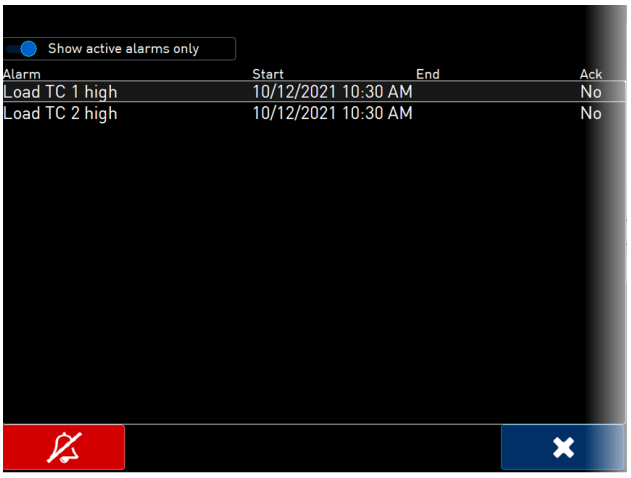


Alarms

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.

Tap X to return to the main display screen.



16130 (Temperature) Control Screen

Control Screen (in Step mode)

Note: Layout of the Control Screen will vary slightly depending on the details of your Matrix Unit. Basic functionality is the same across models.

The Control Display shows an overview of the current status information: set point and process variable; control mode; communication status; current recipe step/segment and status; current alarms.

In addition, there are five active buttons along the bottom of the Status Display:

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

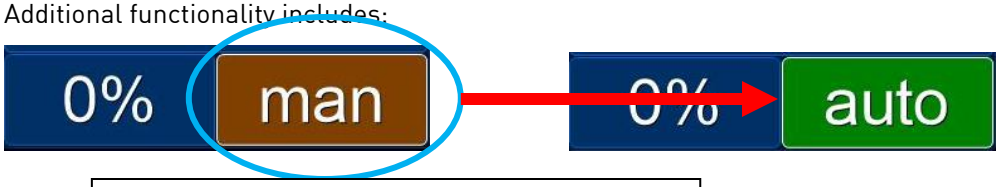
The **Recipe** button will switch to the Recipe Display.

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

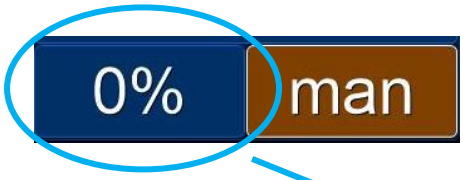
The **Programmer Events** button will bring up the Programmer Events screen.

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

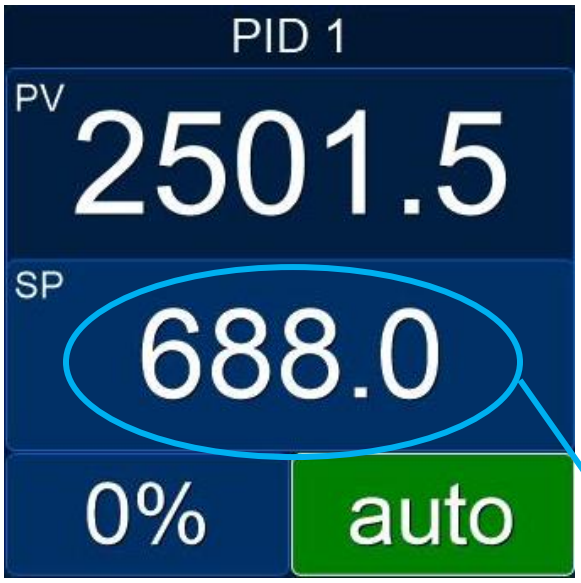
Additional functionality includes:



Tap to switch between auto and manual modes.



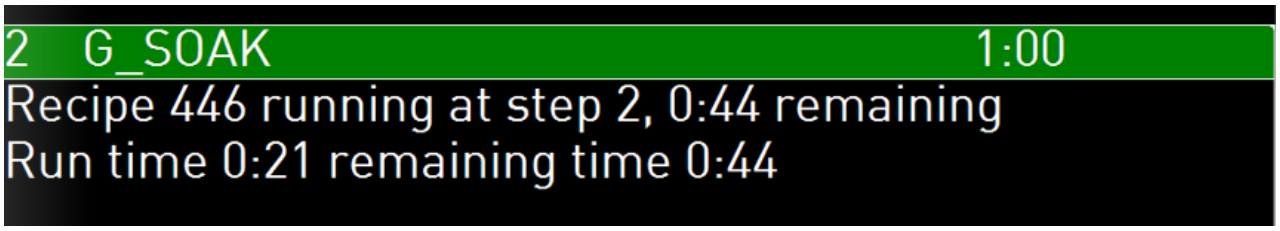
Tap to set %Output (in manual mode only)

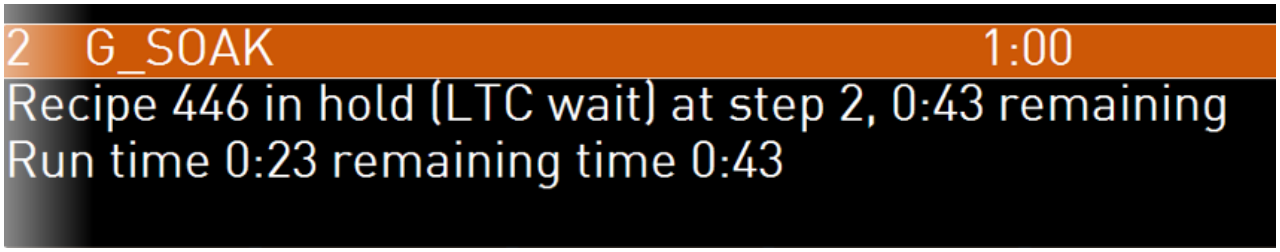


Tap to set Setpoint (in manual mode only)

The Control screen will also display the current step/segment of a running recipe along with timing information for that step/segment.

In Step mode, Green will indicate a step in process, Orange will indicate a Hold.





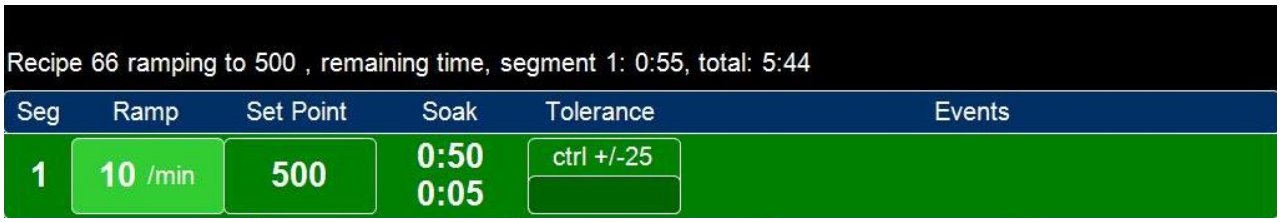
In Segment mode, Green indicates a segment in process, with lighter green indicating the current action. In the example below, light green indicates that the controller is performing a ramp at a rate of 10°/min. This is also explained in the text description above the segment.

The Soak column indicates that there are 50 minutes remaining in the ramp time before the 5 minute soak begins.

The Tolerance column shows a Band of +/- 25° for the Control TC.

There are no output events associated with this segment.

If the segment is displayed in Yellow, the recipe is in a hold.



Matrix Menu

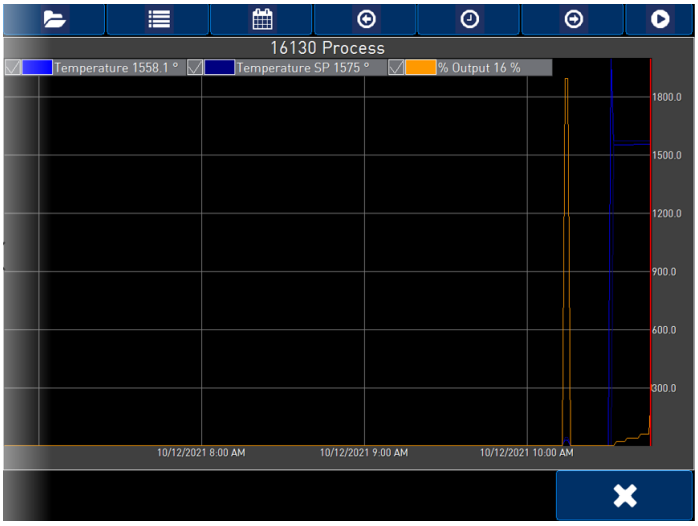
There are three levels of Matrix Menus in the Matrix Controller.

- 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.*

Chart



The Chart Display shows between 15 minutes 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. Process trends can be selected and deselected using checkboxes under the menu bar.

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 **X** 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 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 include: **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

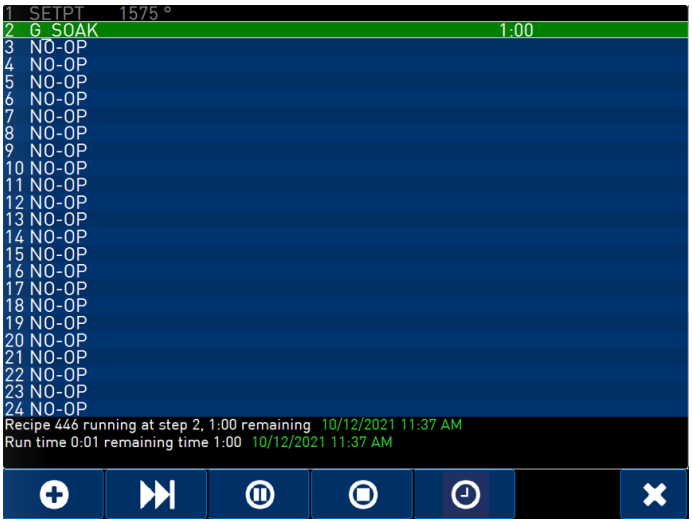
There is a sub-menu available by putting a finger or a stylus anywhere on the chart and holding it there for three seconds. The sub-menu will have the following options available: **Zoom**, **Restore**, and **Exit**.

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 – Step Mode



Tapping the recipe button will display the currently loaded recipe. To load a different recipe or make adjustments to the current recipe, tap the button.

At this point, the current recipe is still displayed.

Tap "Select" to load a different recipe. Depending on settings elsewhere in the controller, this could be by number, name, or from a database.

Tap to move to the next step.

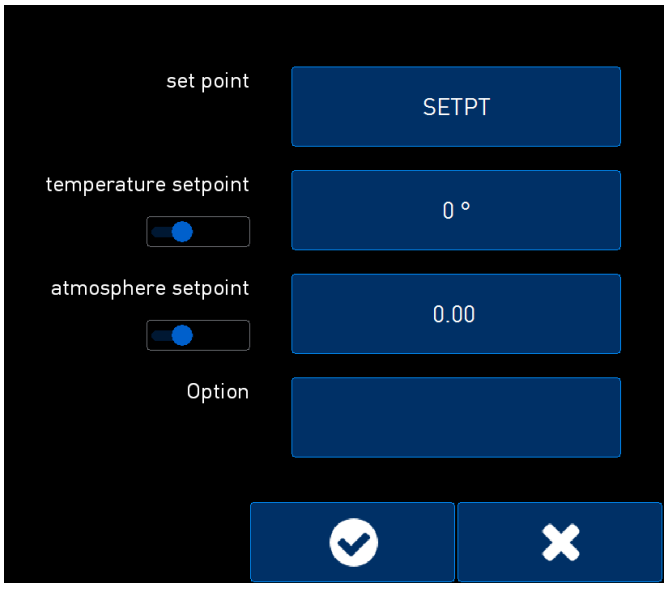
If the recipe is running, tapping will pause the recipe. If the recipe is paused, this button will become a "Play" button. Tap to restart the recipe.

Tap to stop the recipe completely. If you do this, you will need to reload the recipe in order to start it again.

If the step is a soak, the clock button will allow you to adjust the soak.

You cannot change, delete, or add Opcodes to the recipe steps from this screen, but you can adjust timing, settings, and options by double-clicking on a step.

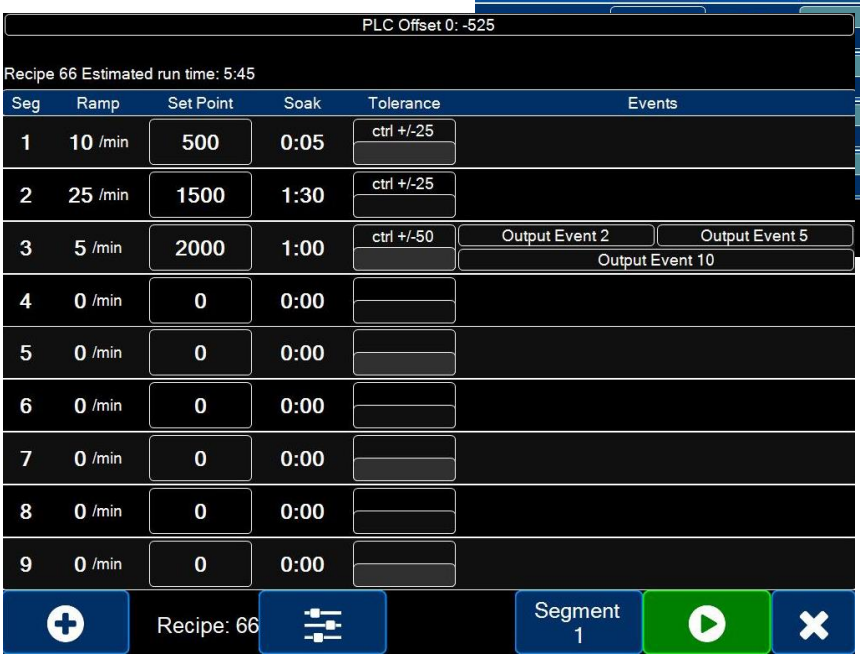
From this screen, tap a button to make changes. If a setting is not editable, the button will have no effect. Tap check to accept changes, and X to exit without saving.



Recipe – Segment Mode

Tapping the recipe button  will bring up the Recipe Screen.

To load a recipe, tap the  button and use the numeric keypad to select a recipe. When loaded, the recipe segments will be displayed as below.



Tap  to select or deselect Load T/Cs for this recipe.

The "Segment #" button displays what the starting Segment of the recipe will be. Tap the button to choose a starting segment using the numeric keypad.

Tap  to run the recipe.

Tap X to return to the Main Control Display.

Recipe - Segment Runtime Display Info

Green indicates a segment in process, with lighter green indicating the current action. In the example above, light green indicates that the controller is performing a ramp at a rate of 10°/min. This is also explained in the text description above the segment.

The Soak column indicates that there are 46 minutes remaining in the ramp time before the 5 minute soak begins.

The Tolerance column shows a Band of +/- 25° for the Control T/C.

There are no output events associated with this segment.

If the segment is displayed in Yellow, the recipe is in a hold.

Tap to load a new recipe (the current recipe will be stopped).

Tap to advance to the next segment.

Tap to put the current recipe into a hold.

Tap to stop the current recipe.

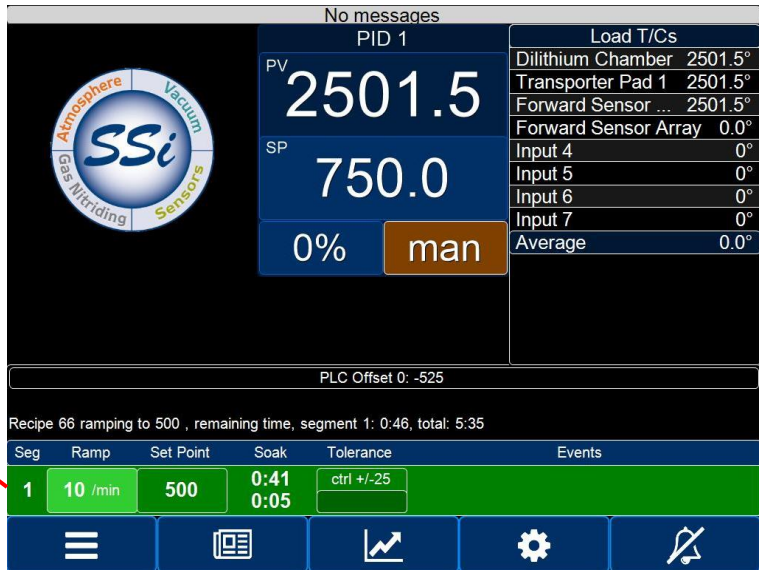
Tap to see a graphical representation of the current recipe, with the current segment and status displayed.

From the graphical display, tap to return to the segment display.

Tap to silence any active alarms.

Tap X to return to the main Control display – if a recipe is running, it will continue to run. The current segment and status will be displayed as shown:

Current segment of running recipe

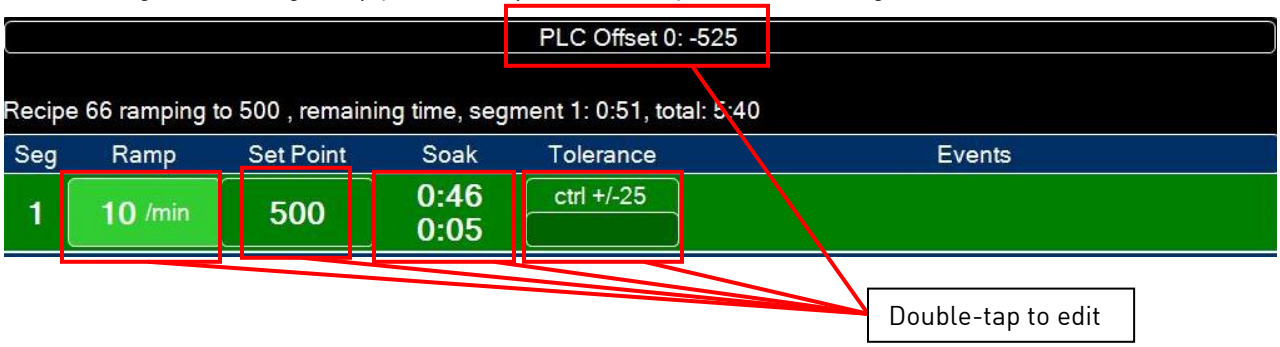


One-Time Recipe Edits

From the Main Recipe screen, a loaded or running recipe cannot be permanently edited – this must take place in the Recipe Edit menu option (explained earlier). However, it is possible to make *one-time* adjustments to a loaded or running recipe from this screen. These changes will only affect the current run of the recipe, and these changes will not be saved.

In the above example, the settings that can be edited in real-time are PLC Offset, Ramp, Set Point, Soak, and Tolerance. Events settings cannot be edited here.

To edit a segment setting, simply double-tap on the area you wish to change.



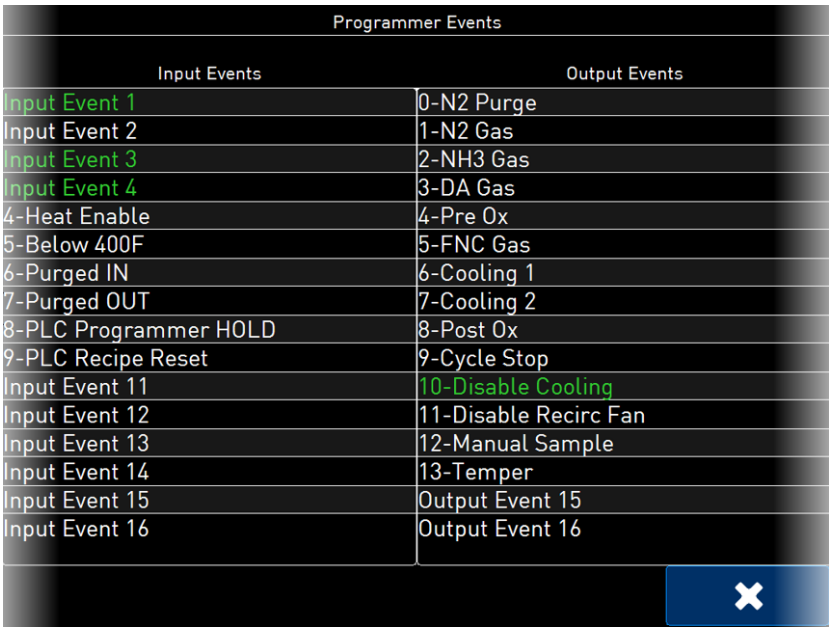
The editing functionality is identical to that found in the Recipe Edit menu option.

NOTE: Any PLC offsets entered here will be sent *immediately* to the PLC.

Tap to save any changes, or tap X to exit without saving.

Programmer Events

The Programmer Events screen allows you to view the current Input and Output Events. These can be set in the Matrix menus.

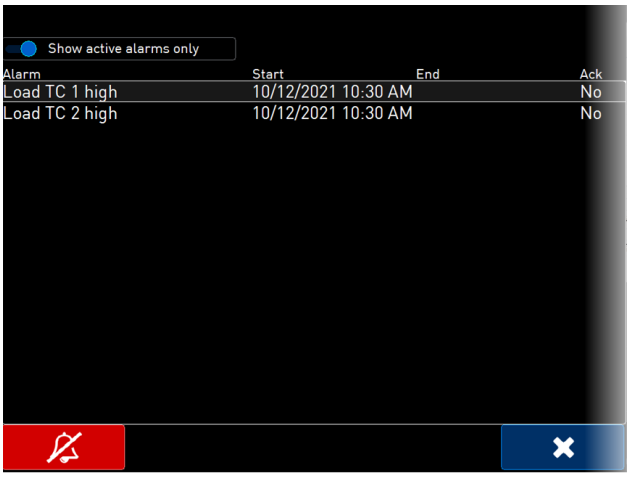


Alarms

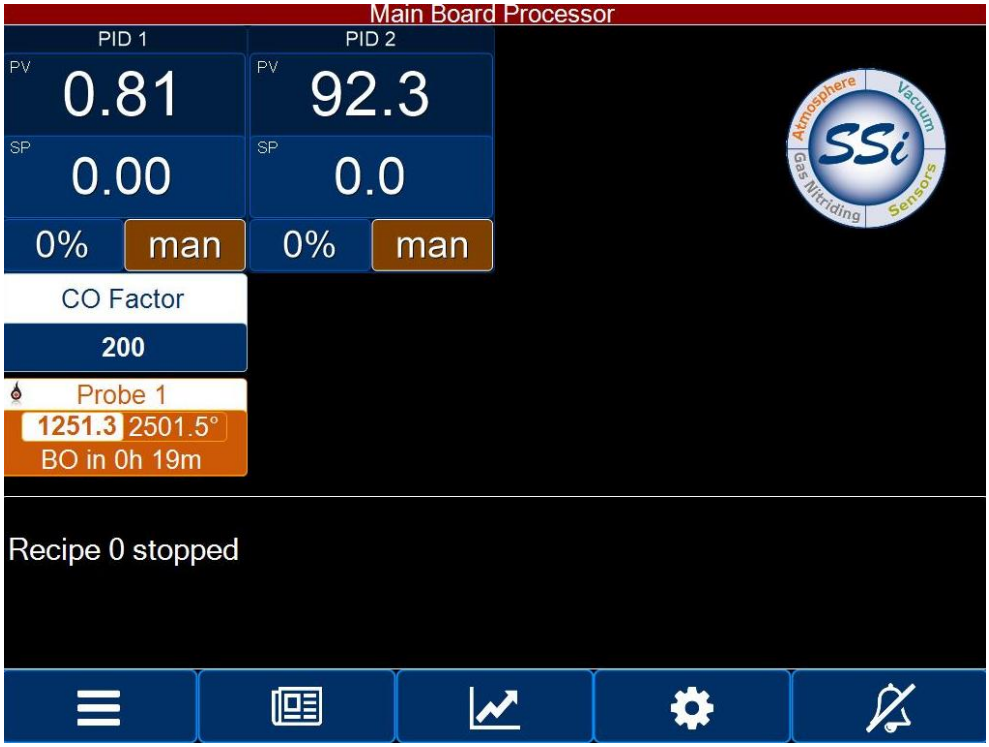
Use the Start and End time selectors to set up the start and end dates for historical alarm displays.

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

Tap X to return to the main display screen.



16205 (Atmosphere) Control Screen



Note: Layout of the Control Screen will vary slightly depending on the details of your Matrix Unit. Basic functionality is the same across models.

The Control Display shows an overview of the current status information: set point and process variable; control mode; communication status; current recipe step/segment and status; current alarms.

In addition, there are five active buttons along the bottom of the Status Display:

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

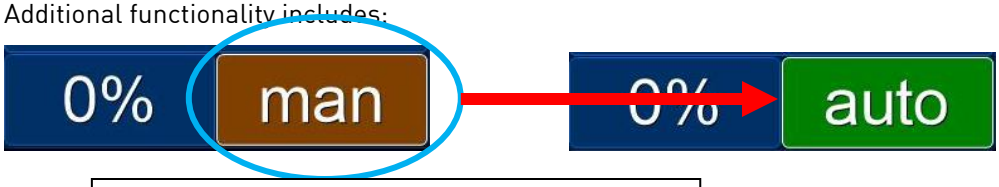
The **Recipe** button will switch to the Recipe Display.

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

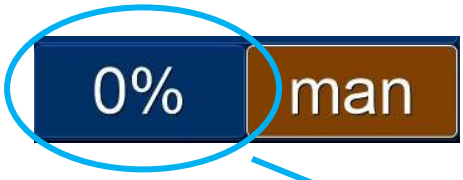
The **Programmer Events** button will bring up the Programmer Events screen.

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

Additional functionality includes:



Tap to switch between auto and manual modes.

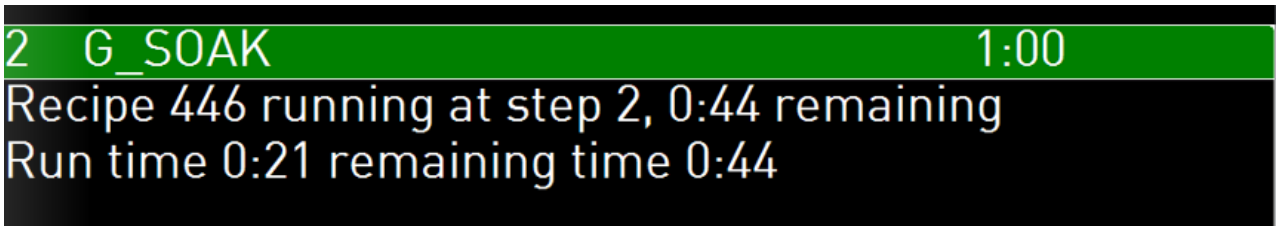


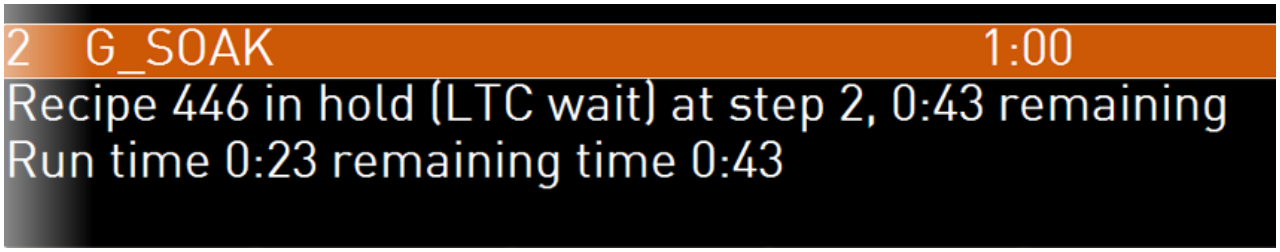
Tap to set %Output (in manual mode only)

Tap to set CO Factor

The Control screen will also display the current step/segment of a running recipe along with timing information for that step/segment.

In Step mode, Green will indicate a step in process, Orange will indicate a Hold.





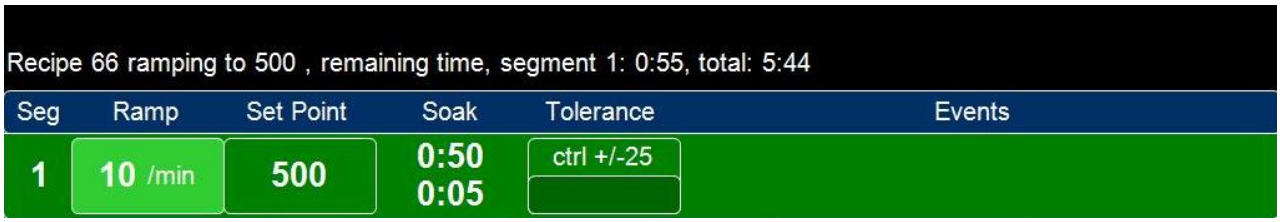
In Segment mode, Green indicates a segment in process, with lighter green indicating the current action. In the example below, light green indicates that the controller is performing a ramp at a rate of 10°/min. This is also explained in the text description above the segment.

The Soak column indicates that there are 50 minutes remaining in the ramp time before the 5 minute soak begins.

The Tolerance column shows a Band of +/- 25° for the Control TC.

There are no output events associated with this segment.

If the segment is displayed in Yellow, the recipe is in a hold.



Matrix Menu

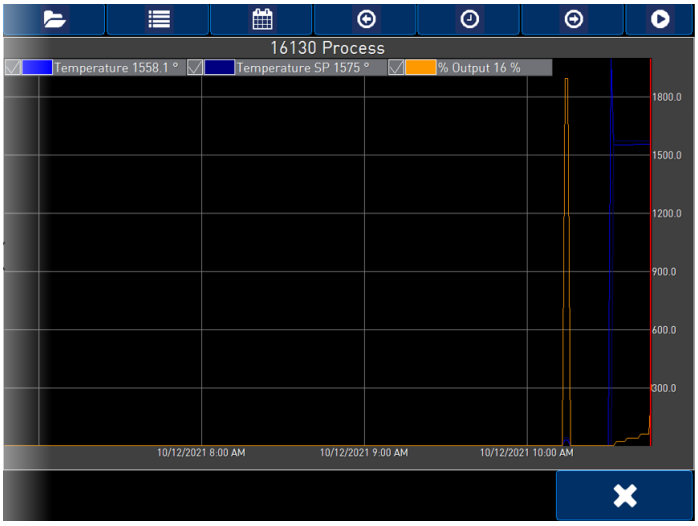
There are three levels of Matrix Menus in the Matrix Controller.

- 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.*

Chart



The Chart Display shows between 15 minutes 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. Process trends can be selected and deselected using checkboxes under the menu bar.

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 **X** 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 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 include: **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

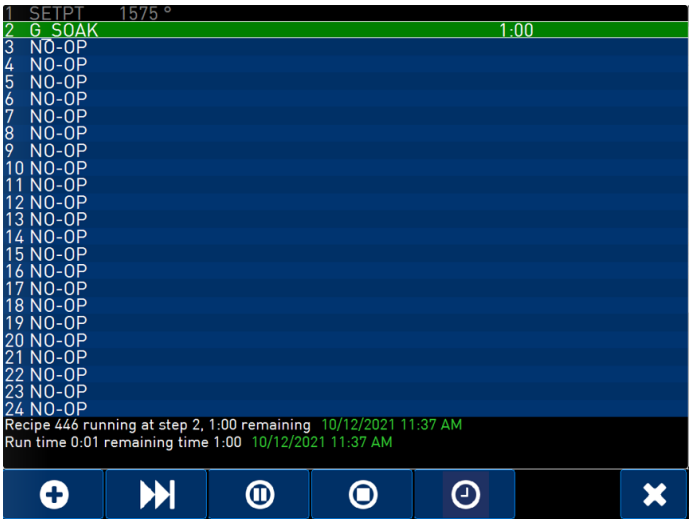
There is a sub-menu available by putting a finger or a stylus anywhere on the chart and holding it there for three seconds. The sub-menu will have the following options available: **Zoom**, **Restore**, and **Exit**.

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 – Step Mode



Tapping the recipe button will display the currently loaded recipe. To load a different recipe or make adjustments to the current recipe, tap the button.

At this point, the current recipe is still displayed.

Tap "Select" to load a different recipe. Depending on settings elsewhere in the controller, this could be by number, name, or from a database.

Tap to move to the next step.

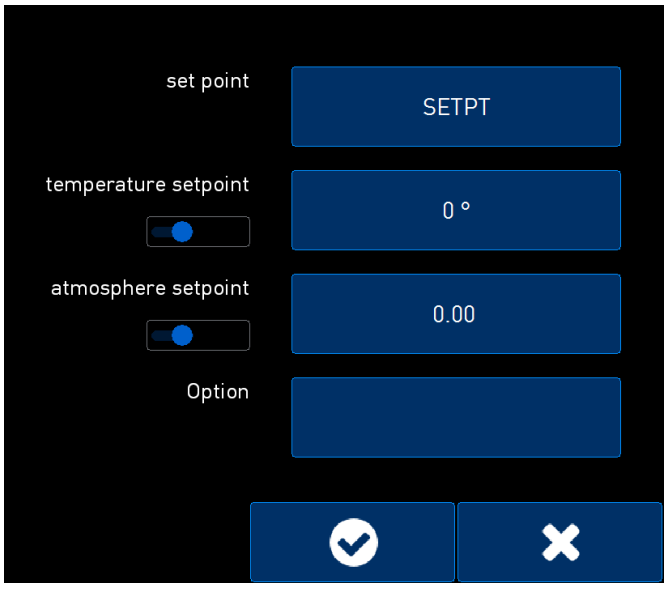
If the recipe is running, tapping will pause the recipe. If the recipe is paused, this button will become a "Play" button. Tap to restart the recipe.

Tap to stop the recipe completely. If you do this, you will need to reload the recipe in order to start it again.

If the step is a soak, the clock button will allow you to adjust the soak.

You cannot change, delete, or add Opcodes to the recipe steps from this screen, but you can adjust timing, settings, and options by double-clicking on a step.

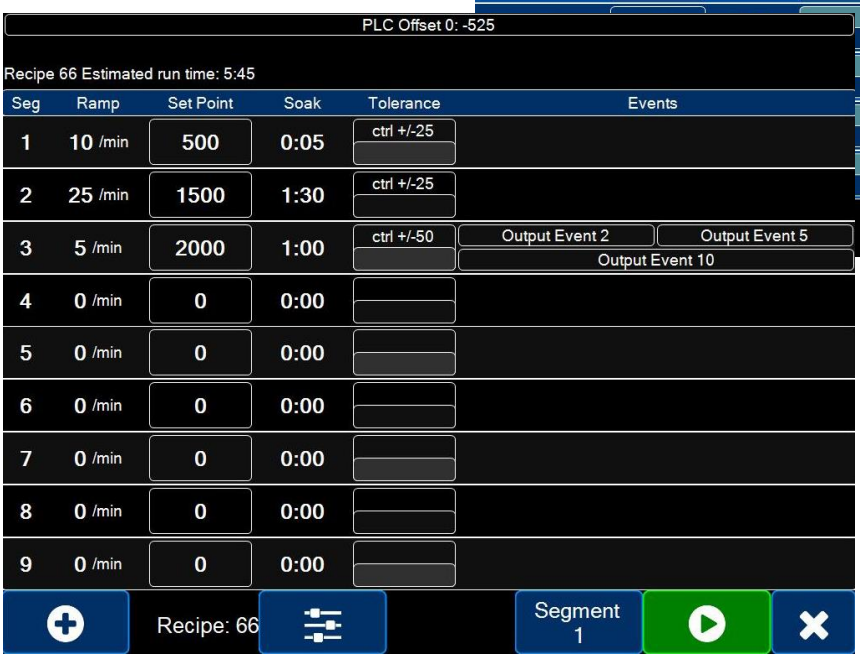
From this screen, tap a button to make changes. If a setting is not editable, the button will have no effect. Tap check to accept changes, and X to exit without saving.



Recipe – Segment Mode

Tapping the recipe button  will bring up the Recipe Screen.

To load a recipe, tap the  button and use the numeric keypad to select a recipe. When loaded, the recipe segments will be displayed as below.



Tap  to select or deselect Load T/Cs for this recipe.

The "Segment #" button displays what the starting Segment of the recipe will be. Tap the button to choose a starting segment using the numeric keypad.

Tap  to run the recipe.

Tap X to return to the Main Control Display.

Recipe - Segment Runtime Display Info

Green indicates a segment in process, with lighter green indicating the current action. In the example above, light green indicates that the controller is performing a ramp at a rate of 10°/min. This is also explained in the text description above the segment.

The Soak column indicates that there are 46 minutes remaining in the ramp time before the 5 minute soak begins.

The Tolerance column shows a Band of +/- 25° for the Control T/C.

There are no output events associated with this segment.

If the segment is displayed in Yellow, the recipe is in a hold.

Tap to load a new recipe (the current recipe will be stopped).

Tap to advance to the next segment.

Tap to put the current recipe into a hold.

Tap to stop the current recipe.

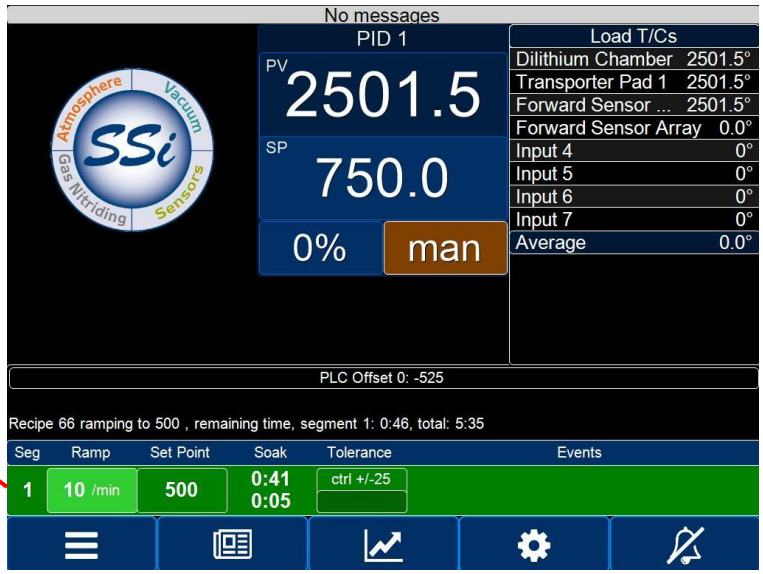
Tap to see a graphical representation of the current recipe, with the current segment and status displayed.

From the graphical display, tap to return to the segment display.

Tap to silence any active alarms.

Tap X to return to the main Control display – if a recipe is running, it will continue to run. The current segment and status will be displayed as shown:

Current segment of running recipe

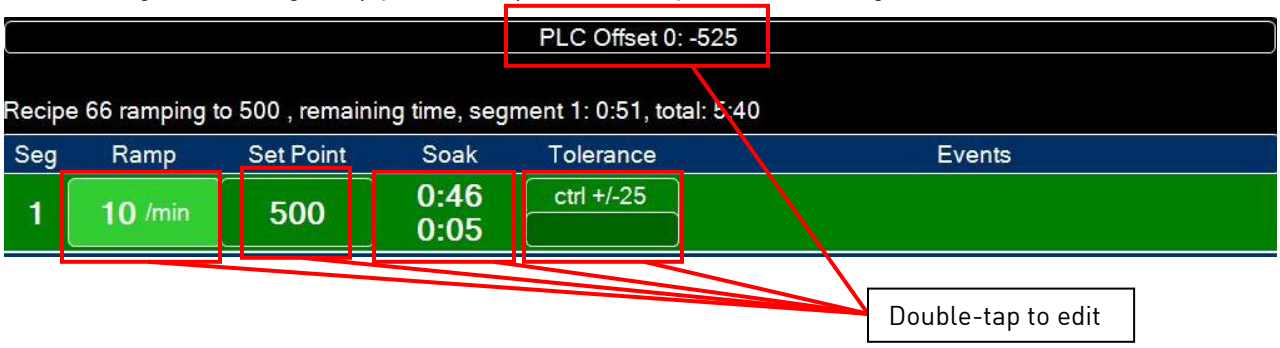


One-Time Recipe Edits

From the Main Recipe screen, a loaded or running recipe cannot be permanently edited – this must take place in the Recipe Edit menu option (explained earlier). However, it is possible to make *one-time* adjustments to a loaded or running recipe from this screen. These changes will only affect the current run of the recipe, and these changes will not be saved.

In the above example, the settings that can be edited in real-time are PLC Offset, Ramp, Set Point, Soak, and Tolerance. Events settings cannot be edited here.

To edit a segment setting, simply double-tap on the area you wish to change.



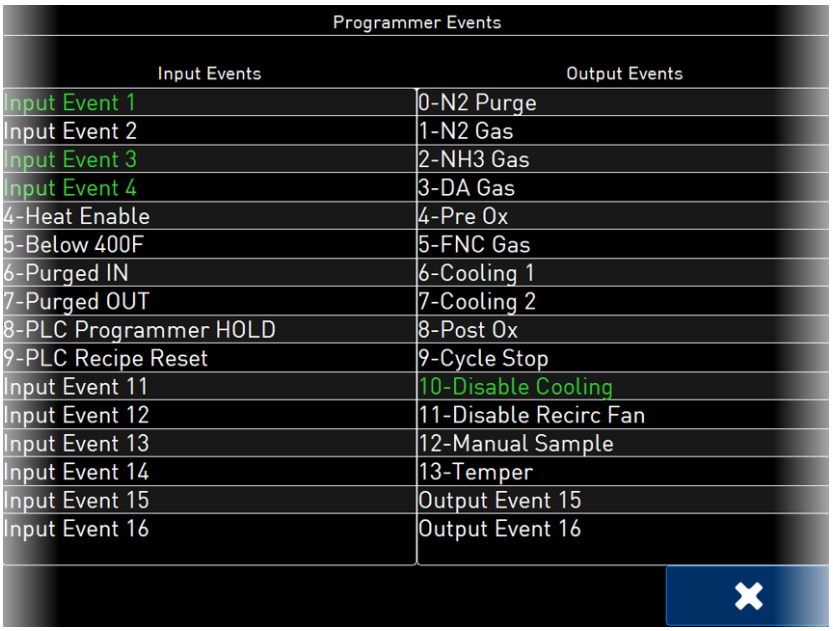
The editing functionality is identical to that found in the Recipe Edit menu option.

NOTE: Any PLC offsets entered here will be sent *immediately* to the PLC.

Tap to save any changes, or tap X to exit without saving.

Programmer Events

The Programmer Events screen allows you to view the current Input and Output Events. These can be set in the Matrix menus.

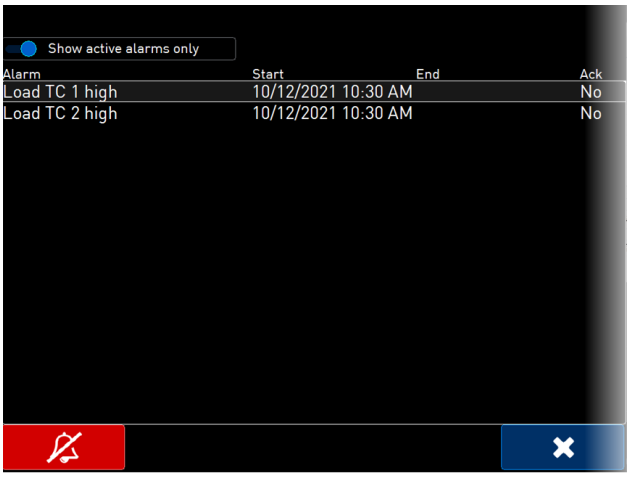


Alarms

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.

Tap X to return to the main display screen.



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 Matrix 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 Matrix Controller/programmer, then disk space.

Chapter 2 – Matrix Menus

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.

Menu options with the SSi logo below may be SSi-level password protected and should not be changed without assistance from SSi customer support.

Note: We are constantly improving and updating this product. Certain features may be added or removed as a part of these updates. In addition, the user interface may change slightly from what is displayed in this manual. If you have questions about a feature or functionality not covered here, or that is inconsistent with what you see on your device, please contact SSi at 513-772-0060 for technical support.

Operator-level menu options may include:

- Maintenance
- About
- Logs
- Board Status
- Burnoff
- Aux Instrument Status
- Shutdown

Supervisor-level menu options may include:

- Maintenance
- About
- Logs
- Board Status
- Burnoff
- Aux Instrument Status
- Shutdown
- Probe Manager
- PID
- Trend Chart Edit

Administrator-level menu options may include:

- Maintenance
- About
- Logs
- Board Status
- Burnoff
- Aux Instrument Status

- Shutdown
- **Load T/C**
- **Manual Event Control**
- Probe Manager
- PID
- **Recipe Edit**
- Trend Chart Edit
- Alarm Setup
- Relay Assignments
- Programmer Configuration
- Furnace
- Communications
- Aux Instruments
- Analog Input
- Analog Input Curve Entry
- Analog Output
- Auxiliary Analog Inputs
- Analog Input Offsets
- Alternate PID
- **Event Hold/Reset**
- Calculated Values
- Tuning Assistant
- Instrument Calculation
- Calibration
- Analog Output Trim
- Thermocouple Check
- RS-485 Loop Data Redirection
- Time Server
- Email Setup
- Security
- Configuration
- Logic I/O Mapping
- Totalizers
- TC Correction Curves
- Multi-Input PID Source
- Redundant T/C Setup
- Autocal Setup
- Sampling Setup
- Sample Point Setup

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 **Select**  button. The **X** button will return the user to the default display screen.

Maintenance

The maintenance screen allows the user to view and generate reports on the status of any maintenance procedures that are due or upcoming. Maintenance records can also be edited, and the security settings for the Maintenance menu can be customized.

Status

The Status option will generate a list of all current Maintenance item, displaying each item's Status, Name, and Condition.

Tap the "Show Due Only" switch to display only items that are currently due.

To complete an item, tap to highlight it in the list, then tap "Complete."

To toggle between Condition display options, tap the "Condition" button. You can choose from "Percent Complete," "Total Remaining," and "Total Complete."

Tap "Return" to return to the Maintenance menu.

Maintenance Report

The Maintenance Report option will display all Completed Maintenance items within the defined date range. Use the dropdown menu to set the desired date, then tap the button at top right to toggle between date ranges of 1 Day, 1 Week, and 1 Month. Once selected, the list will auto-generate.

Tap "Return" to return to the Maintenance menu.

Edit Current Records

The Edit Records option will display a list of Maintenance records. To edit an item, tap to highlight it in the list, then tap "Edit."

To toggle between Condition display options, tap the "Condition" button. You can choose from "Percent Complete," "Total Remaining," and "Total Complete."

Tap "Return" to return to the Maintenance menu.

Edit Security Settings

To customize Maintenance security settings, tap to highlight a menu option from the list, then use the "Toggle" buttons on the bottom row to assign whether Operator and Supervisor levels will have access to that functionality. When finished, tap "Save" to save settings, or "Cancel" to leave without saving those changes.

About

The "About" option displays basic information about the Matrix controller (Serial Number, Interface Revision, various dll versions, and Storage use.) This information is display-only and not editable. Tap X to return to the main menu.

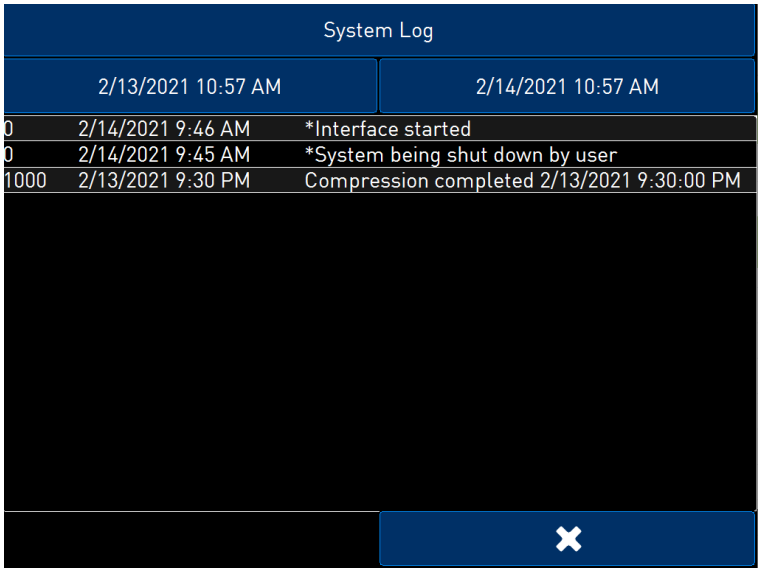
Logs

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

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

Tap the first date/time button to select starting time for the log display. Tap the second date/time button to select the ending time for the log display.

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



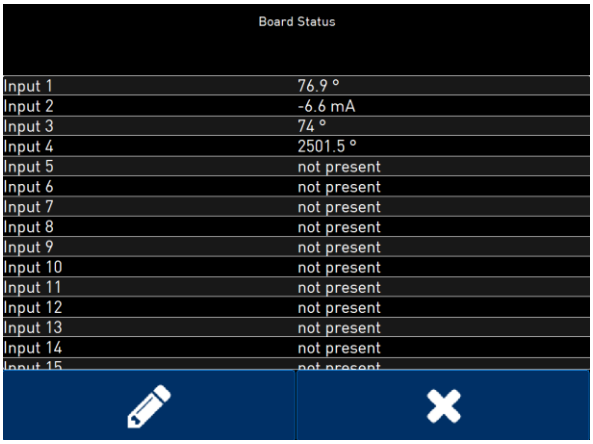
Log Types

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

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

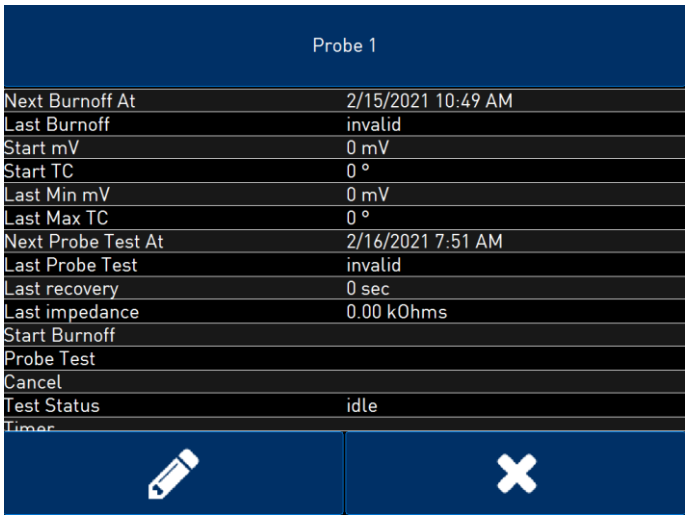
Board Status

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



Burnoff

The Burnoff menu displays and manages various burnoff and impedance test settings and functions. Most information on this screen is display-only – to change the settings for burnoffs or impedance tests, see the **Probe Manager** section.



Tap the top button to select a probe.

Next Burnoff At– Displays the date and time of the next scheduled burnoff.

Last Burnoff – Displays the date and time of the most recent burnoff.

Start mV - Displays the mV reading at the start of the last burnoff

Start TC – Displays the temp reading at the start of the last burnoff

Last Min mV **–** Displays the lowest mV reading during the last burnoff

Last Max TC – Displays the highest temp reading during the last burnoff

Next Probe Test At – Displays the date and time of the next scheduled probe test

Last Probe Test – Displays the date and time of the most recent probe test

Last recovery – Displays the recovery duration of the most recent probe test

Last impedance – Displays the impedance reading of the most recent probe test.

Start Burnoff – Begins a burnoff. Tap to highlight the row, then tap the Edit button to begin the test.

Probe Test – Begins a probe test. Tap to highlight the row, then tap the Edit button to begin the test.

Cancel – Stops the current burnoff or test.

Test Status – displays the state of the current test

Timer – displays the time remaining in the current test

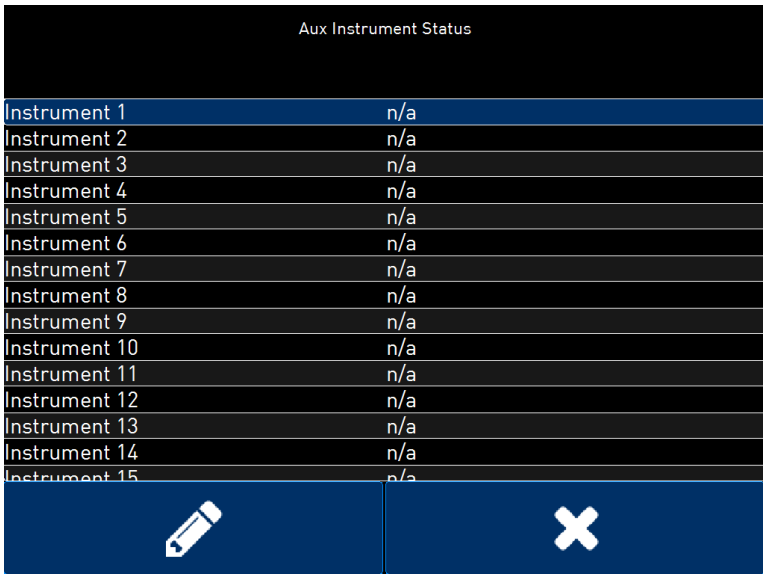
mV – displays the current mV reading

TC – displays the current temperature reading

Probe Stability – monitors mV and Temp for excessive fluctuation in selected probe

Aux Instrument Status

This page is a display of the current process variables of each of the Aux instruments communicating with the Matrix Controller. These values are display-only, and cannot be modified from this screen.



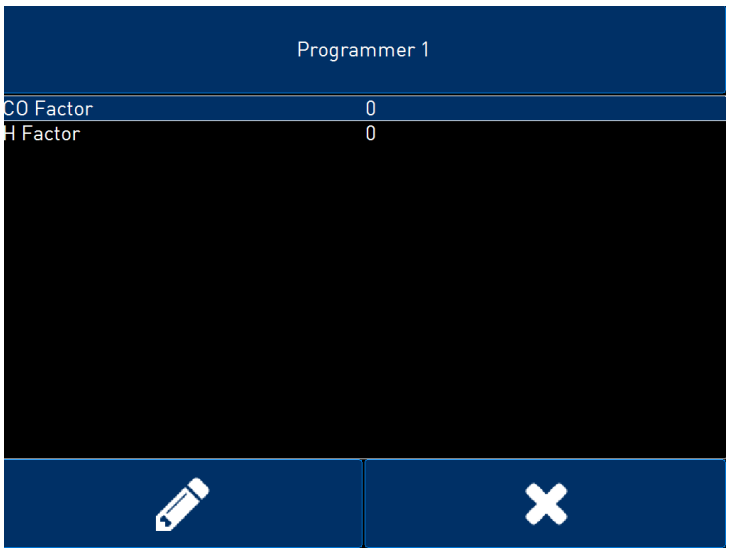
There are five possible messages that can occur to describe the instrument communications status.

- 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

For set-up of the auxiliary instruments go to the menu item "*Aux Instrument Setup*"
The **X** 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 Matrix Controller. When the operator interface is shutdown, the Matrix 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 Matrix Controller***.

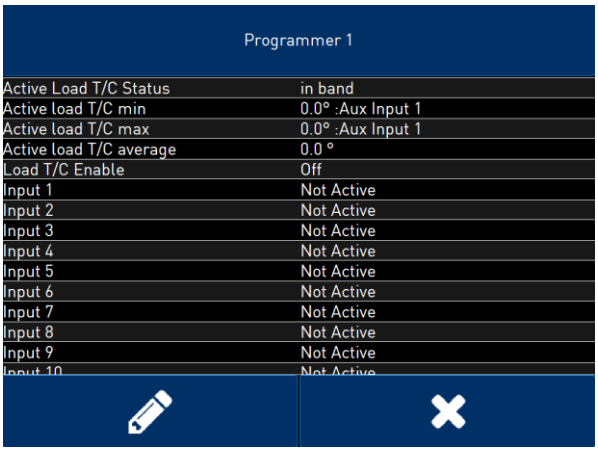


Factors

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.

Load T/C

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



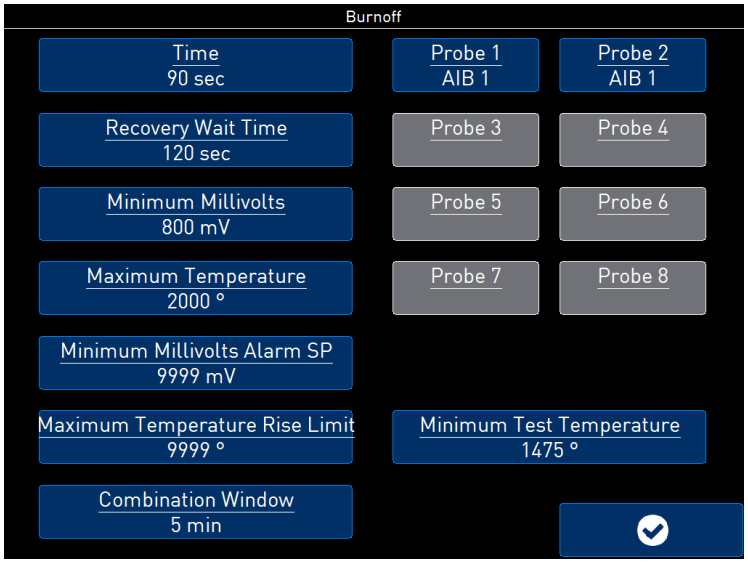
The first four rows on this page (**Active Load T/C Status, Active load T/C min, Active load T/C max**, and **Active Load T/C average** are display-only and represent the current readings for the active load.

The following settings are also editable:

Load TC Enable
This value will manually toggle between **on**, **on + alarms**, and **off**.
On – T/C Enabled
On + Alarms – T/C Enabled, Programmer alarm provided if out of band (Default wait limits)
Off – T/C not enabled

Minimum Load T/C for OK – determines how many Load T/Cs must be within range of wait value

Auto Check for bad Load T/C - when enabled, reviews all active T/Cs



Probe Manager

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.
The Probe Manager is where settings for these burnoffs and probe tests can be set up.

Tap a setting to change its value. Tap "Esc" to leave the setting without saving changes, and tap "OK" to save any changes you have made.

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.

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 reach 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.

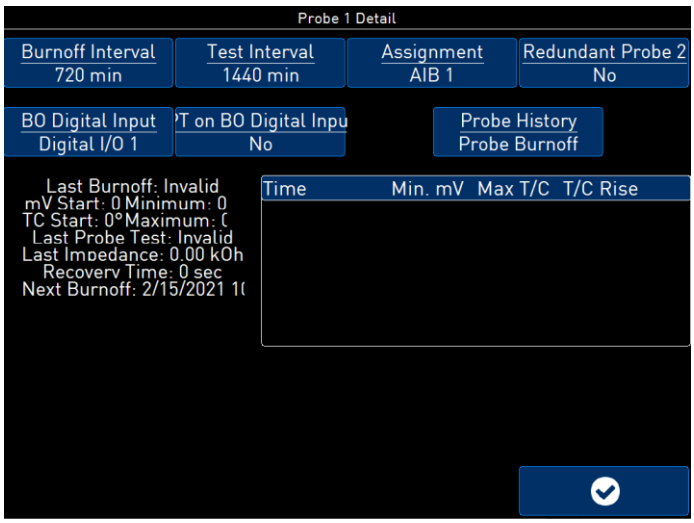
Burnoff Minimum Millivolts Alarm Setpoint: The minimum millivolt value that must be reached in order for the "Insufficient mV drop during BO" alarm not to be generated. If the millivolt value does not drop below the minimum, the alarm will be generated.

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.

Minimum Test Temperature: The minimum temperature allowed during a test.

Combination Window: sets time period for combined burnoff

In addition, tap on one of the numbered Probe buttons to adjust settings and view information specific to that probe.



Burnoff 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.

Test Interval: This is the amount of time between the beginning of one test and the beginning of the next scheduled test, in minutes. The amount of time between tests should be determined by the application.

Assignment: selects an AIB

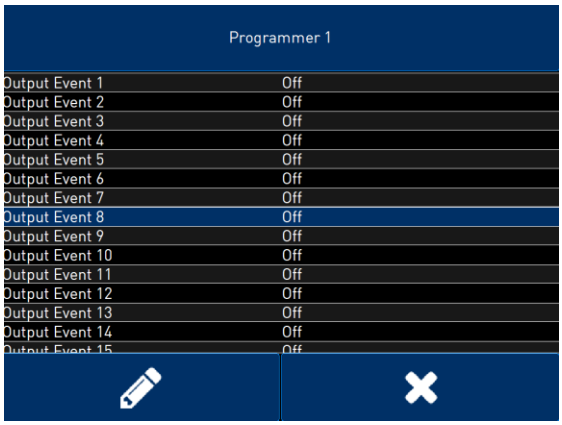
Redundant Probe: Yes/No

BO Digital Input: assigns an I/O for the burnoff

PT on BO Digital Input: Yes/No

Probe History: Tapping this will toggle the history display below the button between displaying the probe's burnoff history and its test history.

Manual Event Control



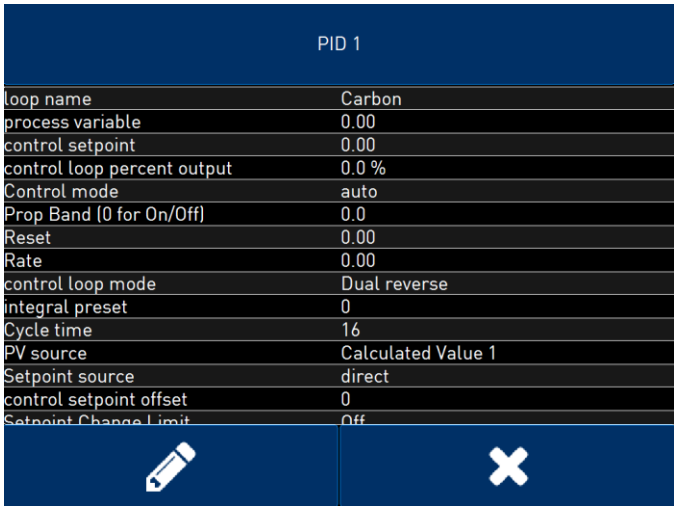
Events are assignable outputs, used in recipes/programs. Typically, they are used to signal the recipe is complete, to turn process gases off and on, and tell the equipment to do a variety of tasks. The Manual Event Control submenu allows the user to force the events off or on.

The Manual Event Control menu option shows the user all of the events 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.



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**.

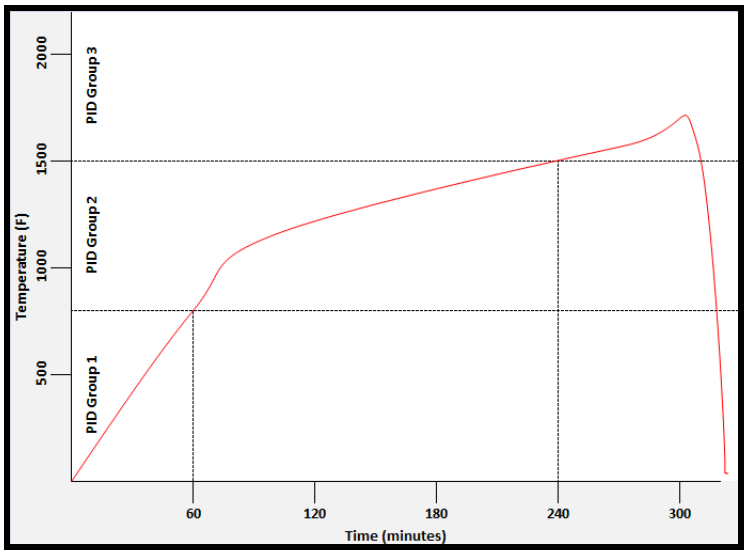
0 Setpoint Stops Control
If the Setpoint is zero, then all outputs are turned off. The option is either **Yes** or **No**.

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 Matrix 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.

Heat+Cool Mode Enable
Allows for use of both Heat and Cool modes rather than one or the other

Heat+Cool Dead Band
Sets the Dead Band when Heat and Cool Mode is enabled

Cool Output
Sets the percent output in cooling mode

Cool Proportional Band
Sets Proportional Band when in cooling mode. 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.

Cool 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**.

Cool 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.

Algorithm: PV Derivative or Proportional PV Derivative

Process Variable Alarm Type:
Selects the PV Alarm Type

Process Variable Alarm Setpoint:
Sets the PV Alarm Setpoint

Process Variable Alarm Smart:
Makes the PV Alarm a Smart Alarm. 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.

Process Variable Alarm Latching:
Enables Latching of the PV Alarm

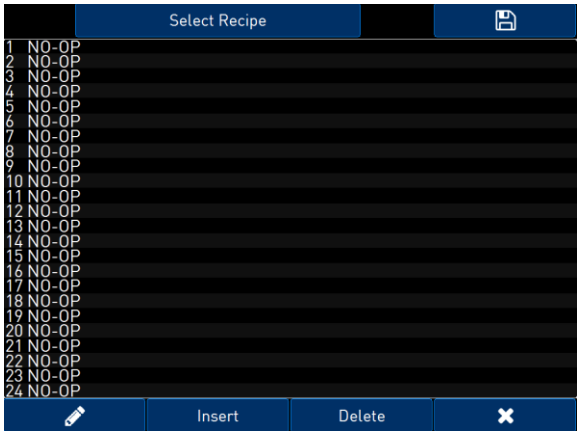
Process Variable Alarm Delay (sec):
Sets Delay for the PV Alarm

Deviation Alarm Inhibit
Prevents Deviation Alarm when set

% Output High Alarm Inhibit
Prevents % Output High Alarm when set

% Output Low Alarm Inhibit
Prevents % Output Low Alarm when set

PV Alarm Inhibit
Prevents PV Alarm when set



Recipe Edit

Your Matrix will come pre-configured with Step mode or Segment mode. Please see the section that applies to your instrument.

Step mode

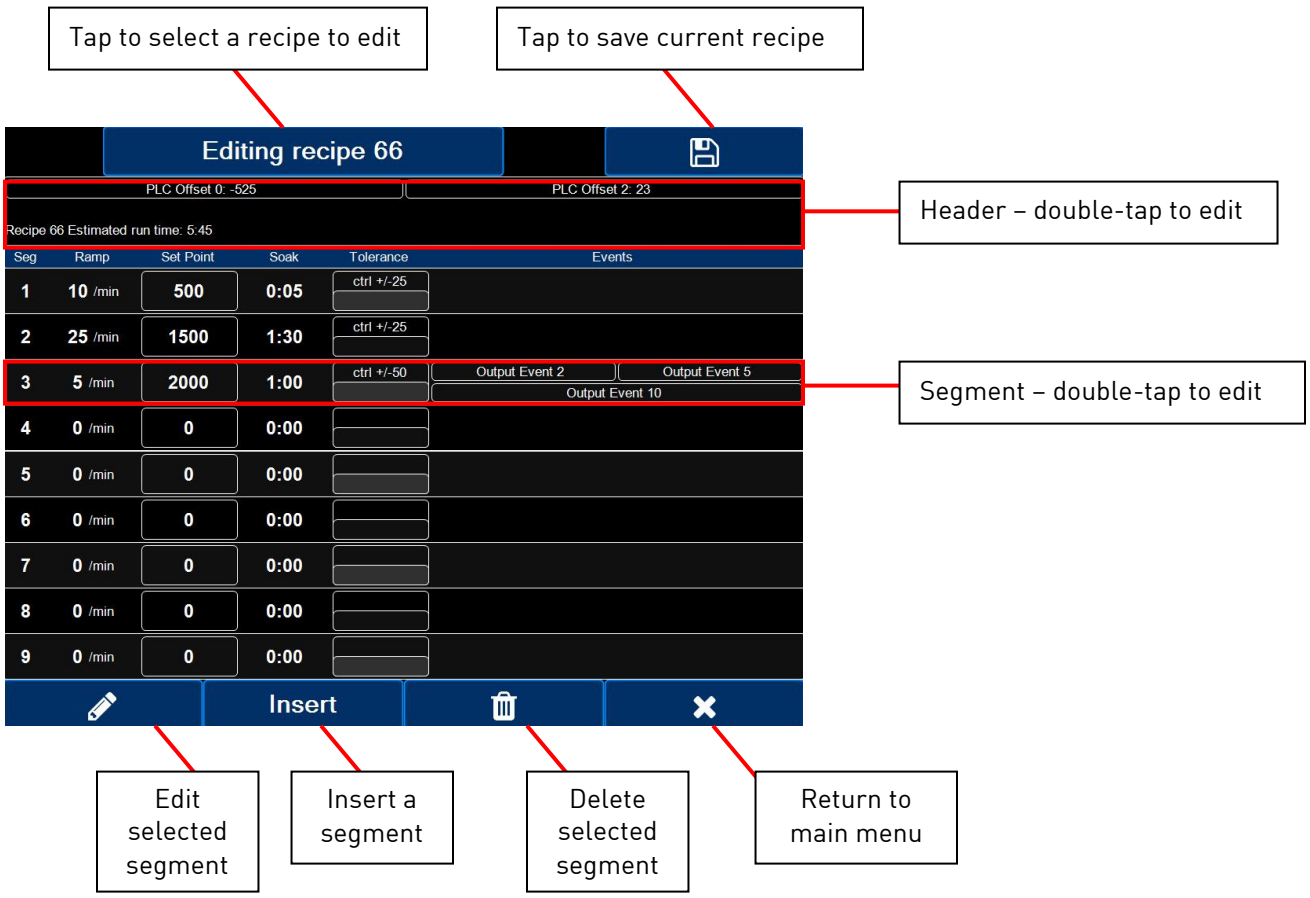
This option will allow the user to edit a recipe that is stored on the Matrix Controller.
The **Select Recipe** button will allow the user to select which recipe to load. Once the recipe has been selected, the recipe will be displayed on the screen.
The higher recipe steps can be viewed by holding a 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. 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.

Segment Mode

To load a recipe, tap the button at the top of the screen. If no recipe is currently opened, this button will read "Select Recipe." If a recipe is opened, the recipe number will be displayed here. Enter a recipe number using the numerical keypad and tap the check button to load.



Header

The Header area contains displays information on any PLC offsets that apply to the entire recipe. To edit this and other settings, double-tap anywhere in the header area.

The Header editor is divided into Recipe Data and PLC Data.

Some of this information may come pre-configured depending on the recipe and your installation. If you wish to start from scratch with a blank recipe, there are two options:

To clear all Recipe and PLC Data, tap "Load Default Header."
To clear all Recipe and PLC Data, and also designate all segments to "No-OP" (meaning no set points or events will be processed), tap "Load Default Recipe."

Recipe Data settings include the following parameters (double-tap or tap to highlight then tap  to edit):

Ramp Type
Determines how the recipe will perform ramps. **Rate** (e.g. 10° / minute), **Time** (e.g. 1 hour), **Rate with Secondary,** and **Time with Secondary.** The last two options allow you to set a secondary target.

Primary Control
Assigns Primary set point target to be used by Load T/Cs.
NOTE: You must make a Primary Control selection in order to create recipe segments.

Secondary Control
Assigns Secondary set point target to be used by Load T/Cs.

Run Output
Assigns an output to be active while a recipe is running.

Hold Output
Assigns an output to be active while a recipe is in a hold.

Hold Input
Assigns an input to be active while a recipe is in a hold.

Hold Limit
Defines how long the recipe will wait before triggering an excessive hold alarm.

Copy Events
When enabled, events will be copied into the standard PLC location.

Link Recipe
If a Link Recipe is assigned, that recipe will run after the completion of Segment 9 of the current recipe.

Register Source 1-2 Set Point

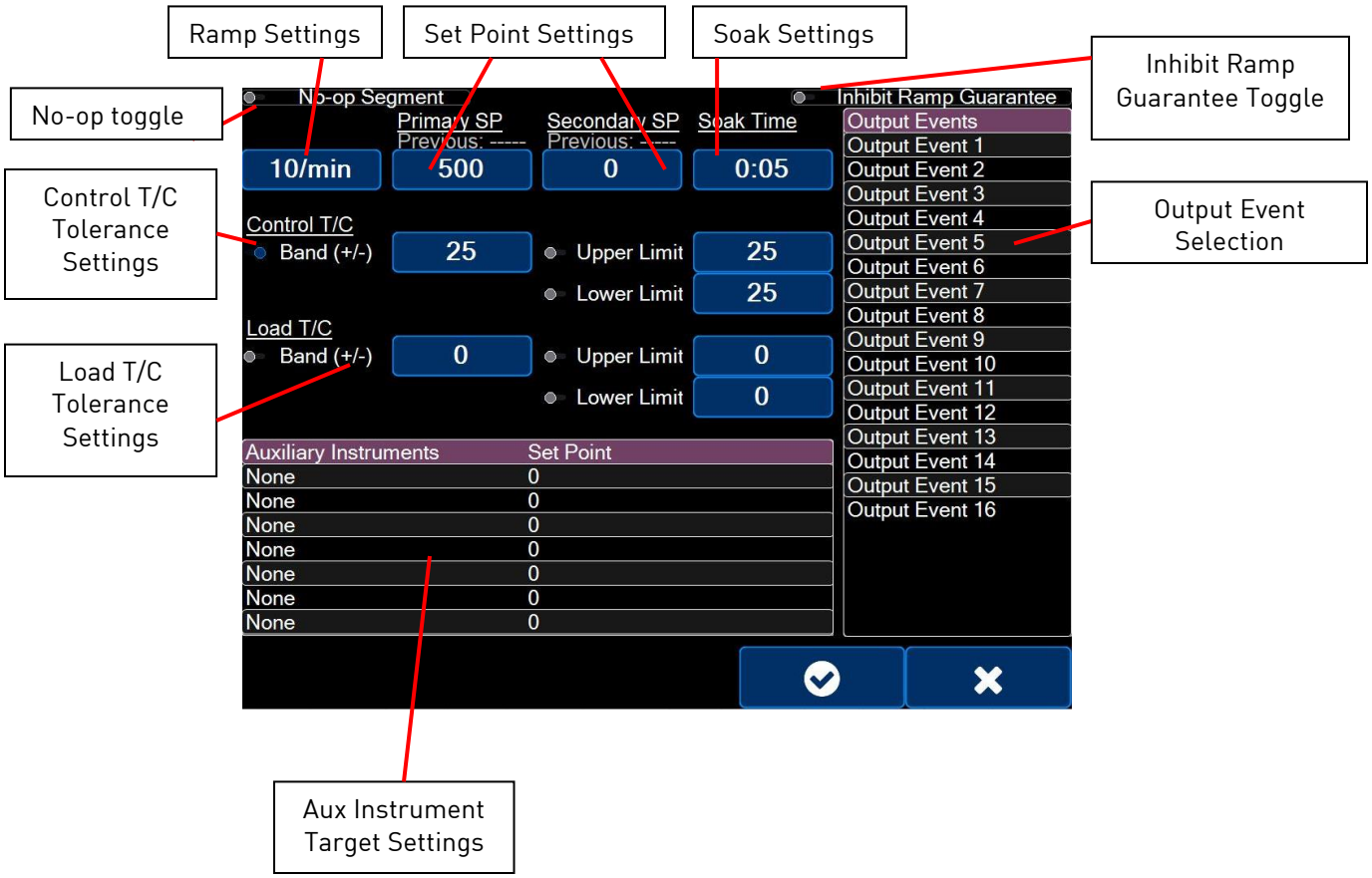
Register Source 1-2 Process Variable

Output Events 1-16
Associates optional output events with the recipe.

PLC Data allows you to assign a series of offsets as needed for your equipment. Double-tap or tap to highlight then tap  to edit, then use the numerical keypad to enter in the necessary offset figures.

When finished entering Header data, tap  to save and return to the main segment view, or X to return without saving.

To create or edit a segment, double tap anywhere on the numbered segment row.



No-Op Toggle
When activated, this switch assigns the current segment as a no-op segment, meaning no set points or events will be processed. As a result, turning this switch on will remove all buttons and options from the segment settings screen.

Ramp Settings
If "Rate" is selected in Header Data, then this button assigns the rate at which a ramp will take place in a segment (e.g. 10° / minute).

If "Time" is selected in Header Data, then this button assigns the time to complete the ramp (e.g. 1 hour).

Tap the button, then use the numeric keypad to enter the desired settings.

Set Point Settings
Tap to set the Primary (and if desired) Secondary Set Points for the segment. Use the numeric keypad to enter the desired settings.

Soak Settings
Tap to set the soak time for the segment. Use the numeric keypad to enter the desired settings. The three boxes represent Hours:Minutes:Seconds.

Control T/C Tolerance Settings
Tolerances (the amount of deviation from Set Point that the segment will allow before triggering an alarm) for the Control T/C can either be set using a Band or a separate Upper and Lower Limit. Tap the corresponding switch to select the method for setting tolerance, then tap the buttons to assign Band or Upper and Lower Limits. Use the numeric keypad to enter the desired settings.

Load T/C Tolerance Settings
Tolerances (the amount of deviation from Set Point that the segment will allow before triggering an alarm) for the Load T/C can either be set using a Band or a separate Upper and Lower Limit. Tap the corresponding switch to select the method for setting tolerance, then tap the buttons to assign Band or Upper and Lower Limits. Use the numeric keypad to enter the desired settings.

Aux Instrument Target Settings

Output Event Selection
Double Tap to assign an Output Event to this segment. Output Event text is assigned in the Configuration > Programmer Configuration menu.

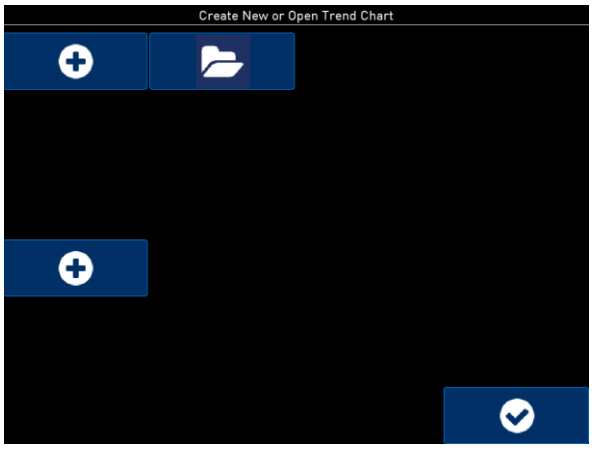
Inhibit Ramp Guarantee Toggle
When the toggle is enabled, the ramp will continue even if out of the assigned tolerance for this segment.

When the toggle is disabled, the ramp will be guaranteed of the assigned tolerance for this segment.

When finished entering segment information, tap to save changes, or X to return without saving.

When finished editing the recipe, tap to save. The recipe can now be loaded and run from the main Control screen using the button.

Trend Chart Edit



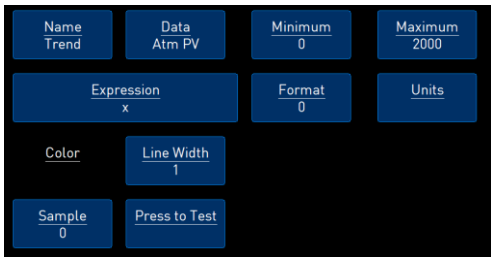
This menu option will allow the user to add, modify, or delete trend lines in a trend chart file, as well as the trend chart files themselves. The trend lines are the number of variables displayed on one screen. For example- this could be a control, overtemp, or load thermocouple on a batch furnace. 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 – **New**, and **Open** – deal with the trend chart files themselves, not the individual trend lines.

New will create a new trend chart file to begin adding trend lines to.

Open will allow the user to select a trend chart file to open up to edit.

Once a new trench chart file has been created, or one has been opened, trend lines can be added, modified, or deleted.

The  button in the middle of the screen allows you to add a new trend line to the file. On the ensuing screen, you can edit the information for a specific trend line.



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 Matrix Controller. Some of the points have a name, such as "Temperature" or "Temperature SP", but others will just show the register in the Matrix 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.

Minimum – the minimum displayed scale value on a chart.

Maxium – 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 Matrix 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.

Units – The type of units used for the trend.

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.

Line Width – a numeric value for the thickness of the trend line. A 1 is a thin line; A higher value = thicker line width.

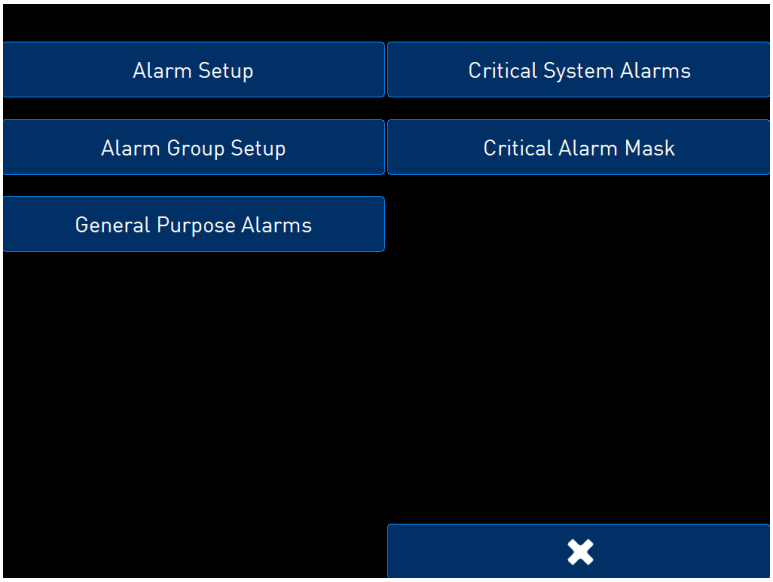
Sample – a number is entered here to test the expression and verify that formatting is correct.
Press to Test – Press the test button to calculate the expression with the value entered in the sample parameter. For example- with an expression of x*.1 and a value of 250 entered in the sample parameter will display a 25.0.

The **check** button will save the values entered. The **X** button will cancel the information and make no changes.

The newly created trend line will now be displayed on the preceding page. From here you can add more trendlines, or highlight existing lines to edit or delete them.

Alarm Setup

Allows the user to adjust settings for different alarm groups.



Tap **Alarm Setup** for the following options:

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.

Tap **Alarm Group Setup** to assign alarms to various loops or inputs. Select the desired option, then tap Edit. Use the checkboxes to make assignments as needed.

Tap **General Purpose Alarms** to assign up to 5 general purpose alarms. Tap the alarm name at top to select one of the 5 available alarms, then adjust the following settings as required:

Source Register
Use the numeric keypad to set the register for the alarm.

Type
Set the alarm as a Process High or Process Low alarm

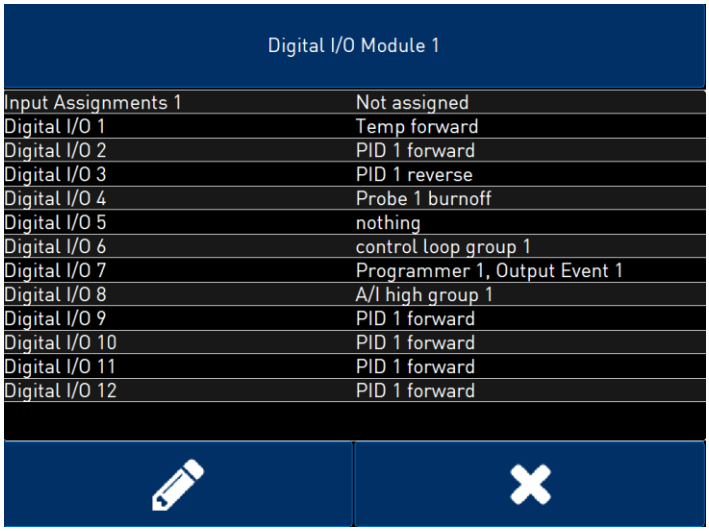
Setpoint
Determines the alarm setpoint. Use the numeric keypad to enter the desired value.

Smart
Determines whether the alarm is a smart alarm.

Latching
Determines whether the alarm is a latching alarm.
Delay [sec]
Sets the alarm delay. Use the numeric keypad to enter the desired value.

Tap **Critical System Alarms** to assign modules as critical system alarms if desired. Modules are set to "No" by default. Highlight a row, then tap "Edit" to set to "Yes"

Tap **Critical Alarm Mask** to assign alarm masks to various PID loops. Tap the button at top to select the alarm mask. Highlight a row, then tap "Edit" to set to "Yes."



Relay Assignments

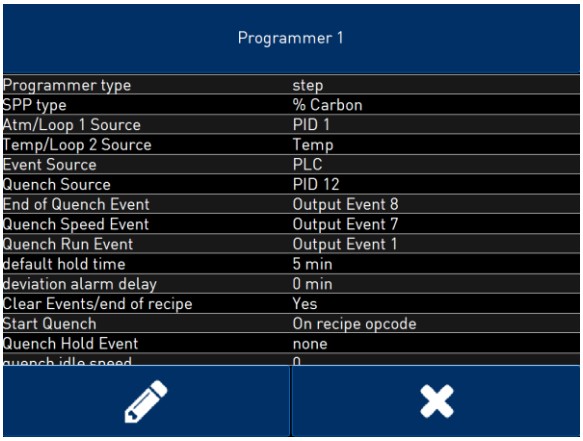
To make relay assignments, tap the button at top to select one of eight Digital I/O Modules. Then, select a row below to highlight and tap Edit to adjust settings as needed. The available options will vary based on your specific application.

Most of the relay assignments are set internally by the logic controller and should not be manually changed. Some relay assignments can be used when needed. These should not be changed without first calling SSi at (513) 772-0060.

NOTE: Invert Relay
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 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**. DO NOT change this setting.

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 Aux 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 Aux 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.

Default Atm/Loop 1 Wait Limit
Default Temp/Loop 2 Wait Limit
Working Atm/Loop 1 Wait Limit
Working Temp/Loop 2 Wait Limit
Working Load T/C Wait Limit
Define how long the recipe will wait before triggering an excessive hold alarm for the assigned situation.

Ramp Start Mode
Sets rules for the beginning of ramps in a segment in relation to previous segments, previous set points, and the current PV.

Disable Ramp Start Mode
Allows you to disable the Ramp Start Mode settings

Zone Setups

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

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

The zone setups feature allows the Matrix Controller program to change set points on all instruments of a multi-zone furnace. The Matrix 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 Aux temperature controllers.

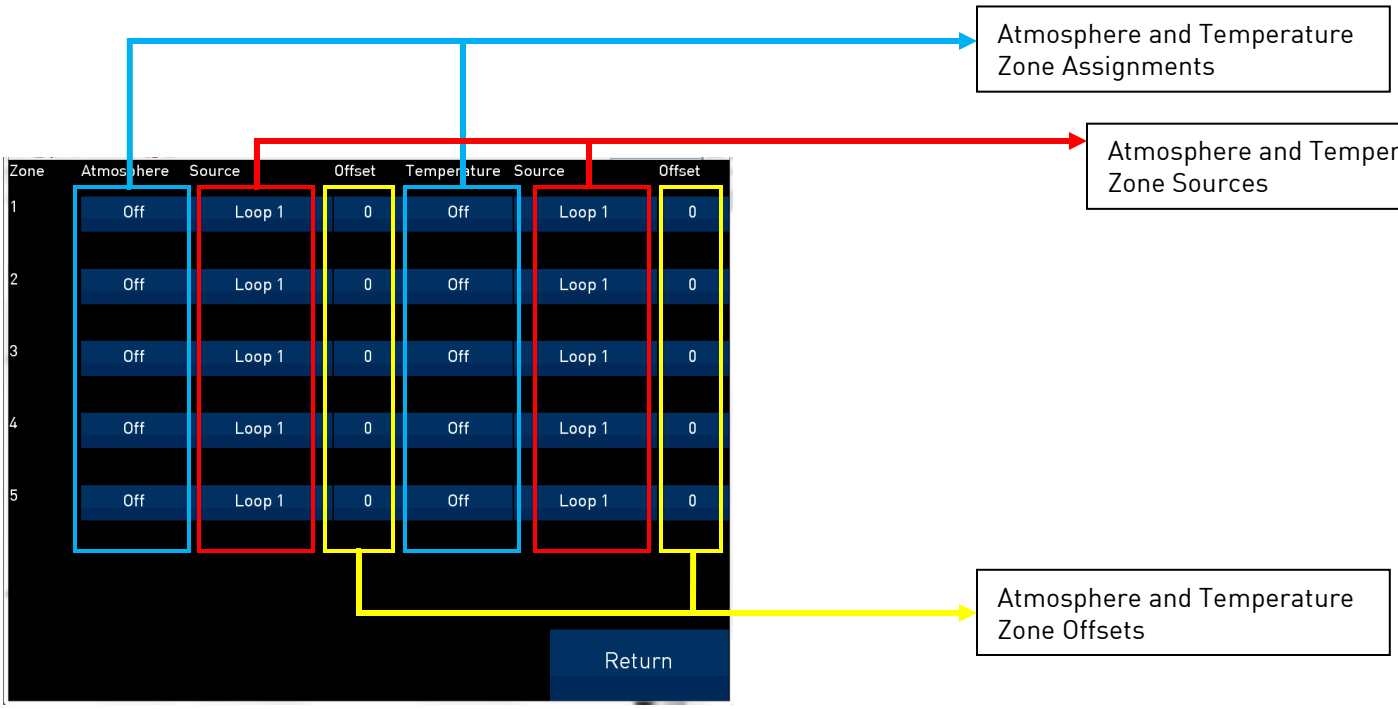
If the *ZONE_OFF* (Zone Offset) opcode had been used in the program, the set point sent to the specified zone instrument would have the offset added. For example, a 3-zone pit furnace, where the bottom zone usually has a higher set point. The middle zone and the top zone usually have a lower set point.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

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

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

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

When using the multi-zone offset feature, the temperature controller assigned as instruments 1 and 2 should be 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**.

Bump options:

In situations where load thermocouples are used to perform a guaranteed soak, the control TC and any enabled load TC need to be in band for the soak timer to start. However, if the load TC stays out of band due to a cold spot, the soak timer never starts - and that can be detrimental to the parts being treated. The configuration screens below allow you to "BUMP" the setpoint in the event that this happens.

Set Point Bump Time
How frequently the SP bump will try to adjust the control set point

Set Point Bump Max Change
The most the set point bump feature will change the control set point (in degrees) when it examines the condition of all of the load T/Cs

Set Point Bump Max Total
The maximum total change to the control set point that the bump feature will allow.

Notes about setpoint bump options:

- Bump is only active during GZSOAKSB opcodes.
- Bump considers only active Load TCs
- Bump can be positive or negative (i.e. bumped up or down)

Load T/C Set Point Tracking

Load T/C Set Point Tracking Scalar

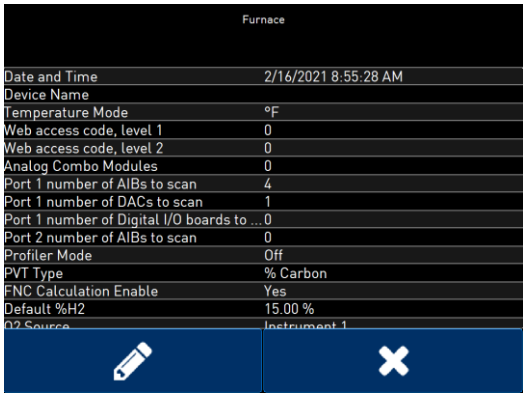
Load T/C Set Point Tracking Max Adjust

Programmer Alarm Acknowledge Event

Ramp Approach Band

Ramp Approach Rate, °/min

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 Matrix 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.**

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 Matrix Controller:

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

DO NOT ADJUST THIS SETTING WITHOUT CONTACTING SSi.

FNC Calculation Enable
Allows you to enable FNC calculation. Select "Yes" or "No."

FNC Calculation CO2 Range

Default %H2
Allows you to set the default H2 percentage for calculations. Use the numeric keypad to enter the desired value.

O2 Source
Allows you to assign the O2 measurement source.

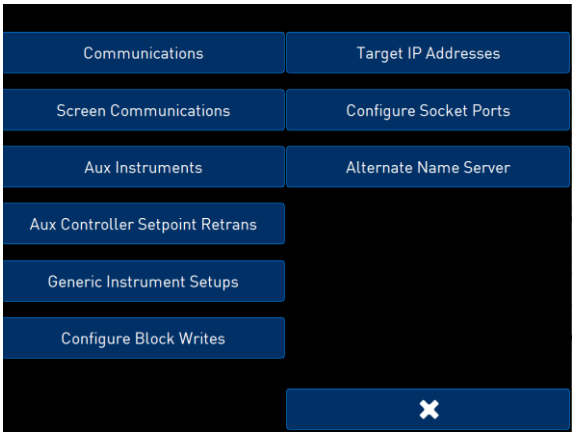
Clear Modbus Aux Data on Bad Coms: No/Yes, edge triggered/Yes, always

Enable Aux Analog Input Offset Display: Yes/No

Enable Aux Analog Input Offset Guarantee: Yes/No

Sampling System Register Enable: Yes/No

Communications



The Communications menu contains several sub-menus:

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

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.

This will identify the IP address of the controller. Please consult your Systems Administrator before changing this value as it can affect communications to the 9220 controller or to other devices on your network. This is necessary if the Touchscreen will be communicating to the 9220 over Ethernet communications. The IP address must be in the "xxx.xxx.xxx.xxx" format.

NOTE: The IP address is not typically used for communications from the touch screen to the controller, but for communications between the controller to SuperDATA modules, PLCs, etc.

IP Mask

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

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

IP Gateway

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

This will identify the IP gateway of the controller. The IP gateway must be in the "xxx.xxx.xxx.xxx" format.

RS485 Host port Baud

This will set the baud rate for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

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

RS485 Host port Mode

This will set the mode for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The options are **Modbus** and **Modbus master**

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

Address
This will set the address for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The range is **1** – **247**.

RS232 Aux 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 Aux 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 Aux, Modbus master, televac, Televac MX200, Varian,** and **Leybold**

RS232 Aux 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 Aux 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 Aux 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 Aux 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

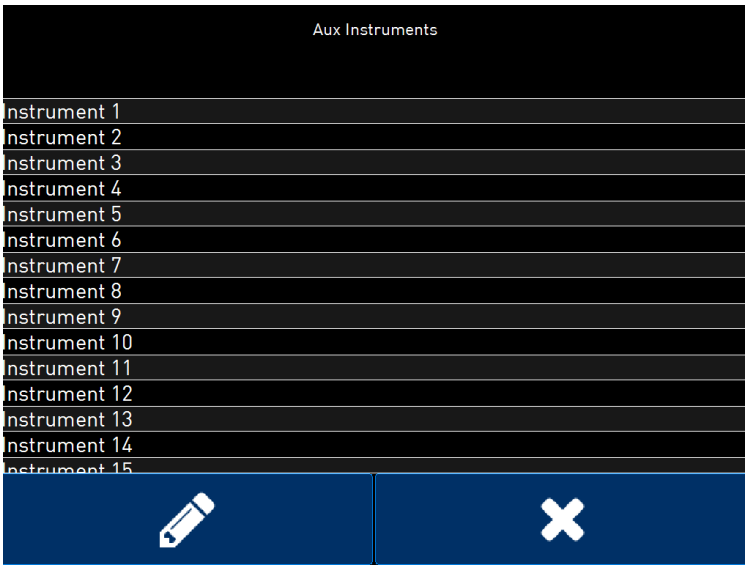
Screen Communications

Tap the top button to set the display name of the touchscreen. Use the **Media, Address**, and **Baud** settings to assign communication settings for the touchscreen.

Aux 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 Aux instruments through the Matrix Controller. To set up a Aux instrument, highlight the instrument number and click on the **Edit** button.

The list of available Aux 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.



**** All devices on the same Aux 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 Aux port and address for the device can be assigned here as well.

The **check** button will set the Aux instrument, and the **X** button will cancel the setup.

Aux Controller Setpoint Retrans
Allows the user to set a Setpoint automatically to a Aux 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.

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

Communications
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 Matrix 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 Matrix Controller. The range is **0** – **32767**.

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

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

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

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

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

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

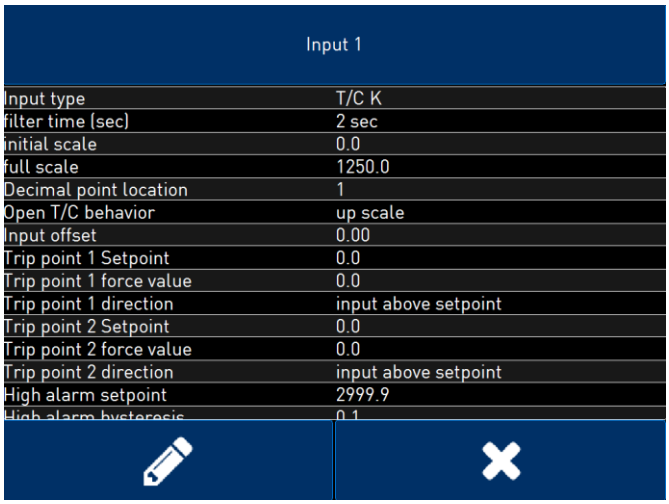
Configure Block Writes
Use the buttons to select one of the available instruments and assign the desired **Update Interval, Source Register, Destination Register**, and **Count**. This screen also displays current information for all block writes.

Target IP Addresses
This screen allows you to set up to 16 target IP addresses along with a corresponding port. Tap to highlight a row, then enter the desired IP address and port information.

Configure Socket Ports
Here you can make port assignments for your communication sockets. Tap the socket to assign an available port. This screen also displays the comm status of each socket.

Alternate Name Server
Here you can enter the IP address for an alternate name server.

Aux Instruments
This is identical to the Aux Instruments section accessible through the **Communications** screen.



Analog Input
The Matrix Controller has multiple 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
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.

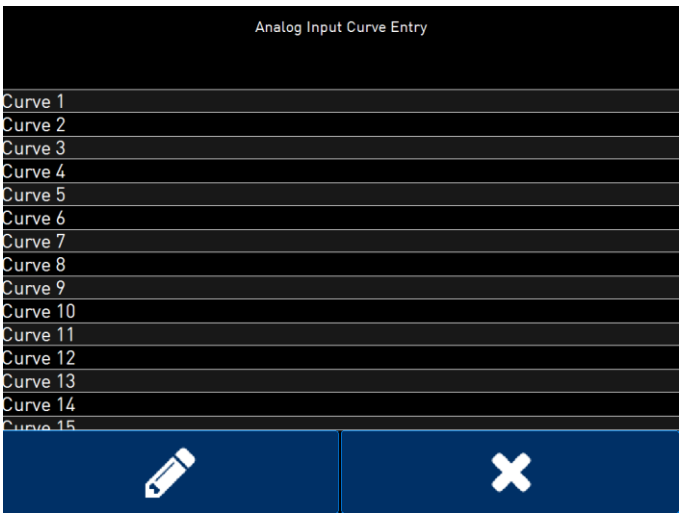
High limit alarm for control shutdown setpoint
This is the high setpoint used to shut down the PID loop if this input is selected in the PID Control shutdown inputs.

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

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

TC Correction Curve
This will allow the user to set the TC correction curve with the numeric keypad.

Custom Curve
This will allow the user to choose a custom curve if desired (see Analog Input Curve Entry section below for more information on setting up these custom curves).



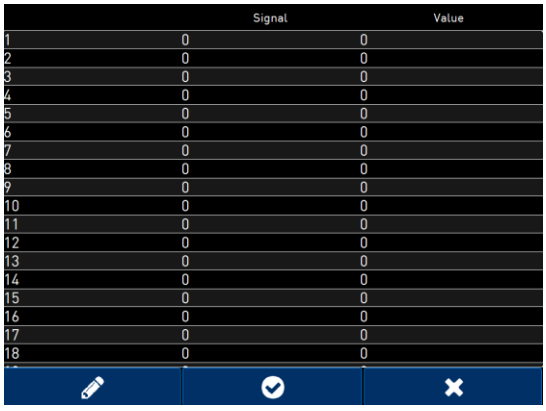
Analog Input Curve Entry

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 the separate curves that can be edited. Selecting one of **Curve 1-40** and pressing **Edit** will display the screen where new curves can be assigned.

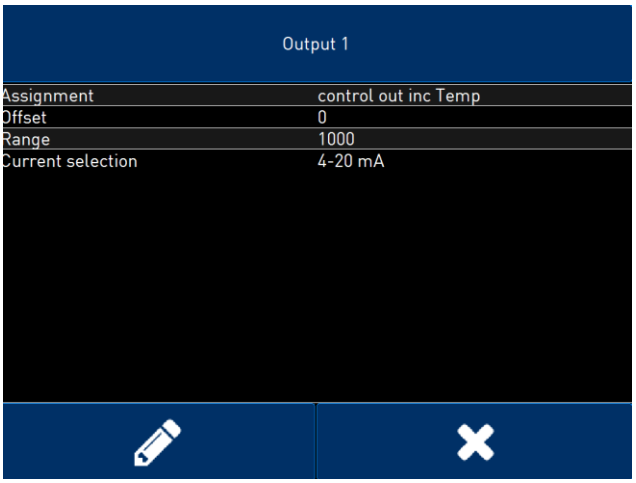
Thirty-two points can be assigned by selecting one of the points and pressing **Edit.** This allows the operator to change the **Millivolts** and the corresponding **Value** by clicking on each option. Pressing **OK** will save the point. Note that all 32 points do not need to be entered; however, the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

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



Analog Output

The Matrix Controller has the option of sixteen 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.

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

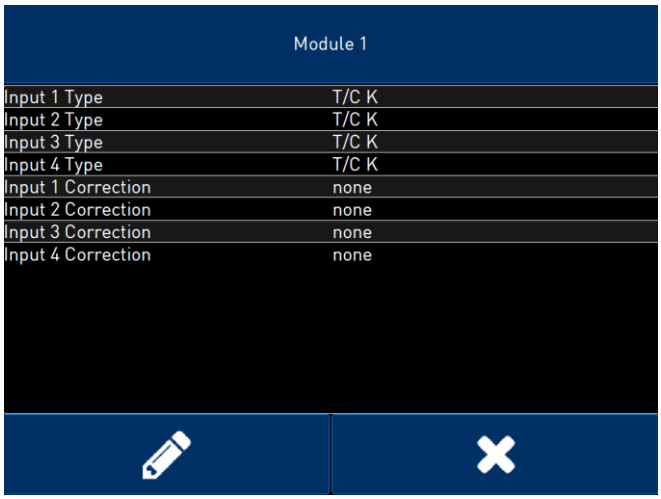
Provides the option of **4-20 mA** or **0-20 mA** control. Clicking on this value will display an input box with a drop-down list from which the user can select either of the two values listed above.

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:

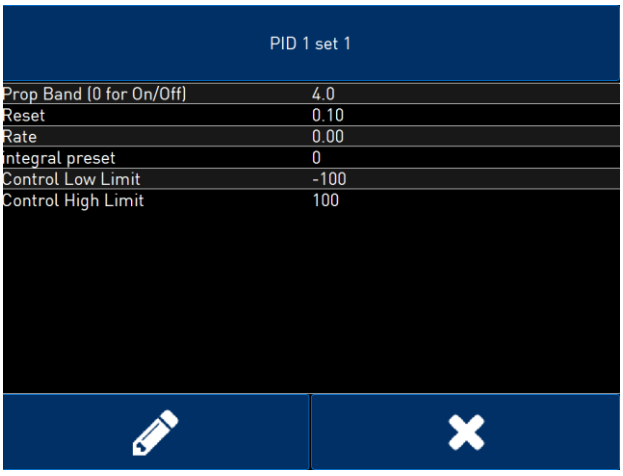
T/C B	T/C R	1.25 V	4-20mA (62)
T/C C	T/C S	160mV	625mV
T/C E	T/C T	80mV	312.5mV
T/C J	T/C D	40mV	781.25mV
T/C K	T/C G	20mV	195.3125mV
T/C N	T/C P	4-20mA (62), 10:1	
T/C NNM	2.5V	4-20mA (124)	

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**.

Analog Input Offsets

Assigns offsets to analog inputs as needed. Enter the desired offset using the numeric keypad.

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).

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

Prop Band (0 for On/Off)

Proportional Band determines the response to the current error. The Proportional Band is the percent of the range of the process variable that will produce 100% output and is the inverse of the proportional gain. A low Proportional Band value results in a larger change in output for a given error. Conversely, a high Proportional Band value results in a smaller change in output for a given error. If the Proportional Band is too small, control may oscillate or be otherwise unstable. If the Proportional Band is too large the control action may be too sluggish in response to changes within the system. Note: If the Proportional Band is set to 0.0, only on/off control is performed. The range is **–1.0** to **999.0**.

Reset

Reset determines the influence of past errors. The Reset, or integral action (expressed in repeats per minute), sums the error between the process variable and setpoint over time and adds this accumulated output to the proportional output. A "proportional only" controller generally operates with steady-state error because some error is required to produce control output. The goal of integral action is to drive the steady-state error to zero and eliminate this droop. The range is **0.00** through **10.00**.

Rate

Rate adjusts the response to future errors. The Rate, or derivative action (expressed in minutes), is used to predict system behavior and has a dampening effect. The more the controller tries to change the process variable the harder the derivative will work to counter that effort. This dampening effect can be valuable in reducing overshoot but is most often useful when trying to improve control on systems with significant and predicable lag. The range is **0.00** through **10.00**. NOTE: The rate is not typically used for carbon control.

Integral Preset

This is the integral preset value. This field provides an offset for the starting point for PID control, also referred to as "Load Line" or "Manual Reset". The range is **–100** to **100**.

Control High Limit

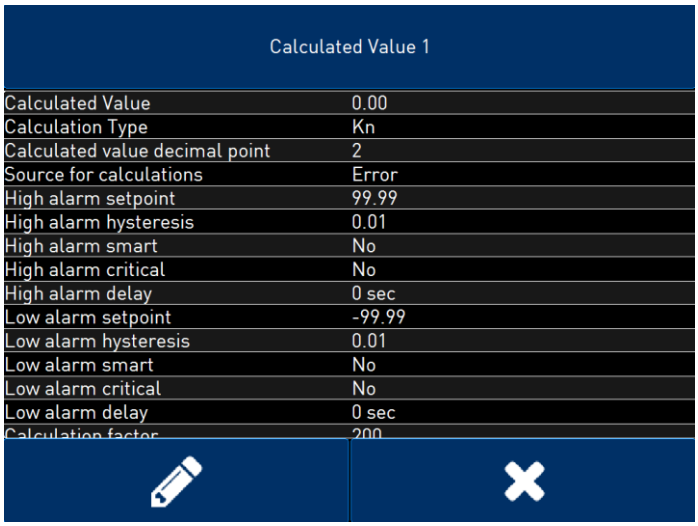
This is the high limit value. The range is **–100** to **100**.

Control Low Limit

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

Calculated Values

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



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

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

Calculated Value 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.

High Alarm 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.

High Alarm 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.

High 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.

Low Alarm 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.

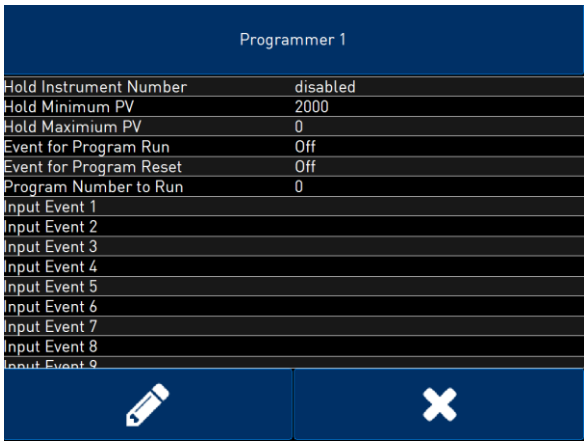
Low Alarm Critical
Critical also refers to latching. If this is set to **Yes**, then once the alarm has occurred, it will latch and stay in the alarm condition even if the calculated value return to the safe region. A critical alarm must be acknowledged to unlatch it.

Low Alarm 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

Event Hold/Reset



The Event Hold/Reset menu option provides the user manual control of actual event outputs. This is useful when testing wiring and field devices

Hold Instrument Number
Selects the Instrument that will be monitored.

Hold Minimum/Maximum PV
Selects the Max and Min PV that will trigger a hold/reset.

Event for Program Run
Selects the event (customized below) that will trigger a program to run.

Event for Program Reset
Selects the event (customized below) that will trigger a reset.

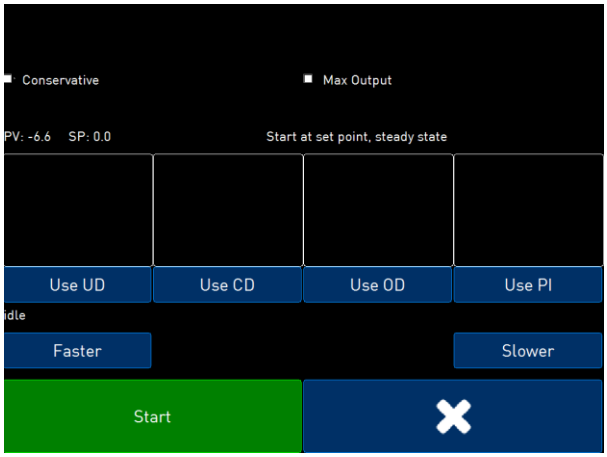
Program Number to Run
Selects the program to be run if triggered by an input event.

Input Events
Allows user to assign the events that will hold or reset recipes as set above. The options are Inactive, Active Closed, and Active Open.

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 Matrix Controller. Select the loop to tune and click on the **Edit** button to auto tune that loop.

*Note: The four buttons **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 "Max Output" option will _____

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

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

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

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

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

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

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

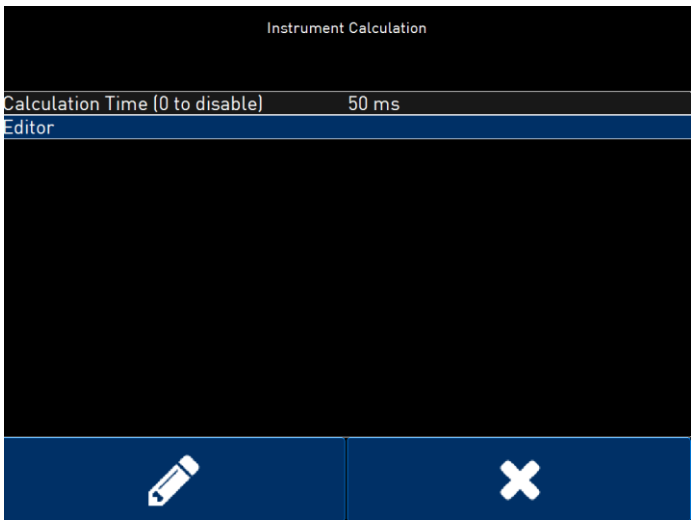
The critically damped values provide a balance between the underdamped and overdamped values with regard to time and overshoot.

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

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

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

Instrument Calculation



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

General Description

The Instrument Calculation allows for fifty (50) lines of program and fifty (50) program variables. Program variables allow for storage on intermediate results of calculations.

A program variable is designated by a v followed by a number from **0** to the number of variables – 1.
A Lower or Upper case "V" is valid, as well as leading zeroes. The following are all considered the same variable: V3, v3, v0003.

The Matrix 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 Aux 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) Aux 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 Aux instrument and must have three (3) variables separated by spaces. The first is the Aux 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.

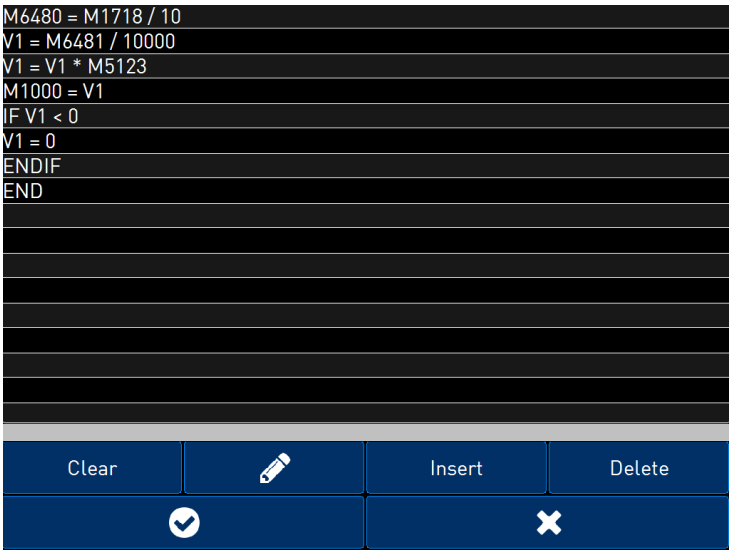
Example:
11 / 4 = 2.75
11 % 4 = 2 (The .75 will not be returned)

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.



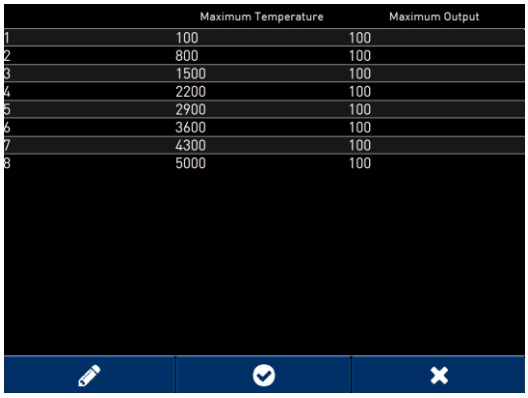
Analog Output Trim

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 use 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.



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:

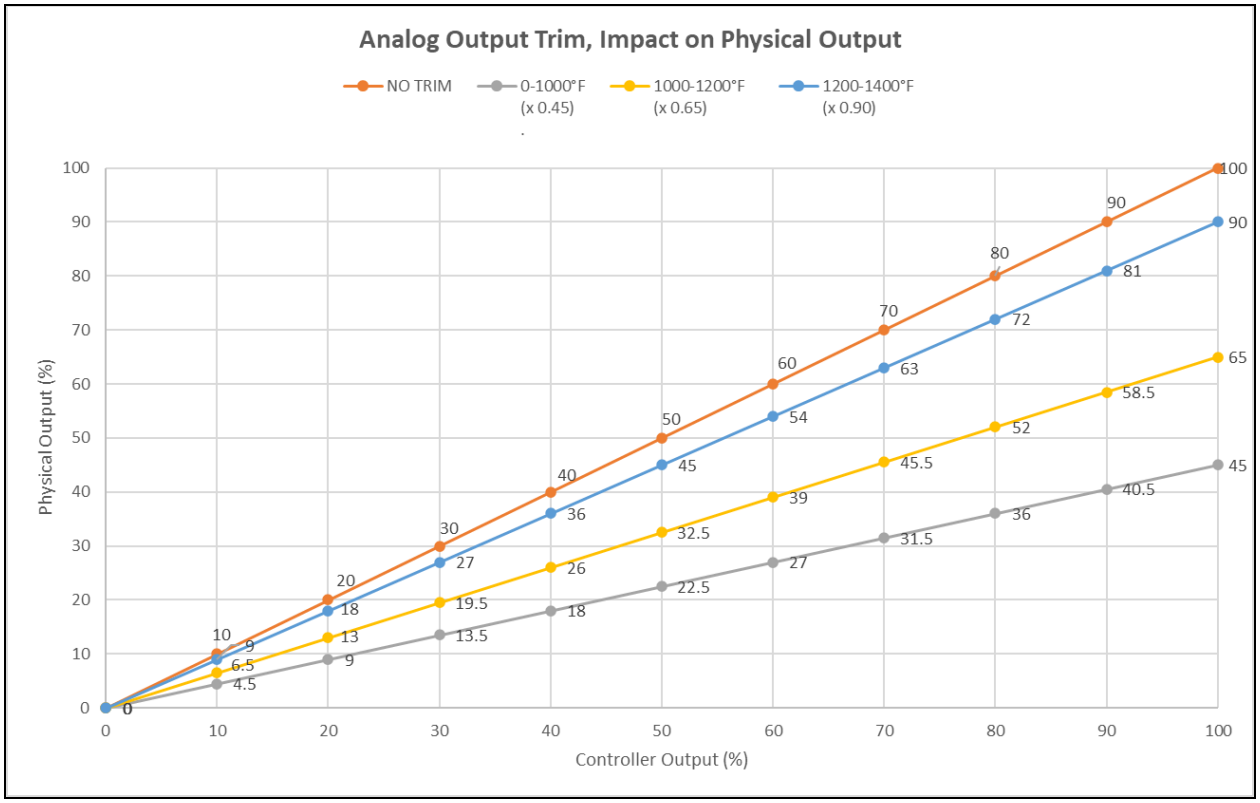
Physical Output	=	Control Output	x	Analog Output Trim

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:



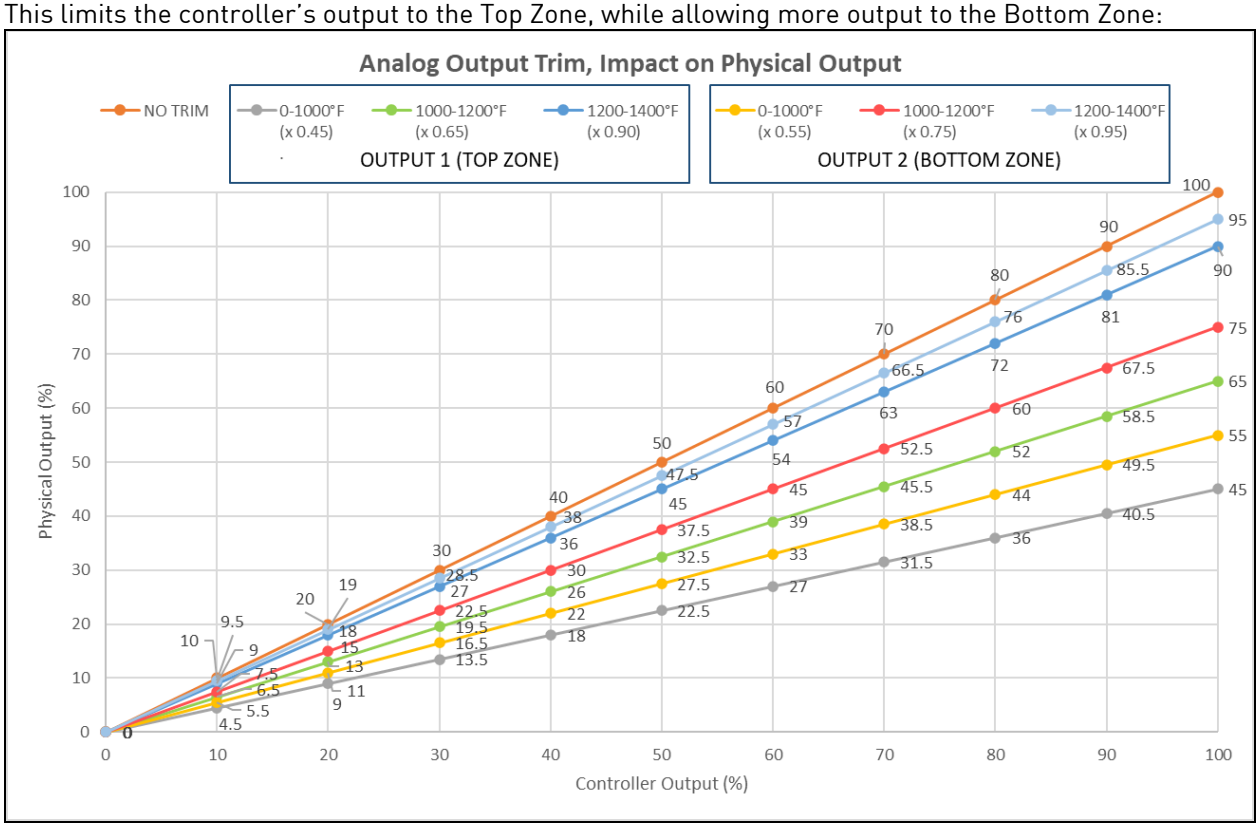
Example 2: Multi-Zone Temperature Uniformity

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):

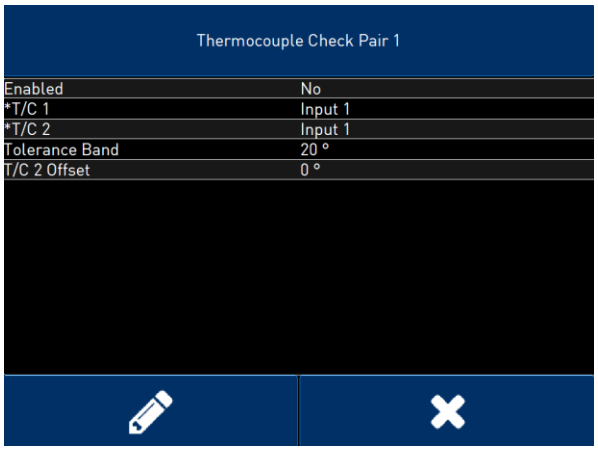
Analog Output Trim 1		
Point	Max Temp	Max Output
1	1000	45
2	1200	65
3	1400	90
4	2000	100

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

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
Aux 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
Aux 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

Tap the Probe name at top to select a different probe. For each probe the adjustable options are:

Enabled (yes or no)

Probe PV Mode:

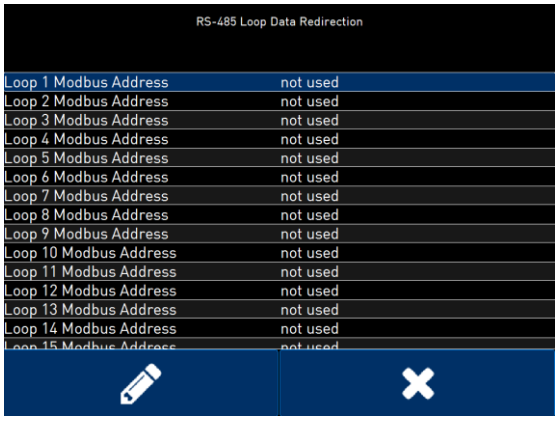
Band (mV)

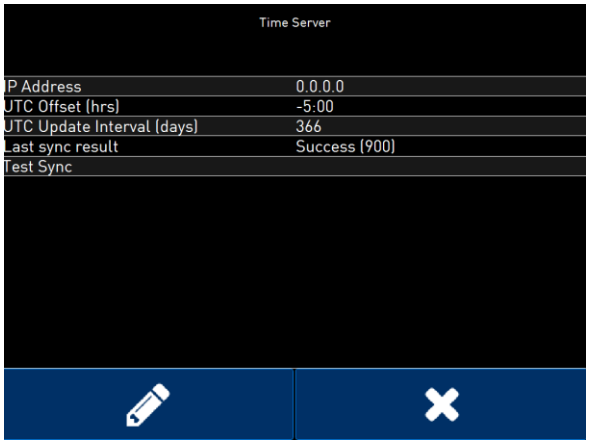
Alarm/switch delay (mins)

Probe switch mode

RS-485 Loop Data Redirection

Assigns Modbus addresses to loops and master setpoints as needed.





Time Server

This feature allows you to assign settings for a time server to ensure accurate timing on your device, as well as set necessary Time Zone adjustments and perform a sync test of the connection.

IP Address: Use this option to assign the IP address of your time server

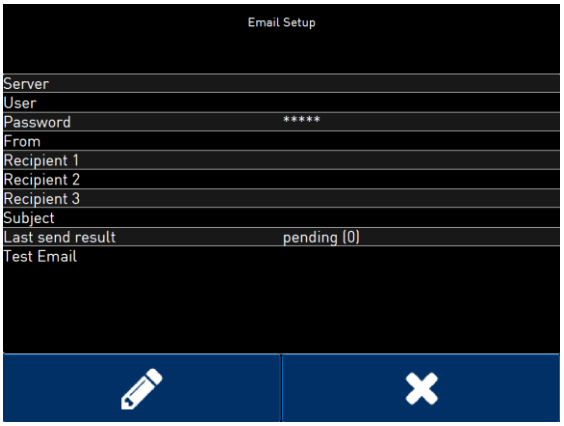
UTC Offset: Use this option to adjust your time zone from Coordinated Universal Time (Greenwich, UK) if necessary.
To determine your required offset, go to https://www.timeanddate.com/worldclock/converter.html

UTC Update Interval [days]: Use this option to set how often your device will update its time setting from your preferred time server.

Last sync result: shows the result of your last sync attempt

Test sync: performs a sync test to ensure communication with your time server

Email Setup



This feature allows you to assign settings for alert emails originating from your device, including:

Server: the server that will be used to send the email

User: the username to log into the server

Password: the password to log into the server

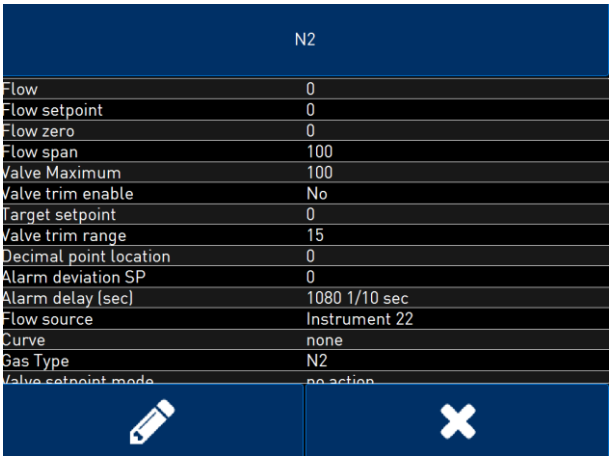
From: what will be displayed in the "From" line of emails

Recipients: who will receive emails

Subject: the default email subject line

Last send result: shows whether the most recent email was sent successfully

Test Email: this option will send a test email based on the above settings.



Valve Setup

This feature allows you to adjust settings for the various valves associated with the device. Tap the top button to select the desired valve you will change settings for.

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, Aux 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_3**, **misc**, **Endo**, **N_2**, and **CO_2**.

Valve setpoint mode
Determines what area of the system will be tracked to control the valve. Options are: **no action, track total flow, track NH_3, track Atmosphere Loop Output forward, track Temperature Loop Output forward, track Loop 3-16 Output forward, track Atmosphere Loop Output reverse, track Temperature Loop Output everse,** and **track Loop 3-16 Output reverse**

Valve setpoint tracking %
Sets what percentage that the Valve setpoint mode will factor into valve control.

Control output device
Determines how output will be controlled. Options are **no action** and **stepping motor control**.

Low Flow SP
Adjusts the setpoint for low flow levels.

Normal Flow SP
Adjusts the setpoint for normal flow levels.

Flow Gain
Controls the valve speed

Flow Control Out
View only. This is the Matrix's %Output for the valve control.

Flow Control Run
View only. This is the Matrix's Run Command (Stop, Run) for the valve if it is a stepper-style valve motor.

Flow Control Direction

(View only) If the controller has control of the valve, this is the Direction Command (Open/Closed) for the valve if it uses a Stepper style valve motor.

Open Limit Switch Assignment and **Close Limit Switch Assignment**
These options allow the user to set what factors will influence the opening and closing action of the valve. Options are:

None	Alarm	Outputs 15-96
Process start	Alarm Horn	
Alarm silence	Emergency Purge	
Retort not overtemp	Process N2 On	
800°	N2 Flowing	
1400°	N2 Timer Done	
Nitrogen Pressure	Methanol On	
Process Nitrogen Flowing	Methanol Flowing	
Emergency Purge	Probe BO	
Fce Open/High Flow	Heat	
Recirc Fan Running	Cool	
Pilots On	Air On	
Emergency Nitrogen Flowing	Natural Gas on	
Inputs 13-23	Ammonia on	

Minimum Flow Shutdown Timer

Minimum % (1%-94% valid) for Variable Gain

Minimum Gain at Minimum %

Vacuum Gauge Setup (16220 only)

This feature allows you to adjust settings for the various vacuum gauges associated with the device. Tap the top button to select the desired gauge you will change settings for.

Enabled
Enables or disables the gauge. Options are **Yes** or **No**.

Source
Selects the source of the gauge.

Type
Selects the gauge type.

Gas
Selects the gas.

Units
Selects the units that the source will be measured in.

Display Units
Selects the units that will be displayed on the Control Screen.

Zero
Sets the desired low end or the gauge.

Span
Sets the desired high end for the gauge.

Gas Calibration Factors – sets Calibration Factors for various gases. For assistance, contact SSi.

Televac Configuration

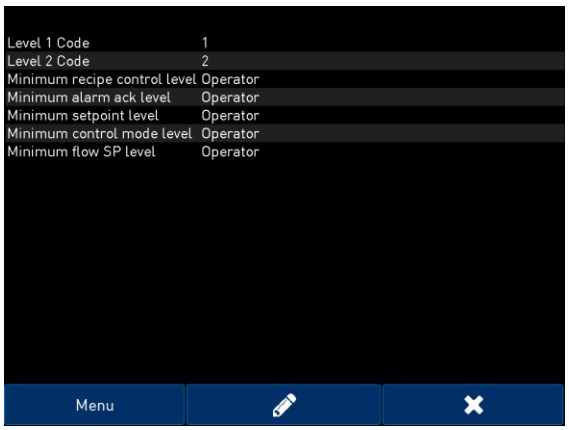
Allows the user to enable and adjust settings for Televac gauges, relays, and channel assignments.

Security

Allows the user to set the Supervisor and Administrator Passcodes.

In addition, you can quickly set minimum levels of access for Recipe Control, Alarm Acknowledge, Setpoint adjustment, Control Mode adjustment, and Flow Setpoint adjustment.

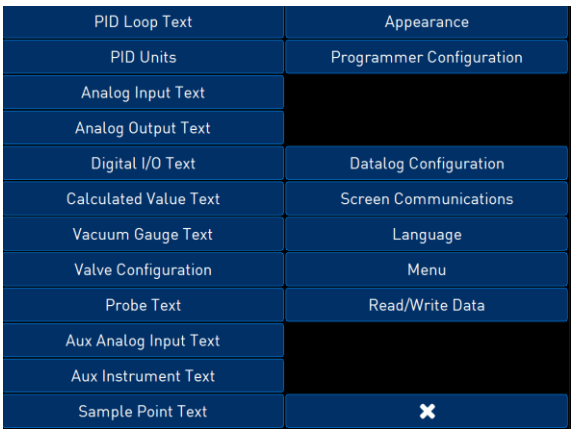
Finally, by tapping "Menu" you can customize all the available menu options for your own security levels as needed.



Configuration

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

PID Loop Text
PID Units
Analog Input Text
Analog Output Text
Digital I/O Text
Calculated Value Text
Vacuum Gauge Text
Probe Text
Aux Analog Input Text
Aux Instrument Text
Sample Point Text



The Configuration menu also includes:

Valve Configuration
Allows you to enable and disable available valves for display. Tap the swtich to enable the valve, and tap the button to change the valve display text.

Appearance
Allows you to customize your main display by selecting or deselecting various optional datapoints. Tap a checkbox to activate that item.

Programmer Configuration
This feature allows you to change display text for the two programmers, as well as adjust technical settings for each programmer.

Programmer Name
Here you can change the display name for Programmer 1 and Programmer 2. Tap to highlight, tap edit, and enter the desired text.

Input Events
Here you can change the display text for 32 input events. Tap the top button to select a programmer, then tap to highlight an Input Event, tap edit, and enter the desired text.

Output Events
Here you can change the display text for 32 output events. Tap the top button to select a programmer, then tap to highlight an Output Event, tap edit, and enter the desired text.

User Alarms
Here you can change the display text for 100 user alarms. Tap the top button to select a programmer, then tap to highlight a User Alarm, tap edit, and enter the desired text.

PLC Alarms
Here you can change the display text for 160 PLC alarms. Tap the top button to select a programmer, then tap to highlight a PLC alarm, tap edit, and enter the desired text.

Programmer Configuration
Here you can change the settings for individual programmers. See the Programmer Configuration section for these features.

Common Configuration
Here you can change display settings that the two Programmers have in common. Tap any of the following options and use the ensuing keypads to adjust text or settings as desired: **Atm Name, Atm Units, Temp Name, Temp Units, Output Events, Input Events, PIDs, Load T/Cs, Aux Load T/Cs, Aux Instruments, Flowmeters, Vacuum Gauges, Televac Gauges.**

Step Configuration
Here you can include and exclude various opcodes from use in recipe programming. First, tap the top button to select a programmer. You will see a list of Included and a list of Excluded opcodes (all opcodes are included by default). To exclude an opcode, highlight it, then tap the right arrow button to move it to the list of excluded opcodes. Likewise, to include an opcode that is on the "Excluded" list, tap to highlight, then tap the left arrow button to move it back to the "Included" list. Tap check to save and X to cancel changes.

Segment Configuration
Here you can include and exclude various opcodes from use in recipe programming, and make various adjustments specific to segment functionality. First, tap the top button to select a programmer. You will see a list of Included and a list of Excluded opcodes (all opcodes are included by default). To exclude an opcode, highlight it, then tap the right arrow button to move it to the list of excluded opcodes. Likewise, to include an opcode that is on the "Excluded" list, tap to highlight, then tap the left arrow button to move it back to the "Included" list.

In addition, use the other buttons above the lists to adjust **Rate DP** and **Options**, and enable/disable settings for **Atmosphere** and **M:ss Soak**.

Tap check to save and X to cancel changes.

Recipe Configuration

Here you can set how users will access recipes – by number, by name, or from a database. Within this screen you can also Compact the database, which will free up extra space and speed up communications with the database.

Datalog Configuration

Allows you to assign registers to various data for the purposes of datalogging, as well as adjusting the text for that logged data.

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 Aux 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.

Menu

From this screen you can customize all the available menu options for your own security levels as needed.

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 Ret urn button to return to the Configuration menu.

Totalizers

The Totalizers option allows you to set 25 totalizers. To edit, tap to highlight a numbered Totalizer from the list, then tap the edit button.

From the Edit page, you can set the Source, Internal register source, Full scale units of energy, Cost decimal place, and Cost per unit of energy, using the corresponding buttons. You can also toggle the following options using the switches:

- Use Internal Register as Multiple
- Frequency: Repeats per minute
- Frequency: Repeats per hour

To cancel all existing changes to a Totalizer, tap "Reset."

Tap X to return to the Totalizers menu.

T/C Correction Curves

The T/C Correction Curves option allows you to create 7 correction curves, each with up to 35 signal points. To create, tap to highlight a numbered row, then tap the Edit button. On the ensuing screen, set the Signal and Value using the buttons and numeric keypads. When finished, tap OK to save and X to cancel without saving.

Multi input PID Sources

This option allows you to create 3 groups of inputs to drive your PID loops. To create a group, tap to highlight a row from the list, then tap the Edit button.

Tapping a "Type" button will allow you to set the group type. Options are: not used, low value, high value, average value, and register value. Tap OK to save choice, and Tap X to return without saving.

Tapping an "Inputs" button will allow you to select the available inputs to be included in this group. Tap the switches to toggle on and off. Tap OK to save choices, and tap X to return without saving.

The "Output" lines on the list will display the output of any assigned groups.

Tap X to return to the main menu.

Redundant T/C Setup

The Redundant T/C Setup option allows you to customize settings for any redundant T/Cs on your system. Tap a list item to highlight, then tap Edit to change settings.

The T/C 1 and T/C 2 items will allow you to assign inputs for the two Redundant T/Cs.

The Band and Delay Time options allow you to assign the desired settings using the numeric keypad.

The Select Mode option allows you to choose between highest, lowest, and manual.

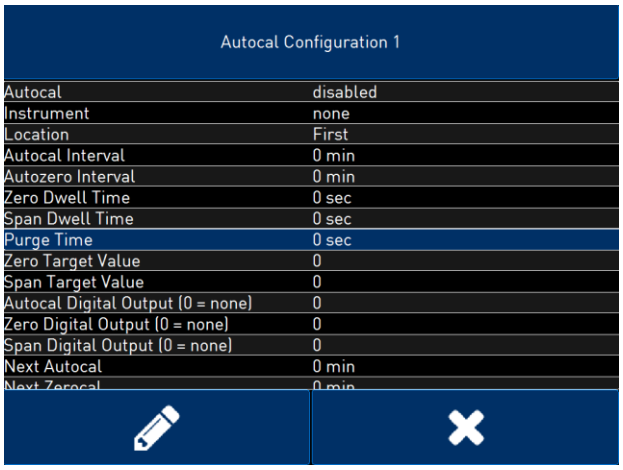
T/C Selection allows you to select between the two T/C configured on this page.

Digital Input Selection can be set to Enabled or Disabled.

Tap X to return to the main menu.

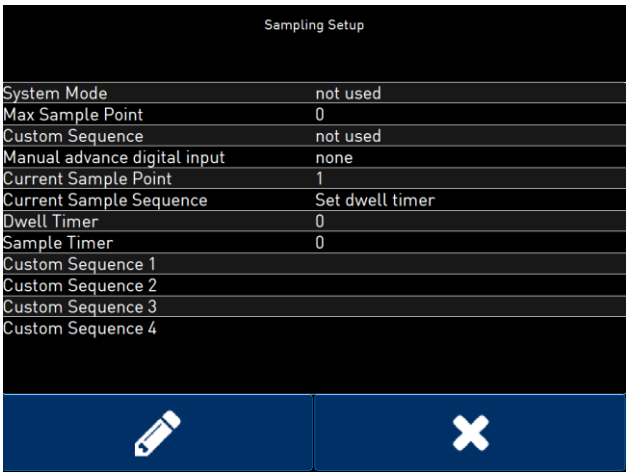
Autocal Setup

Contact SSi for assistance with this function.



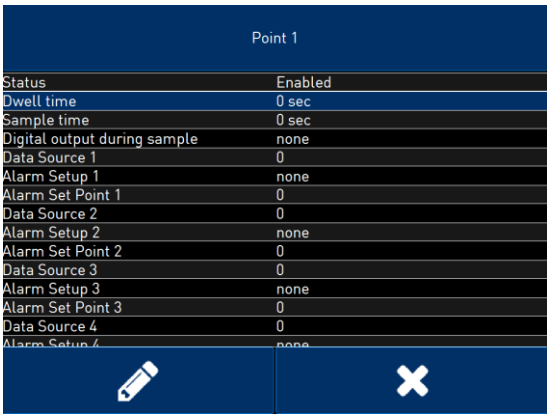
Sampling Setup

Contact SSi for assistance with this function.



Sample Point Setup

Contact SSi for assistance with this function.



Chapter 3 - Aux Instrument Mapping

The following tables can be used as a reference for retrieving information such as the PV, setpoint, etc from a Aux instrument. The Aux 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:

Base Offset = (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 Aux 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 Aux 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 Aux 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_2

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
Assumes Loop 1 =	61	11062	1	1	Probe Millivolts
Atmosphere	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	11	123	1	1	Temperature Controller Actual
(Modbus Mode)	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	2	2	1	1	Temperature Controller Actual
(Modbus Mode)	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	1	0	10	10	Temperature Controller Actual
(Modbus Mode)	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	18	17	8	8	Temperature Controller Actual
(Modbus Mode)	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	18	17	8	8	Temperature Controller Actual
(Modbus Mode)	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
Assumes Loop 2 is Temperature	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 Aux	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 Aux	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 Aux or E Aux	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	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 Loop 2	26	1025	1	1	Temperature Controller Actual
(Modbus Mode)	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	51	1049	1	1	Temperature Controller Actual
(Modbus Mode)	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	*No Value Available*

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
UMC 800 Loop 1	0	64	1	1	PV Actual
All Values are	4	68	1	1	Working Setpoint
Floating Point	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	*No Value Available*

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	*No Value Available*

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	*No Value Available*

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	*No Value Available*

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

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
PLC5DF1	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
SLKDF1	10	110	1	1	Events Actual
RS-232	0	100	1	1	Events Setpoint
	15	115	1	1	Events Input

Temperature Value Column	Atmosphere Value Column	Option Value Column

AB_SOAK

N/A	N/A	Soak Time

This sets a soak time for an autoboost 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 autoboost 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

This is a guaranteed soak opcode. 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 Wait Limit is the wait time, in Hours: Minutes format, for the wait limit. The Hours range from 0 – 533, and the Minutes range from 0 – 59.
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.

GDELAY

N/A	N/A	Delay Time

This opcode is a guaranteed short delay. It guarantees on the temperature loop unless the load TCs are enabled, in which case it guarantees against the load TC map for the specified number of seconds.
The Delay Time is from 1 – 500 seconds.

GHDELAY

N/A	N/A	Delay Time

This opcode is a guaranteed high short delay opcode. The temperature process value must be below the high limit deviation band to allow the delay timer to run. If the temperature process value goes out of the deviation band, then the delay 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.

GHSOAK

N/A	Wait Limit	Soak Time

This is a guaranteed soak high opcode. The temperature process value must be below 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 Wait Limit is the wait time, in Hours: Minutes format, for the wait limit. The Hours range from 0 – 167, and the Minutes range from 0 – 59.
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.

GHZDELAY

N/A	N/A	Delay Time

This is a guaranteed high short delay opcode for a zone. The temperature process value must be below the high limit deviation band to allow the delay timer to run. If the temperature process value goes out of the deviation band, then the delay 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.

GHZSOAK

N/A	Wait Limit	Soak Time

This is a guaranteed soak high opcode for a zone. The temperature process value must be below the high limit 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 Wait Limit is the wait time, in Hours: Minutes format, for the wait limit. The Hours range from 0 – 533, and the Minutes range from 0 – 59.

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.

GLDELAY

N/A	N/A	Delay Time

This opcode is a guaranteed low short delay opcode. The temperature process value must be above the lower limit deviation band to allow the delay timer to run. If the temperature process value goes out of the deviation band, then the delay 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.

GLSOAK

N/A	Wait Limit	Soak Time

This is a guaranteed soak low opcode. The temperature process value must be above the lower limit 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 Wait Limit is the wait time, in Hours: Minutes format, for the wait limit. The Hours range from 0 – 533, and the Minutes range from 0 – 59.
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.

GLZDELAY

N/A	N/A	Delay Time

This is a guaranteed low short delay opcode for a zone. The temperature process value must be below the deviation band to allow the delay timer to run. If the temperature process value goes out of the deviation band, then the delay 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.

GLZSOAK

N/A	Wait Limit	Soak Time

This is a guaranteed soak low opcode for a zone. The temperature process value must be above the lower limit 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 Wait Limit is the wait time, in Hours: Minutes format, for the wait limit. The Hours range from 0 – 533, and the Minutes range from 0 – 59.
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.

GOSUB

N/A	N/A	Recipe Number

The go to subroutine opcode is used to call a program to run and then return to the calling program. This is used to execute standard routines that can be used by many programs. *GOSUBs* can be stacked up to eight (8) levels.
The Recipe Number is the recipe (program) to run. The range is 1 – 300.

GRAMP

Temperature Setpoint	Atmosphere Setpoint	Time

This is a guaranteed ramp opcode. The process value must be within the deviation band to allow the ramp timer to run. If the process value goes out of the deviation band, then the ramp timer will stop and wait until the 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) – **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

Delay Time **T/C** **Option**

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

N/A **N/A** **Soak Time**

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

N/A **N/A** **Delay Time**

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

Temperature Setpoint **Atmosphere Setpoint** **Time**

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

Temperature Setpoint **Atmosphere Setpoint** **N/A**
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
Temperature PO Value **Atmosphere PO Value** **N/A**
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
N/A **N/A** **N/A**
This opcode increments the integer ID number by one.

ID_INQ
ID Number Value **N/A** **Option**
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
ID Number Value **N/A** **N/A**
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
Input Value **Input** **Option**
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
N/A **N/A** **Recipe Number**
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
N/A **N/A** **Time Limit**

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

N/A	Millivolt Level	Option

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

N/A	N/A	N/A

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

Loop 2	Loop 1	Loop 3

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

Value	Write Location	Option

This opcode will set specially configured values in a Aux 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

Temperature PO Value	Atmosphere PO Value	Option

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

N/A	N/A	Recipe Number Recipe Step Recipe Programmer

This opcode direct the controller to begin a new recipe, at the selected step, in the current Matrix 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 Matrix 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

N/A	Transfer Time (Seconds)	N/A

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

Temperature Setpoint	N/A	N/A

This is the quench setpoint opcode. The Temperature Setpoint is the setpoint for a quench cycle. The range is **-301** (disable) – **30000**.

QUENCH

Temperature	Time	Speed

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 Aux instrument in the Aux 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**

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**

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_AUX
Recipe Number Recipe Step Aux Instrument
This opcode will start a recipe on the specified Aux SSI recipe programmer instrument.
The Recipe Number is the program number to start on the Aux instrument. The range is 1 – 300.
The Recipe Step is the program step to start on in the Aux instrument. The range is 1 – 24.
The Aux Instrument is the Aux instrument to select to start the recipe on (SSi recipe programmers only).
The options are: 1 – 25.

SET_AUX
Setpoint Value N/A Aux 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 Aux Instrument is the Aux 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
This opcode is used to set the CO factor or the H_2 factor of the atmosphere controller. If the atmosphere type for the loop is set to dew point then the H_2 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 NH3 +, 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
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 Aux 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 Matrix 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 **Aux** **Option**

This opcode will check a Aux instrument for a specific process variable value, and wait until the PV from the Aux instrument matches.
The Process Variable is the PV to check. The range is **-301** (disable) – **32000**.
The Aux is the Aux 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

Temperature Level	N/A	Option

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 S*ET_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

N/A	Delay Time	Option

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

N/A	N/A	Time

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

Temperature Level	N/A	Option

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 S*ET_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.

Z_SETPT

Temperature Setpoint **Atmosphere Setpoint** **Option**

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 –Calibration

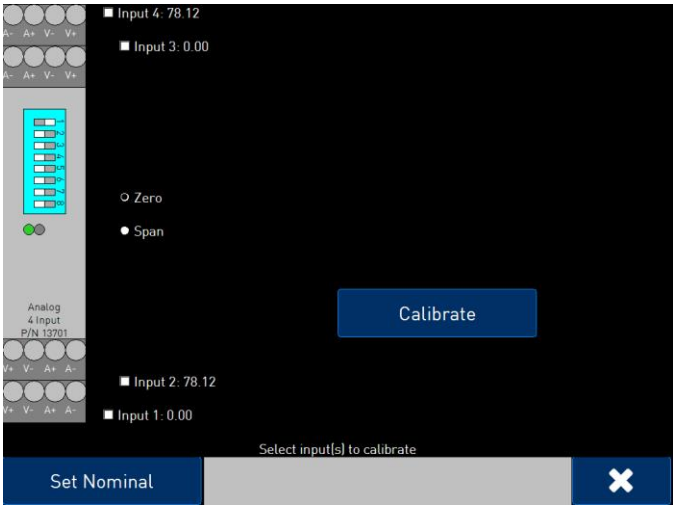
This menu option allows the operator to calibrate each input on a Matrix module.

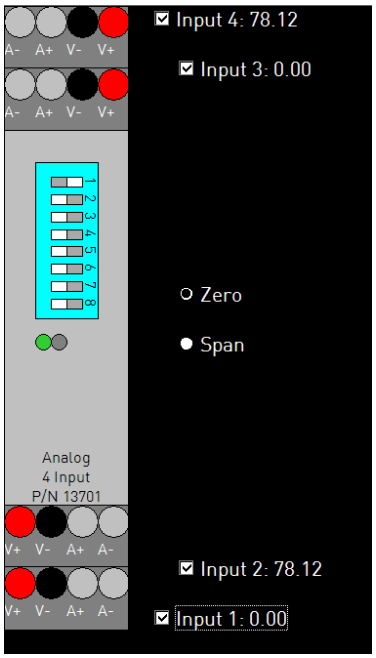
Calibrate Analog Inputs

The example below is for the 13701 4-analog input module.

NOTE: Use the Analog Input Type Setup function to set Analog Input Types prior to calibration.
Highlight "Calibrate Analog Inputs" from the first Calibration screen and tap . Select the module you want to calibrate from the list and tap .

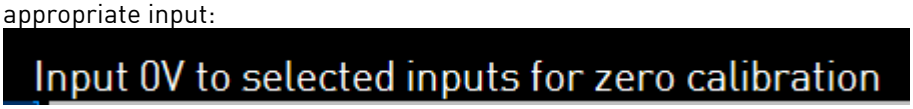
The main calibration screen includes a diagram of the selected module, checkboxes representing each input, and a Zero/Span selector. The inputs will also display readings if applicable.





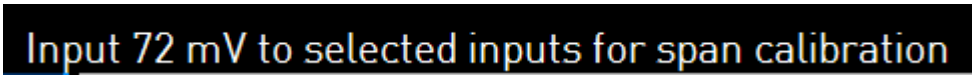
Tapping the input name will select the checkbox. It will also highlight the connections to be used for calibrating the inputs as shown.
NOTE: Only inputs with like ranges can be calibrated simultaneously.

Select the inputs to calibrate. The screen will now direct you to source the appropriate input:



Connect as directed. Make sure that "Zero" is selected (always run Zero Calibration before Span Calibration) and tap "Calibrate" to begin.
The progress bar and countdown will display the progress of the calibration.

When completed, select "Span." The screen will now direct you to source the appropriate span input:



Connect as directed and tap "Calibrate" to begin.

The progress bar and countdown will display the progress of the calibration.

When completed, check that your readings are accurate. If readings seem significantly off, it may be beneficial to use the "Set Nominal" feature. This will restore factory defaults and allow you to attempt a new calibration.

After completing the Analog Input Calibration, perform an analog input trim as follows:

Trim Analog Inputs

NOTE: Use the Analog Input Type Setup function to set Analog Input Types prior to calibration.

Highlight "Trim Analog Inputs" from the first Calibration screen and tap  . Select the module you want to calibrate from the list and tap  .

The main trim screen is similar to the main calibration screen, with the addition of a "Enter Signal" button.

Tapping the input name will select the checkbox. It will also highlight the connections to be used for trimming the inputs as shown (these should already be connected if you just performed a zero/span calibration).

NOTE: Only inputs with like ranges can be trimmed simultaneously.

Select the inputs to trim. Tap "Enter Signal" and select the source you will be inputting. When ready, tap "Calibrate" to begin.

The progress bar and countdown will display the progress of the calibration.
Repeat as needed for all desired inputs.

When completed, check that your readings are accurate If readings seem significantly off, it may be beneficial to use the "Set Nominal" feature.

Appendix B – Guide to Building a Recipe using the Step Programmer

The SSi Matrix Controller is a multi-loop programmable recipe controller. The Matrix 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 Matrix 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 Matrix 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.

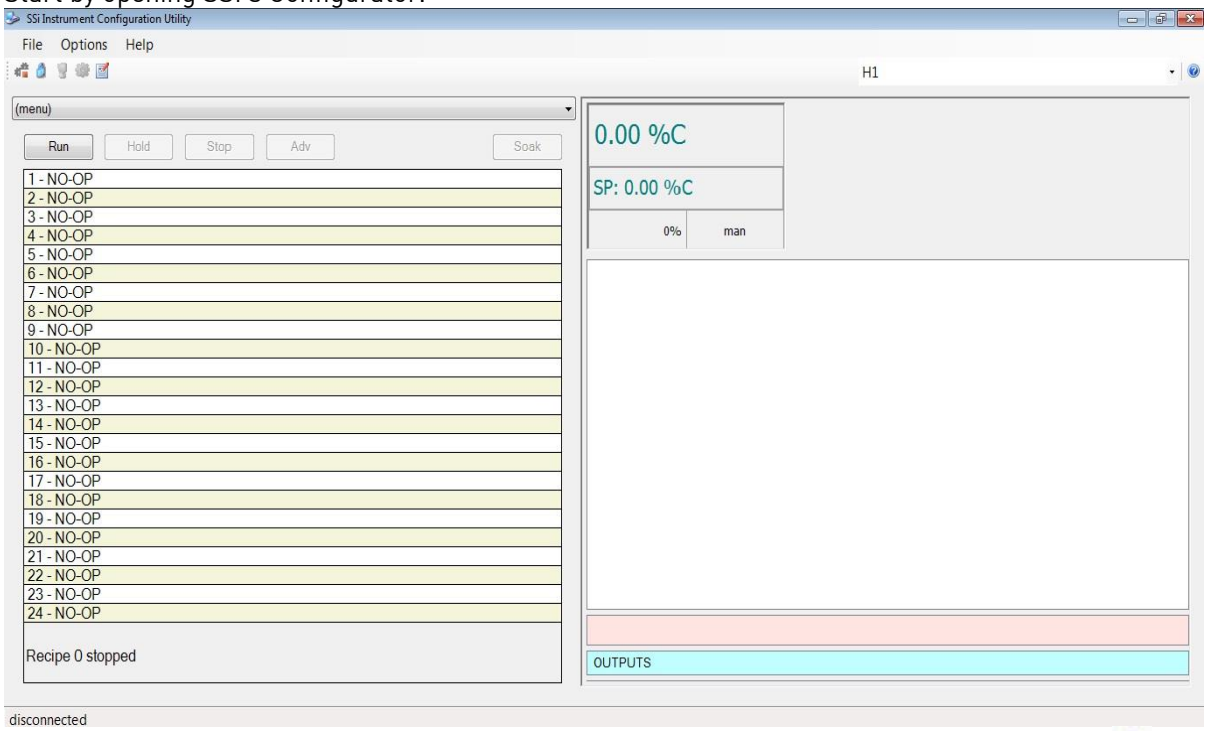
7) The controller is now starting its Soak Timer in Step 7. The work will soak for 30 minutes. Once the Soak Timer has completed, the recipe will continue to Step 8.

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 being 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

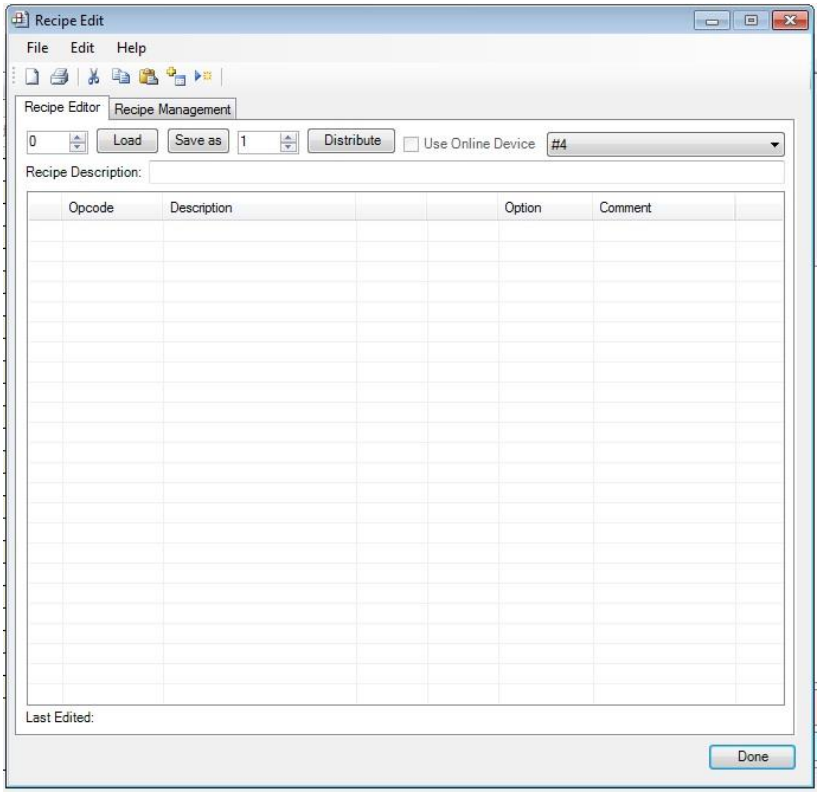
Start by opening SSI's Configurator.



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.

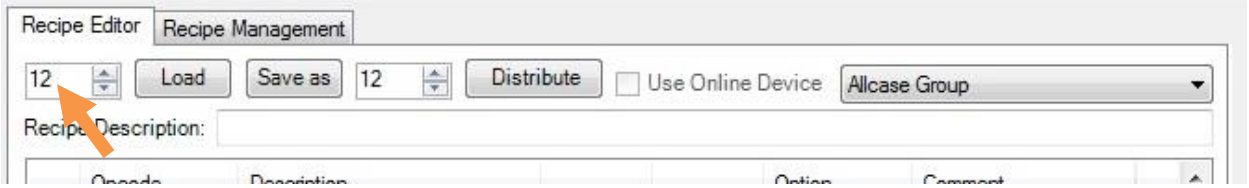
To start to build or modify recipes, click the Recipe Editor icon  in the upper left hand corner of the screen.

The Recipe Editor will open.

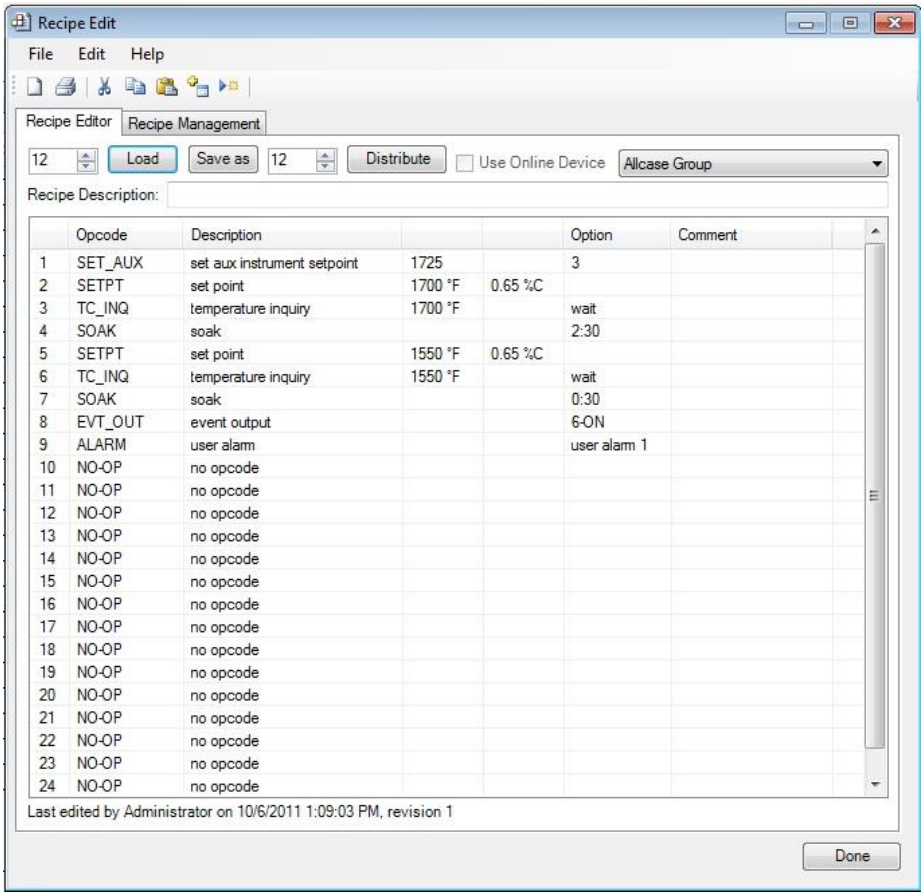


First, start by choosing the correct Recipe Group. To do this, click the drop down box near the upper right hand corner of the screen.

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.

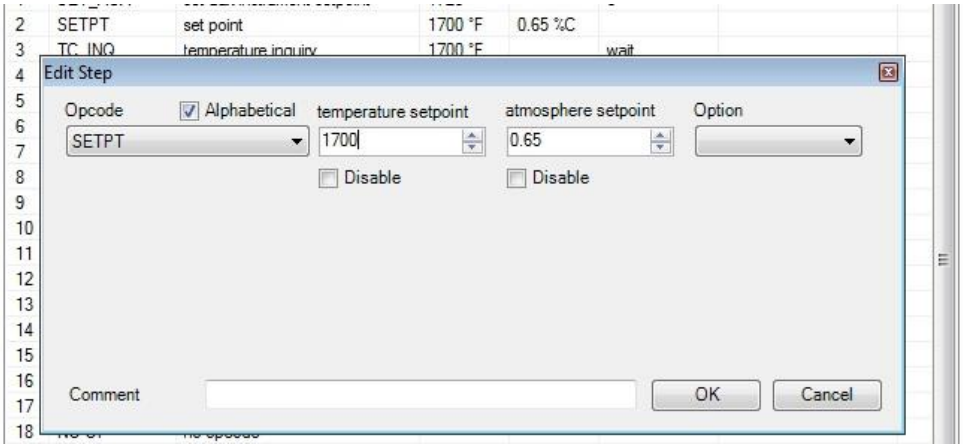


Once the correct recipe number is selected, click the Load button. If a recipe has already been created under that recipe number, it will appear in the Recipe Box. If a recipe has not yet been created, the Recipe Box will remain empty. In the example seen below, a recipe has already been created for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

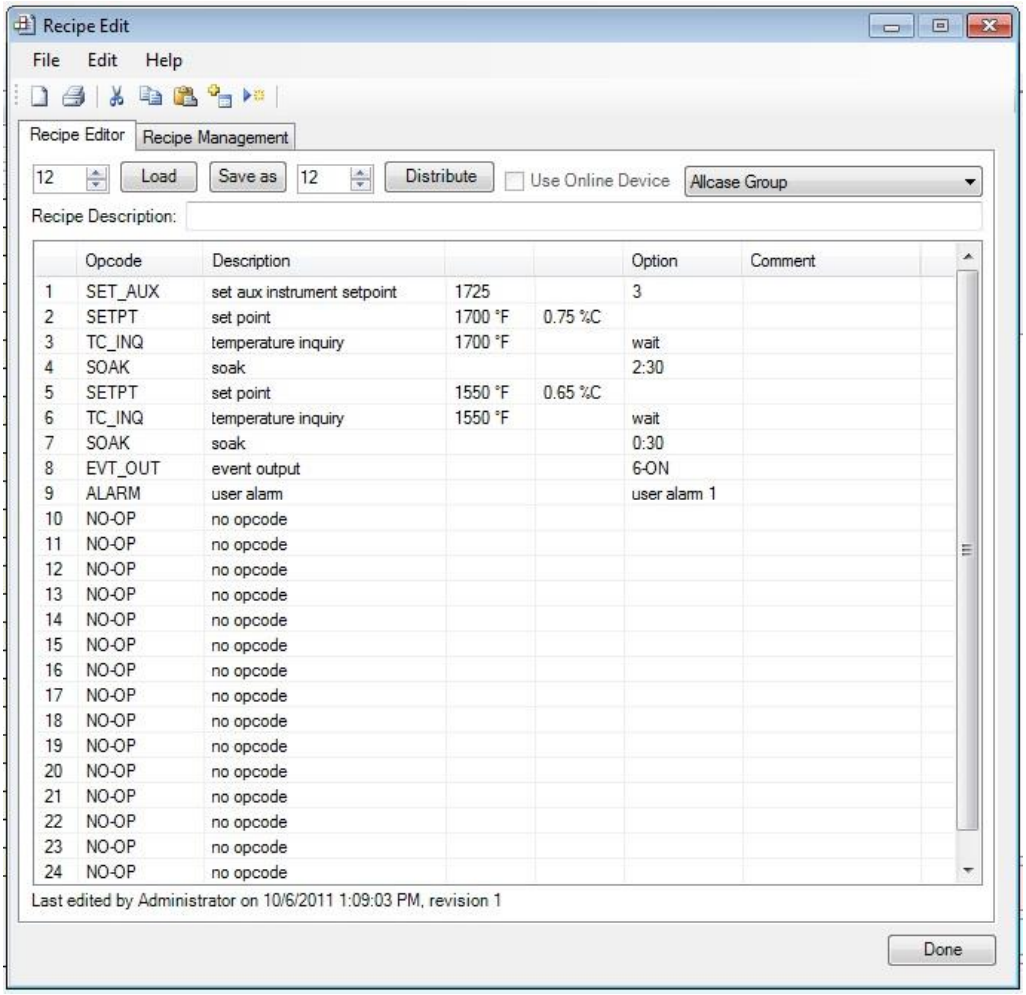


	Opcode	Description			Option	Comment
1	SET_AUX	set aux instrument setpoint	1725		3	
2	SETPT	set point	1700 °F	0.65 %C		
3	TC_INQ	temperature inquiry	1700 °F		wait	
4	SOAK	soak			2:30	
5	SETPT	set point	1550 °F	0.65 %C		
6	TC_INQ	temperature inquiry	1550 °F		wait	
7	SOAK	soak			0:30	
8	EVT_OUT	event output			6-ON	
9	ALARM	user alarm			user alarm 1	
10	NO-OP	no opcode				
11	NO-OP	no opcode				
12	NO-OP	no opcode				
13	NO-OP	no opcode				
14	NO-OP	no opcode				
15	NO-OP	no opcode				
16	NO-OP	no opcode				
17	NO-OP	no opcode				
18	NO-OP	no opcode				
19	NO-OP	no opcode				
20	NO-OP	no opcode				
21	NO-OP	no opcode				
22	NO-OP	no opcode				
23	NO-OP	no opcode				
24	NO-OP	no opcode				

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.

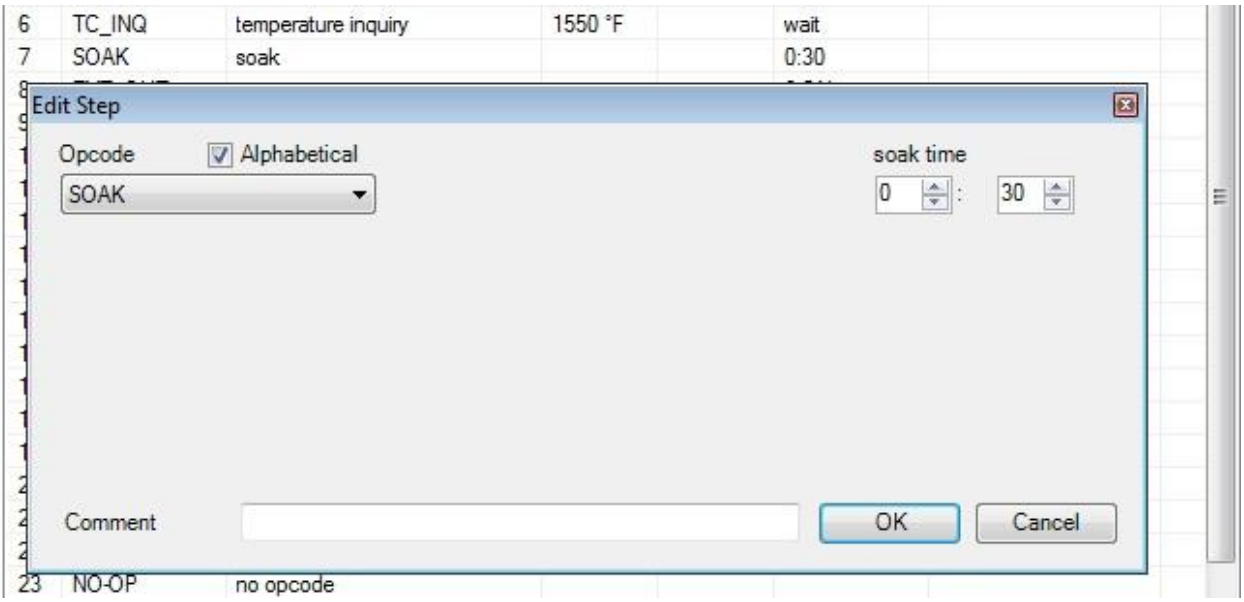


Under the Atmosphere Setpoint text in the upper middle portion of the Edit Step box, there is a numeric entry box. To modify this setpoint, either the Up or Down arrows can be pressed, or the desired atmosphere level can be entered into the box from a keyboard. Once the correct setpoint has been entered,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

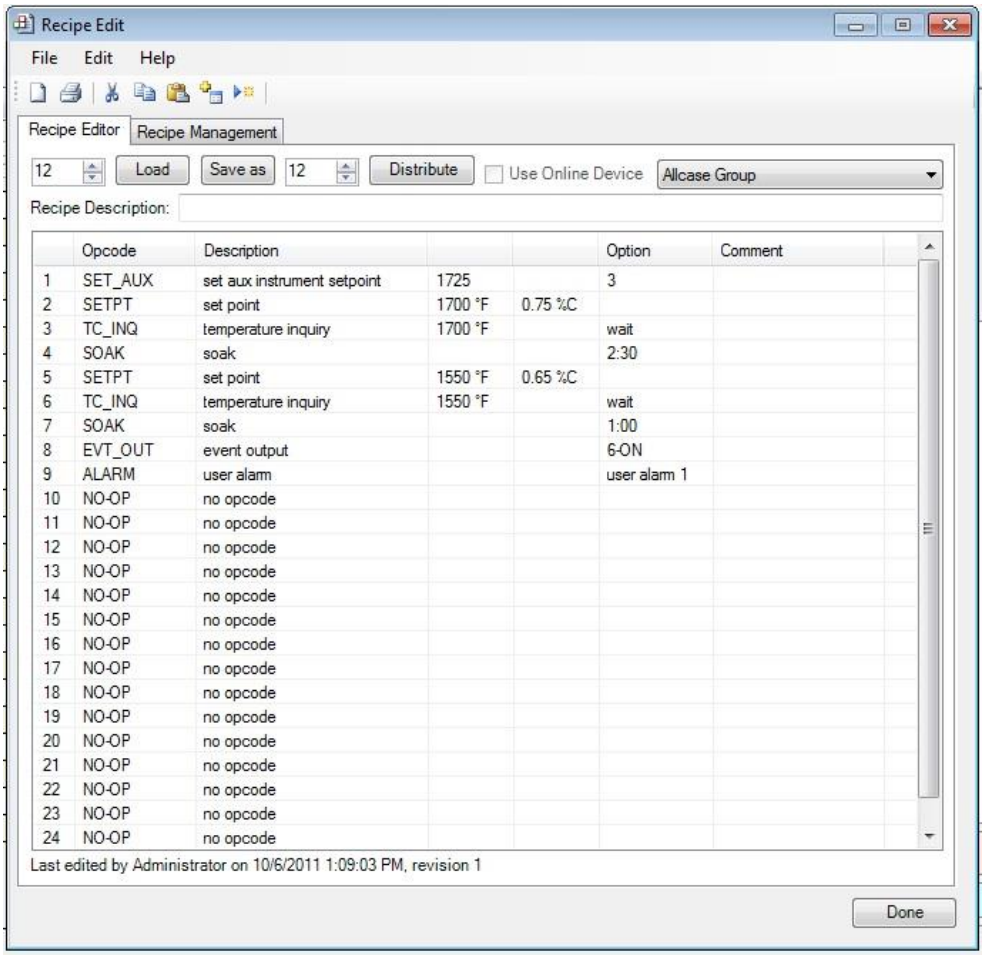


Here, the Atmosphere setpoint has been modified.

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.



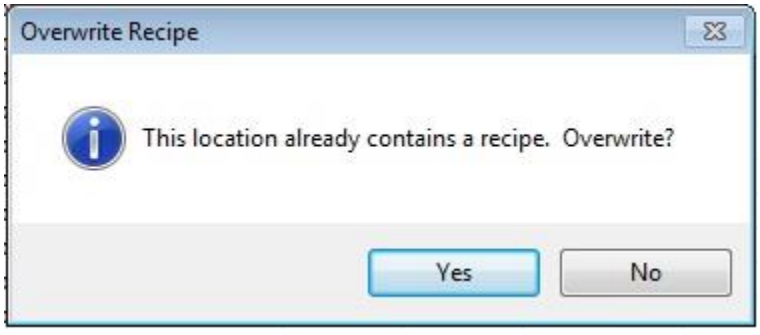
Under the Soak Time in the upper left hand corner, there are two numeric entry boxes. The left most numeric entry box is for time in hours. The right most numeric entry box is for time in minutes. To modify these times, either the Up or Down arrows can be pressed, or the desired time can be entered into 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.

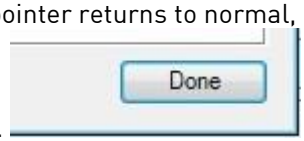
1) To permanently save Recipe #12 with the modifications, click the Save As button. A pop up box will appear.



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	4/02/2026	2376