PROGRAMMABLE
ATMOSPHERE AND TEMPERATURE CONTROLLER
WITH NITRIDING AND FERRITIC NITROCARBURIZING (FNC)
CONTROL CAPABILITIES

Series 9215

OPERATIONS MANUAL

Super Systems Inc.
7205 Edington Drive
Cincinnati, OH 45249
513-772-0060
Fax: 513-772-9466
www.supersystems.com

Super Systems Inc.
USA Office
Corporate Headquarters:
7205 Edington Drive
Shipping Address:
7245 Edington Drive
Cincinnati, OH 45249
Phone: (513) 772-0060
http://www.supersystems.com

Super Systems Europe
Unit E, Tyburn Trading Estate,
Ashold Farm Road, Birmingham
B24 9QG
UNITED KINGDOM
Phone: +44 (0) 121 306 5180
http://www.supersystemseurope.com

Super Systems México
Sistemas Superiores Integrales S de RL de CV
Acceso IV No. 31 Int. H Parque Industrial Benito Juarez
C.P. 76120 Queretaro, Qro.
Phone: +52 442 210 2459
http://www.supersystems.com.mx

Super Systems China
No. 369 XianXia Road
Room 703
Shanghai, CHINA
200336
Phone: +86 21 5206 5701/2
http://www.supersystems.cn

Super Systems India Pvt. Ltd.
A-26 Mezzanine Floor, FIEE Complex,
Okhla Indl. Area, Phase – 2
New Delhi, India 110 020
Phone: +91 11 41050097
http://www.supersystemsindia.com

Table of Contents

INSTALLATION SAFETY REQUIREMENTS **5**

CHAPTER 1 - OVERVIEW **8**

MOUNTING 8
MOUNTING THE TOUCHSCREEN INTERFACE 9
DIMENSIONAL DRAWINGS 10
WIRING 12
ELECTRICAL INSTALLATION 12
PIN OUT 13
ANCILLARY ITEMS 13
SETUP 14
ADDITIONAL FEATURES 14
ETHERNET CONNECTIONS 14
INSTRUMENT START-UP 15
FLASH CARD & FLASH CARD READER 15
DEFAULT STATUS SCREEN 15
MENU 16
CHART 16
CHART SUB MENU 18
RECIPE 19
LOOPS 20
ACK (ALARM ACKNOWLEDGE) 20
DATA LOGGING USING FLASH CARD 21

CHAPTER 2 - CONFIGURATION **22**

MENU (CONFIGURATION) 22
About *24*
Maintenance *24*
Configuration ..... ***Error! Bookmark not defined.***
Logs *25*
Slave Communications Status *25*
Load TC/Auxiliary Analog Input *26*
MGA *26*
Manual Event Control *28*
Shutdown *28*
Probe Burnoff Setup *29*
PID Loop Setup *30*
Recipe Edit *35*
Load T/C Configuration *35*
Trend Chart Edit *36*
Configuration ..... ***Error! Bookmark not defined.***
Communications Setup *38*
Slave Instrument Setup *41*
Zone Assignments *43*
Furnace Setup *45*
Default Wait Limits *49*
Alarm Setup *49*

Relay Assignments *51*
Relay Setpoints *53*
Analog Input Setup *53*
Analog Output Setup *56*
Alarm Polarity *57*
Redundant TC Setup *57*
Generic Instrument Setup *58*
DF1 Configuration *60*
Event Hold/Reset *61*
Valve Configuration *62*
Valve Setup *62*
Security *64*
Curve Entry *66*
Alternate PID Setup *66*
Aux Analog Input Setup *67*
TC Type mV Range Chart *68*
Calibration *70*
Configuration *73*
A/I Module Offset Correction *85*
Aux Setpoint Configuration *85*
T/C Extension Correction Curves *86*
Analog Input Correction Curves *86*
MGA Setup *86*
Flow Set Point Configuration *88*
Instrument Calculation *89*
Tuning Assistant *91*
Redundant TC Setup *92*

CHAPTER 3 – CONFIGURATOR 2.0 MENUS 94

BURNOFF 94
SLAVE INSTRUMENTS 96
AUXILIARY A/I 96
MGA 97
MANUAL EVENT CONTROL 97
PROBE BURNOFF SETUP 98
PID LOOP SETUP 99
LOAD T/C CONFIGURATION 103
PORT SETUP 104
SLAVE INSTRUMENT SETUP 107
ZONE ASSIGNMENTS 110
FURNACE SETUP 111
DEFAULT WAIT LIMITS 115
ALARM SETUP 115
RELAY ASSIGNMENTS 117
RELAY SETPOINTS 118
ANALOG INPUT SETUP 119
ANALOG OUTPUT SETUP 121
PASSCODE AND ALARM 123
GENERIC MAPPING SETUPS 124
Configure Generic Instruments *124*
Configure IP Addresses *125*
Configure Block Writes *125*
DF1 CONFIGURATION 125

IP Address 126
Event Control 127
Valve Configuration 127
Valve Setup 128
Custom Curves 131
Alternate PID Setup 132
SSi Analog Input Setup 133
SSi Configuration and Calibration 133
Overview 133
Equipment needed 134
Notes 134
User Calibration 134
Full Calibration 136
TC Type mV Range Chart 138
Aux Input Offset Correction 138
Aux Setpoint Configuration 138
TC Extension Correction Curves 139
MGA Setup 140
Flow Set Point Configuration 141
Instrument Calculation 142
Tuning Assistant 144
Redundant TC Setup 144
Programmer Description 145
Wait 147
Wait Up 147
Wait Down 148
Wait in a Guaranteed Soak 149
Guarantee High Assignment 150
Sample Event Assignments 151
Flash Card Management 151
Slave Instrument Mapping 154
Atmosphere Instruments 154
Temperature Instruments 157
Events Instruments 163
9215 Analog Input Board Jumper Settings 166

CHAPTER 4 – OPCODES 168

WARRANTY 184

APPENDIX A – WIRING DIAGRAM OF SERIES 9215 185

APPENDIX B – GUIDE TO BUILDING A RECIPE 186

APPENDIX C – 9215 INSTRUMENT ALARMS 194

APPENDIX D – FACTORY DEFAULT SETTINGS FOR THE 9215 CONTROLLER 196

REVISION HISTORY 226

Installation Safety Requirements

Safety Symbols

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

Caution, (refer to the accompanying documents)

Functional earth (ground) terminal!

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

Personnel

Installation must only be carried out by technically qualified personnel.

Enclosure of live parts

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

Caution: Live sensors

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

Wiring

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

Power Isolation

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

Earth leakage current

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

Over current protection

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

Voltage rating

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

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

The controller should not be wired to VAC. The 24V DC power supply voltage across the connections and between the power supply and ground must not exceed 2.5kV. Where occasional voltage over 2.5kV are expected or measured, the power installation to both the instrument supply and load circuits should include a transient limiting device.
These units will typically include gas discharge tubes and metal oxide varistors that limit and control voltage transients on the supply line due to lightning strikes or inductive load switching. Devices are available in a range of energy ratings and should be selected to suit conditions at the installation.

Conductive pollution

Electrically conductive pollution must be excluded from the cabinet in which the controller is mounted. For example, carbon dust is a form of electrically conductive pollution. To secure a suitable atmosphere in conditions of conductive pollution, fit an air filter to the air intake of the cabinet. Where condensation is likely, for example at low temperatures, include a thermostatically controlled heater in the cabinet.

Over-temperature protection

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

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

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

Installation requirements for EMC

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

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

Routing of wires

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

Chapter 1 - Overview

The 9215 is SSi's versatile atmosphere programmable controller with Ethernet, RS485 Modbus, and DF1 communications to various slave devices such as temperature controllers, flow meters, and PLCs. This instrument can be used to address many thermal processing applications where nitriding or ferritic nitrocarburizing (FNC), along with event I/O management, are necessary. The 9215 has math block capability allowing custom calculations and custom Modbus mapping for communications.

The 9215 recipe programmer includes 24 independent steps per recipe with operational codes (opcodes) to enable effective process control. The 9215 also supports multiple user interface screens for more flexibility. Screen sizes include 5.7" and 12.1". Functionality added to the screens include "stylus" notes entry, user defined data points and trend charts for paperless chart recording, zoom and pan touch screen control on the charting screen, and remote data retrieval through Ethernet.

Approximate Box Dimensions	2.75" x 4" x 4.5"
Power Requirements	24VDC, 4 Watts
Temperature Range	32˚F - 132˚F
Digital Output Rating	300VAC / 1 AMP
Analog Output Load Rating	1000 Ohms (Total)
Controller Enclosure Rating	IP10 – hand protected
Number of RS232 Ports	Two (2)
Number of Ethernet Ports	One (1)
Number of RS485 Host Ports	One (1)
Number of RS485 Slave Ports	Two (2)
Number of Internal Relays	Eight (8)
Number of Analog Inputs	Three (3)
Number of Analog Outputs	Two (2)
Number of Digital Inputs	Four (4)
Number of Control Loops	Three (3)

The Model 9215 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 Model 9215 to control <u>temperature and atmosphere</u>.

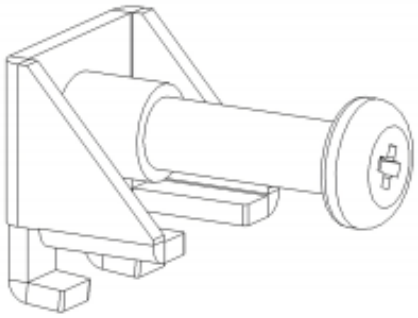
The product is available in two different screen sizes: 5.7" and 12".

Mounting

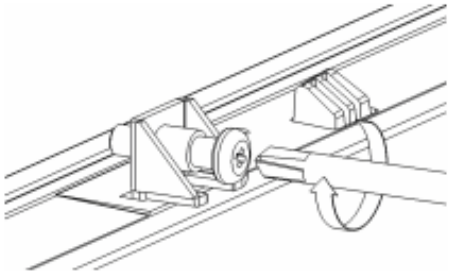
The Series 9215 Operator Interface mounts into a panel or on a plate by using the enclosed mounting brackets. A rectangular cutout is required; the size of the cutout is determined by the operator interface size.

Mounting the Touchscreen Interface

1. There is an adhesive waterproof gasket on the front bezel. Ensure that the waterproof gasket is in place before installing the TPC system in the panel opening.
2. Install the TPC in the panel opening.
3. Retrieve the clamps and long screws from the accessory pack. Hook the clamps the holes located on the four sides of the bezel. Insert screws into every clamp and tighten them to fasten the clamp in place. These screws will push against the mounting panel and secure the unit.
4. The suggested mounting panel thickness is less than 6 mm (0.236 in).
5. The suggested mounting screw torque is 2 KGF-cm (kilogram-force centimeter) or 0.14 ft*lb (foot pound) *(Finger tight + ¼ turn + removable Loctite)*



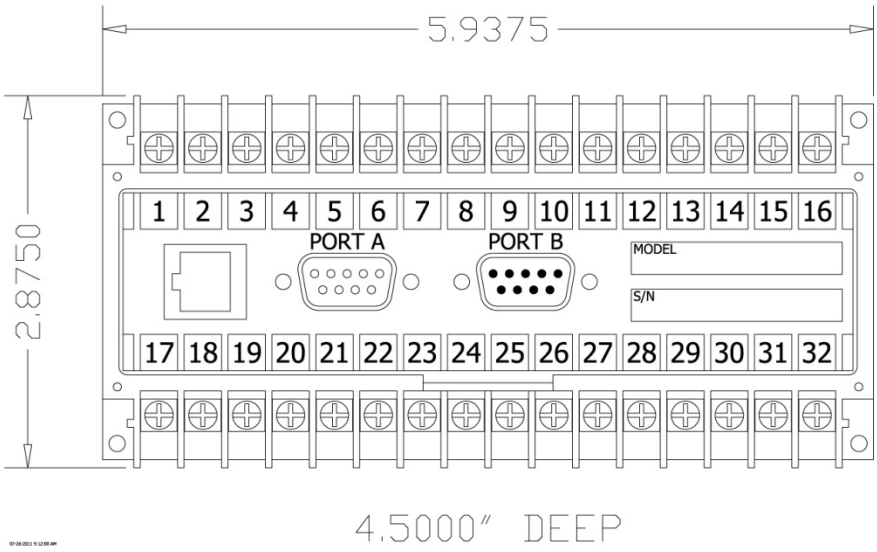
Insert the screws into each clamp and tighten them to fasten the clamp in place.



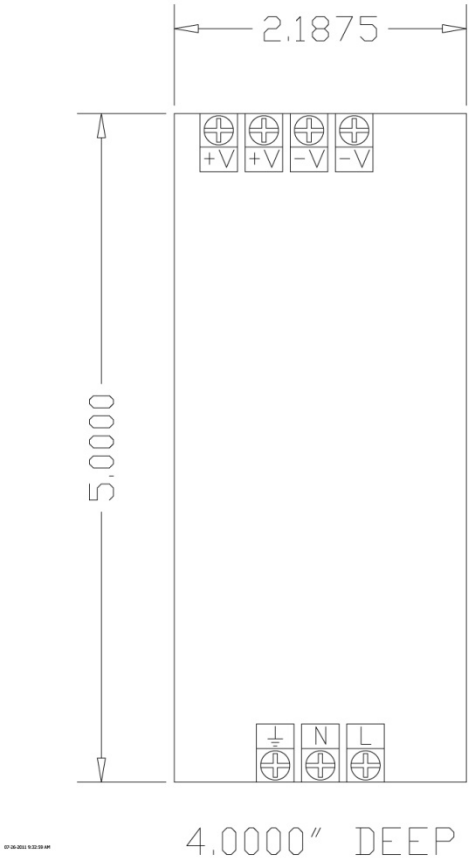
Hook the clamps into the holes and fasten the screws
Torque: 2 kgf-cm
These screws will push the mounting panel and secure the unit.

These units, along with an optional SSi SR3, 6, or 9 analog input board, will mount on a commercially available DIN rail. This can be mounted on the sub-panel on the side of an enclosure for the convenience of the control system.

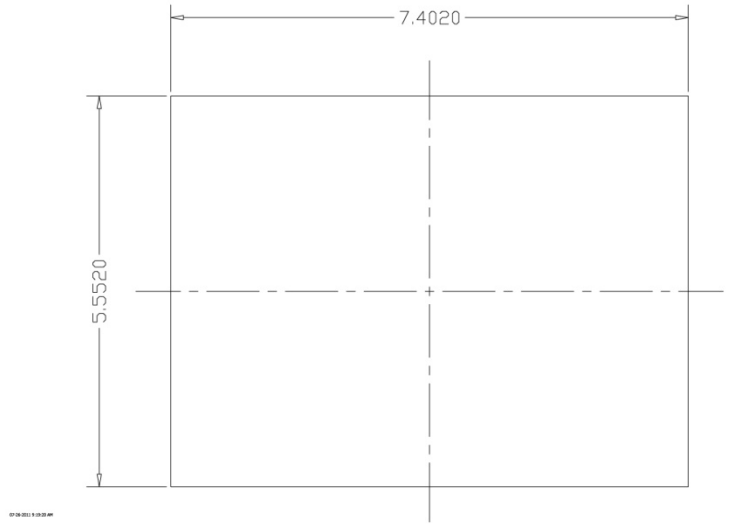
Dimensional Drawings



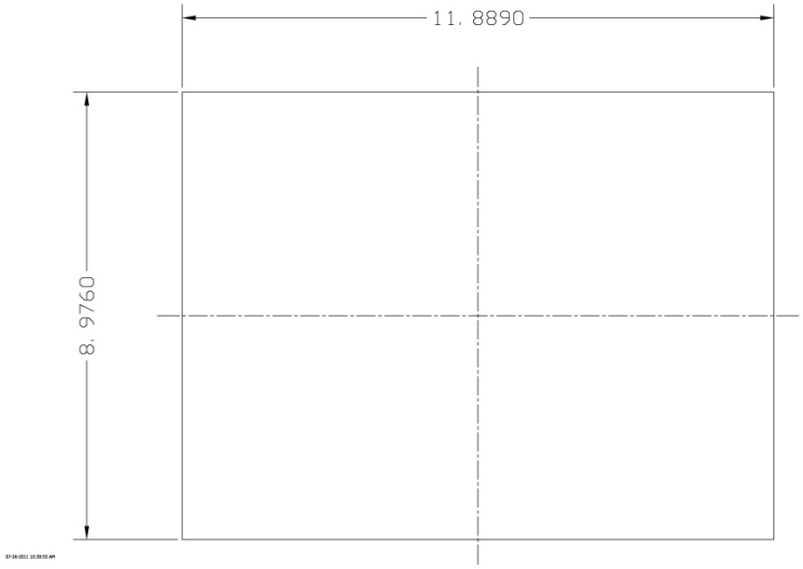
Series 9215 Controller Dimensions



24V DC Power Supply Dimensions



5.7" Operator Interface Cutout dimensions



12" Operator Interface Cutout dimensions

Wiring

Wiring to the Series 9215 operator interface can be done using 232 or 485 to two connectors, comm1 (232) or comm3 (485). The terminal strip on the lower right rear corner of the operator interface is used to connect 24VDC power. The DB-9 port A connection is used to connect the display via 232 to the Series 9215 PID controller. The controller is connected via RS485 communication to the single-loop controllers.

Electrical Installation

The Model 9215 requires 24VDC, 4 Watt, single-phase power. A 24 VDC power supply is required and is generally included as part of the Model 9215 system. This power supply has a universal input that can accept between 60 and 265VAC. Power should be applied in accordance with the electrical drawings that have been supplied. Since each installation is unique to the site, the customer is responsible for providing adequate power and making it available to the Model 9215 power supply.

SSi requirement:

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

Pin Out

SUPER SYSTEMS INC.
(800) 666-4330
www.supersystems.com

1 - 24VDC (COM)	12 - RELAY OUT 5	22 - SLAVE 2 RS485 (+)
2 - 24VDC (+)	13 - RELAY OUT 6	23 - SLAVE 2 RS485 (-)
3 - RS485 RT (-)	14 - RELAY OUT 7	24 - 4-20mA OUT 1 (-)
4 - RS485 RT (+)	15 - RELAY OUT 8 NC	25 - 4-20mA OUT COM (+)
5 - SLAVE 1 RS485 (-)	16 - RELAY OUT 8 NO	26 - 4-20mA OUT 2 (-)
6 - SLAVE 1 RS485 (+)	17 - DIGITAL IN 1	27 - ANALOG IN 3 (-)
7 - RELAY COMMON	18 - DIGITAL IN 2	28 - ANALOG IN 3 (+)
8 - RELAY OUT 1	19 - DIGITAL IN 3	29 - ANALOG IN 2 (-)
9 - RELAY OUT 2	20 - DIGITAL IN 4	30 - ANALOG IN 2 (+)
10 - RELAY OUT 3	21 - DIGITAL IN COM	31 - ANALOG IN 1 (-)
11 - RELAY OUT 4		32 - ANALOG IN 1 (+)

9215 Pin Out

A wiring diagram of the Series 9215 controller can be found in Appendix A – Wiring Diagram of Series 9215.

Ancillary Items

The following items can be included with the Series 9215: a flash card, a flash card reader, a touch screen, an RS232 cable, an RS485 cable, a 24V DC DIN rail mount power supply, and a software CD with Configurator, the Configurator manual, TS Manager, and .NET 2.0. The flash card is installed in the operator interface and the flash card reader connects to a Windows® based computer.

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

The following table shows the ancillary items and their part numbers.

Part	Part Number
5.7" Operator Interface	31297
12.1" Operator Interface	31299
TS Manager/PC Configurator Software	13339
RS485 comms cable for 12.1" and 5.7 "	A20576
Flash Card	31604
Flash Card Reader	13333
RS232 Cable	33027
24V DC Din Rail Mounted Power Supply	31135 or 31137
9215 Controller	13445

Setup

The Series 9215 setup consists of setting the local time if required. As shipped from the factory the communications ports are set at 19200 baud in Modbus mode.

Time will be set for local time in Cincinnati, Ohio (EST /EDT) or time zone of location of city and state on sales order. For instruction on adjusting these values, please see *Chapter 3 - Configuration*.

Additional Features

The Operator Interface (touch screen) contains a removable compact Flash or SD Card that can be used to transfer data from the Model 9215 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 Series 9215 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

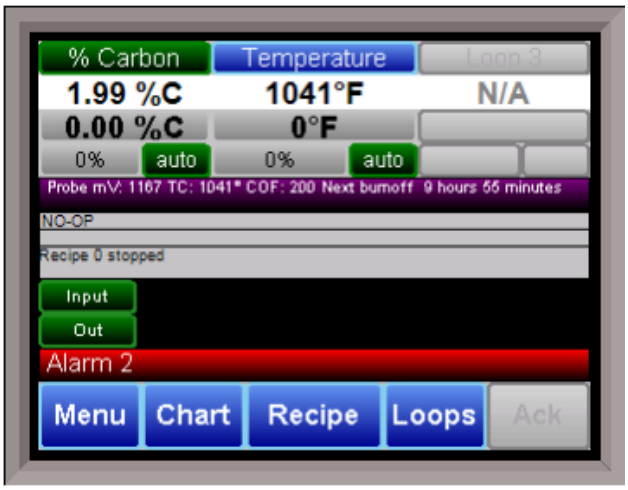
Never remove the flash card when the Operator Interface is "ON".

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 - CONFIGURATION 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.

Default Status Screen

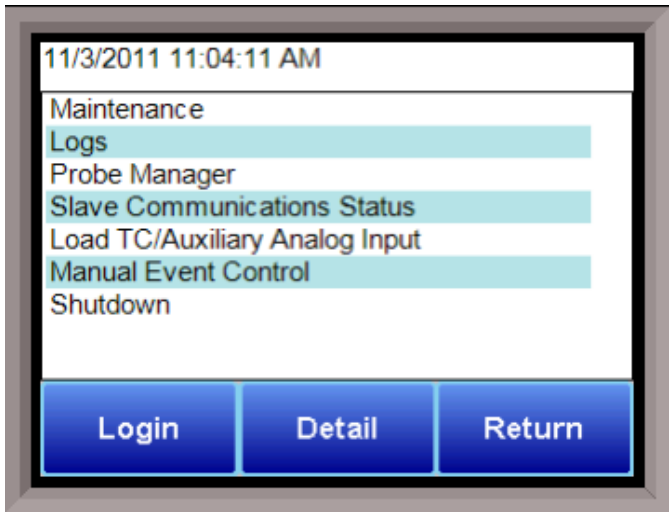
The Status Display shows the temperature controller information as well as any auxiliary analog inputs, the status of the timer, and an overview of the programmer. There are five active buttons on the Status Display: **Menu**, **Chart**, **Recipe**, **Loops**, and **Ack.**



- The **Menu** button will display the configuration menu.
- The **Chart** button will display the video recorder screen. Use of the Chart Display is explained below.
- The **Recipe** button will switch to the Program Display. This is a companion display to the status screen and is described below.
- The **Loops** button will display the main control loop, Temperature, as well as the timer status and any auxiliary analog inputs.
- The **Ack** (Alarm Acknowledge) button is used to acknowledge an alarm. The alarm message is displayed directly under the recipe display. Is this only present when an alarm is going off. This button only acknowledges 9215 alarms and does not acknowledge any PLC alarms.

When the quench timer is running, the ACK button is replaced with a quench button. This quench button is used to adjust the quench timer time remaining. In the purple status bar, the quench time remaining is displayed.

Menu



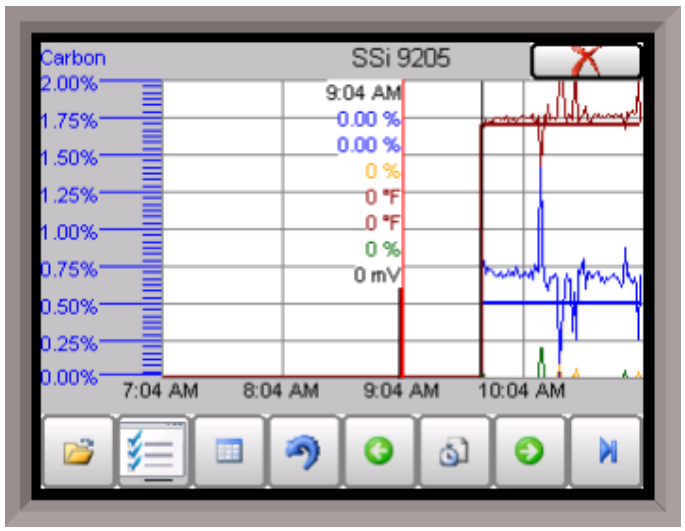
There are three levels of menus in the Series 9215.

- 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 – Configuration.*

Chart

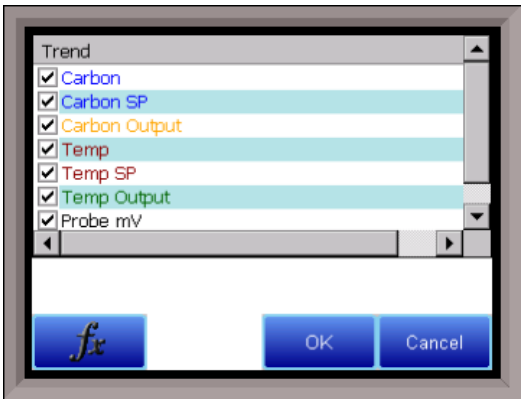


The Chart Display shows between 1 hour and 24 hours of process variable data on the screen and can be scrolled back to view all of the data stored on the hard drive. The vertical timelines change as the time changes on the screen. Any trend charts that have been created through the Configuration menu are accessible here. See the Chapter 2 - CONFIGURATION section for more information on creating trend charts.

The function buttons run along the bottom of the screen.

The folder button - -

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



`

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

The Refresh button - - will refresh the screen's trend data if the screen is not in real-time mode.

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

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

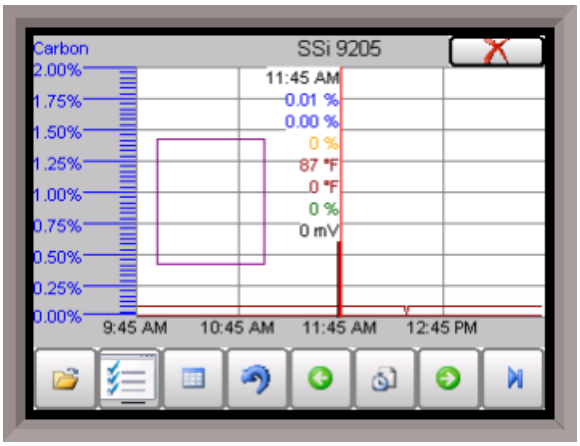
The right-pointing green arrow button - - will move the chart's view forward in time by the specified chart interval.

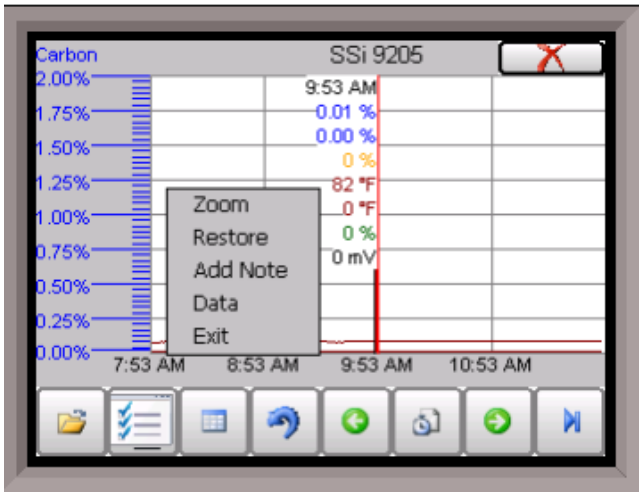
The right-pointing arrow with the vertical line next to it button - - will put the chart into real-time mode if it is not in real-time mode, or take the chart out of real-time mode if it is. When in real-time mode, the chart will automatically be updated once a minute.

Some chart display settings are configurable – see the Configuration Menu section for details.

Chart Sub Menu

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





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

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

The **Add Note** option allows the operator to enter a note on the chart, similar to writing on a paper chart. The note shows up when the chart is printed out using the utility software included with the Series 9215 instrumentation. Pressing the **Add Note** option displays a screen where the operator can enter the operator ID or initials and a note. The user has the option to enter a note using the operator interface keyboard, where he or she will be able to type in the note; or the user can use the Signature mode, which will allow them to write a note using a stylus.

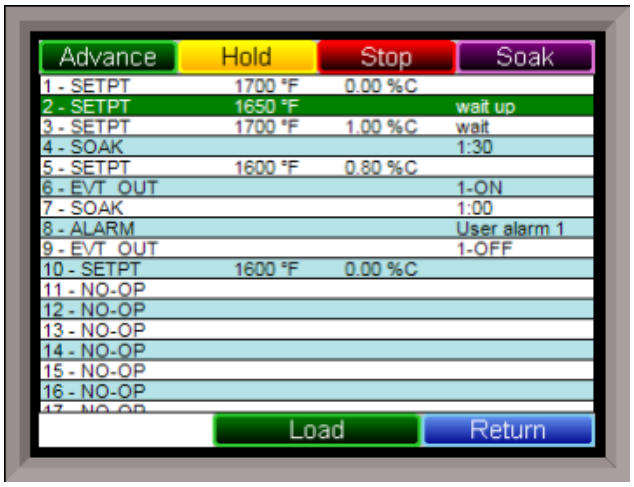
The **Data** option will show the trend data as a data grid instead of the trend lines on a chart. This functionality is exactly the same as if the user pressed the Datagrid View button - - from the chart screen.

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

Pressing the red 'X' in the top right-hand corner of the screen will take the user back to the status screen.

Recipe

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



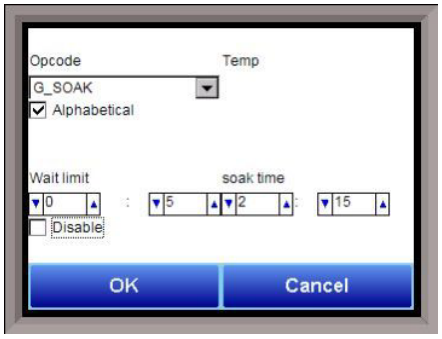
The recipe screen shows the last program loaded into the program run buffer and its status. If the program is running, the active step number is highlighted green. When the step is highlighted green, then the recipe is running on that step. When a step is highlighted yellow, the recipe is in hold on that step. A red **Acknowledge** button in the bottom left corner of the screen displays an alarm condition. *Note – the main status screen will also show the recipe running status, as well as run time and remaining time for the step as well as the entire recipe*.

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

- The **Advance** button will advance the recipe to the next step in the recipe. The user will need to confirm the advance command.
- The **Hold** button places the displayed recipe program in hold. Once a decision is made that affects the recipe, it may be continued by pressing the **Resume** button. *Note – When a recipe is put into hold status, the text on the **Hold** button will change to "Resume". When the step is started up again, the text on the button will change back to "Hold".* When a recipe step is in a hold status, the step will be highlighted yellow. The user will need to confirm the hold or resume command.
- The **Stop** button stops the recipe program that is currently running. Stop means exactly that! It stops the program. It is NOT a hold button. See the description for the hold button above. To re-start the program if it has been stopped you must use the **Load** button, enter the recipe number, and then highlight the segment number of the recipe that you want to start with and start the recipe again. The user will need to confirm the stop command.
- The **Soak** button allows you to enter a new value for the time remaining in the current soak or ramp cycle only – future soak or ramp cycle times cannot be modified. The step must be a soak or ramp cycle for a change in soak/ramp time to be adjusted.
- The **Acknowledge** button will acknowledge the alarm. In most cases, it will be acknowledging *end of soak*. The alarm must be acknowledged to allow the program to go to the next step. *Note – The **Acknowledge** button is only visible when an alarm condition is present. Once the condition is acknowledged, the **Acknowledge** button will become invisible again*.

- The **Load** button allows the operator to enter the recipe number to be run and to view the recipe before pushing the **Run** button. Pushing the **Run** button starts the recipe. If a recipe program is running and the operator enters a new recipe program it can be viewed and modified. The recipe does not become active until the **Run** button is pushed. Pressing **Run** places the program currently being viewed in the active memory and will begin to run the new

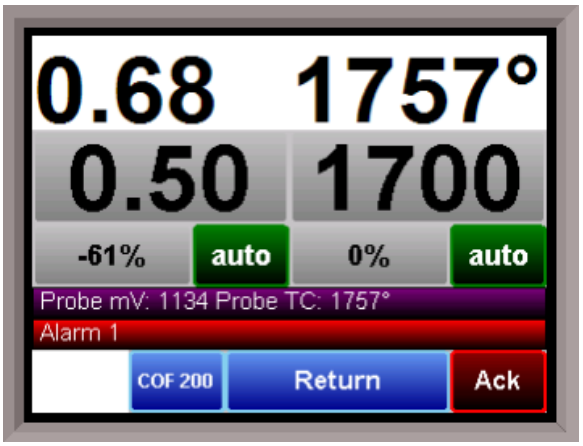
recipe. To select the recipe to view or edit, click on the recipe number button in the top left corner of the screen. This will display a screen where the user will be able to load up a valid recipe (range **1** – **300**). The program can be started in any step by clicking on the step number button next to the "Step" text and entering the new step number (range **1** – **24**), and then pressing the **Run** key.



While reviewing the program that is about to be run, each step can be modified. Highlight a step number and click on the **Edit** button. The opcode can be changed with the drop down list at the top. This list can be sorted alphabetically by click on the "Alphabetical" checkbox. The parameters of the opcode can be modified on this screen as well. See the Chapter 4 – OPCODES section for details about each opcode. Click on the **OK** button to accept the changes; click on the **Cancel** button to ignore the changes. *Note – Any change to the recipe is a one-time edit, and will not affect the recipe that is saved on the 9215 controller*. Click on the Cancel button on the Load Recipe screen to cancel loading a recipe and return to the main recipe screen.

- The **Return** button returns you to the main status screen.

Loops



This screen will display the program loops for the 9215. Up to three loops can be displayed. The current process variable is displayed at the top, with each loop set point displayed beneath the process variable. The operator can change the process set point by touching the screen area below the large process variable numbers. When pressing the Temperature set point, a numeric keypad is displayed, showing the current value and allowing the operator to enter a new set point by simply pressing on the appropriate numeric keys. Once the correct set point has been entered, press the **OK** key to make the change. When the **OK** key is pressed the display returns to the *Loops* Screen. Another active key within the *Loops* Screen is the **Auto/Man** (Auto/Manual) button. Pressing that button toggles the controller's mode between Auto and Manual. In the manual mode, pressing the percent output button on the *Loops* Screen (next to the **Auto/Man** button) displays a numeric keypad, allowing a % output to control the "loop" in a manual mode to be entered. If a timer is running, the status will be displayed at the top right of the screen. Any load T/Cs that are actively communicating will be listed in the box to the right of the setpoint/percent output values. If an alarm condition is present, the alarm text will be displayed below the loop information. If the alarm needs acknowledging, then the **Alarm Ack** button will be displayed in the bottom left corner. If the alarm is part of a recipe step, the alarm will need to be acknowledged before the recipe can move to the next step.
The Loops Screen also allows you to move back to the default Status Screen by pressing the **Return**.

Ack (Alarm Acknowledge)

The **Ack** (Alarm Acknowledge) button will allow the user to acknowledge any alarms that have been configured, or that have been made part of the recipes that run on the Series 9215. If a recipe has an alarm as a step, the alarm must be acknowledged before the recipe will continue to the next step.

Data Logging using Flash Card

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

The 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 9215 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 9215 controller/programmer, then disk space.

See the Flash Card Management Section for more information.

Chapter 2 - CONFIGURATION

Menu (Configuration)

The Configuration Menu is entered through the **Menu** key that is part of the four buttons running along the bottom of the Default Display Screen.

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

The list of the operator-level menu options is:

- About
- Maintenance
- Logs
- Slave Communications Status
- Load TC/Auxiliary Analog Input
- MGA
- Manual Event Control
- Shutdown

The list of supervisor-level menu options is:

- About
- Maintenance
- Logs
- Slave Communications Status
- Load TC/Auxiliary Analog Input
- MGA
- Manual Event Control
- Shutdown
- Probe Burnoff Setup
- PID Loop Setup
- Recipe Edit
- Load T/C Configuration
- Trend Chart Edit

The list of administrator-level menu options is:

- About
- Maintenance
- Logs
- Slave Communications Status
- Load TC/Auxiliary Analog Input
- MGA
- Manual Event Control
- Shutdown
- Probe Burnoff Setup
- PID Loop Setup
- Recipe Edit
- Load T/C Configuration

- Trend Chart Edit
- Communications Setup
- Slave Instrument Setup
- Zone Assignments
- Furnace Setup
- Default Wait Limits
- Alarm Setup
- Relay Assignments
- Relay Setpoints
- Analog Input Setup
- Analog Output Setup
- Alarm Polarity
- Redundant TC Setup
- Generic Instrument Setup
- DF1 Configuration
- Event Hold/Reset
- Valve Configuration
- Valve Setup
- Security
- Curve Entry
- Alternate PID Setup
- Aux Analog Input Setup
- Calibration
- Configuration
- A/I Module Offset Correction
- Aux Setpoint Configuration
- T/C Extension Correction Curves
- Analog Input Correction Curves
- MGA Setup
- Flow Set Point Configuration
- Instrument Calculation
- Tuning Assistant
- Redundant TC Setup

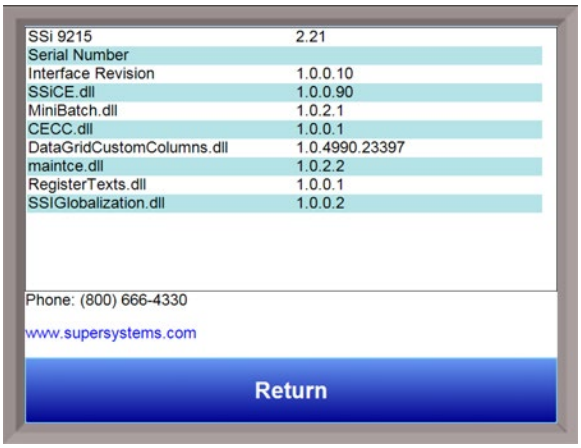
To select any of the menu options, highlight that item by clicking on it, and click on the **Detail** button.

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

About

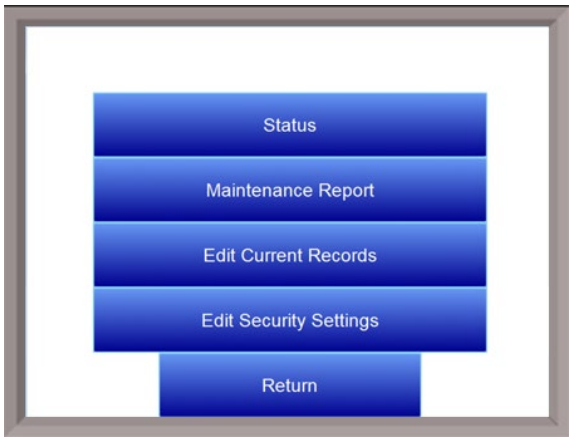
The About screen displays important information on the 9215 controller that the touch screen is communicating with. The **SSi 9215** field shows the firmware version of the controller itself. **Serial Number** shows the serial number of the controller. **Interface Revision** shows the current version of the touch screen interface.

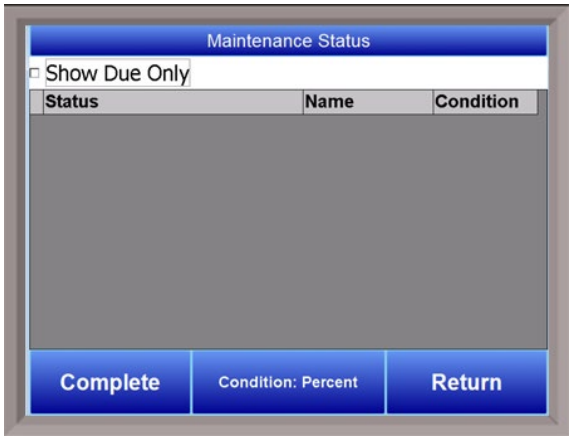
The remaining fields show versions of various DLL (dynamic link library) files that the touch screen software uses to operate. These fields may be needed for troubleshooting if you need to contact SSi for technical support.



Maintenance

From the **Maintenance Status** menu, you can view a list of scheduled and completed maintenance items. Maintenance items are added from the Configuration -> Maintenance menu. See the screen





Configuration

This option will allow the user to set some general configuration settings.
The list of configurable items is:

- **Log Maintenance**
- **Programmer Alarm Text**
- **Event Text**
- **Auxiliary Analog Input Text**
- **Analog Output Text**
- **Compact Database**
- **Screen Communications**
- **Datalogging Setup**
- **Repair Database**
- **Device Configuration**
- **Recipe Configuration**
- **Product Activation**
- **Alarm Text**
- **Time Synchronization**
- **Probe Management**

- Maintenance
- Toad TC Map
- Chart Settings
- Read/Write Data

section on page 72 for more information.

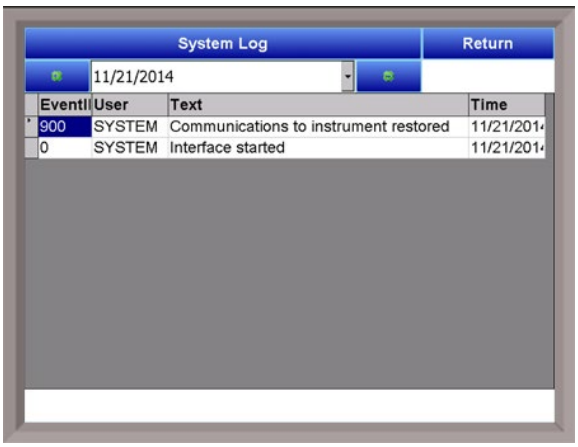
Logs

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

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

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

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



Log Types

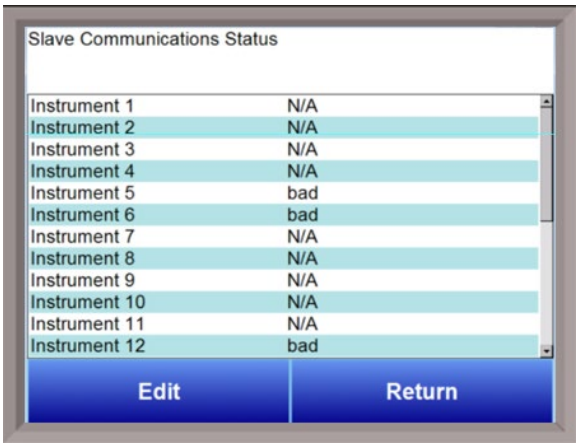
The System Log tracks the startup and shutdown activity of the touch screen as well as when communications to the controller are established.

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

The Cycle Log keeps track of charged loads and completed recipes. Specifically, it displays the start time and date, completed time and date, and recipe number executed. A Utilization button can be pressed to open a page with information on utilization based a selected date and on the amount of time that the 9215 controller has run a recipe compared to the amount of time it has not run a recipe.

Slave Communications Status

This page is a display of the current process variables of each of the slave instruments communicating with the 9215 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.

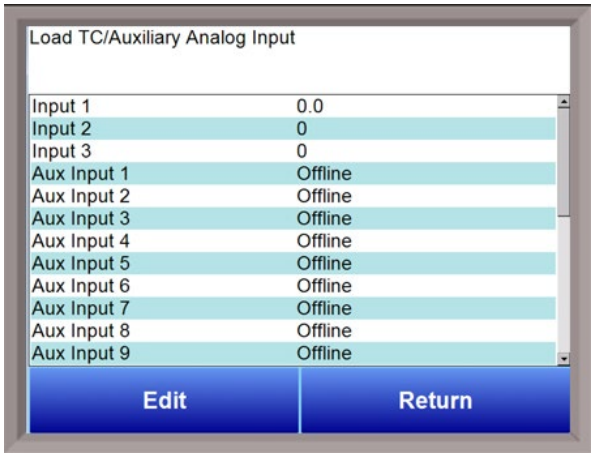
- N/A – No instrument is connected
- Bad – No communications exist
- ??? – Communications exist, but there are frequent errors
- ?OK – Communications exist, but there are occasional errors
- OK – Communication is established and working properly
-

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

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

Load TC/Auxiliary Analog Input

The Load TC/Auxiliary Analog Input screen will show the values for the load TCs and the auxiliary analog inputs. These values are display-only, and cannot be modified from this screen.



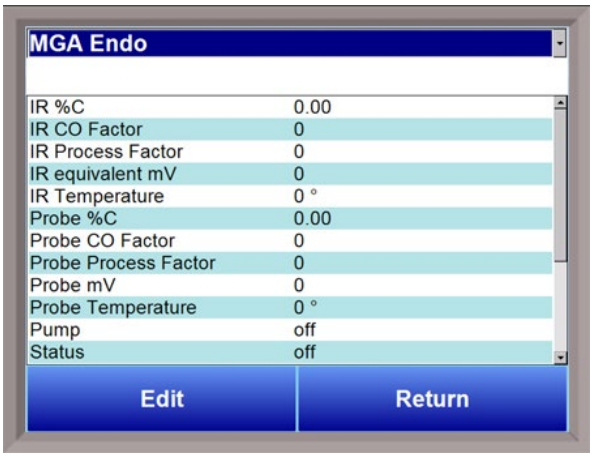
MGA

An SSi MGA (Multi-Gas Analyzer) can be set up as a slave instrument to the 9215. Refer to the

Slave Instrument Setup menu on page 41 for more information on how to configure a slave instrument from the touch screen.

A drop-down menu allows you to select the part of the process at which the gas is being analyzed. **MGA Endo** is for incoming gas. **MGA Furnace** is for outgoing gas.

Once an MGA is slaved, several parameters can be read from the MGA and displayed on the 9215 screen. These include **IR %C, IR CO Factor** (see note below), **IR Process Factor, IR equivalent mV, IR Temperature, Probe %C, Probe CO Factor, Probe Process Factor, Probe mV, Probe Temperature, Pump Status, Alarms,** and **Gas 1-6** (parameter value shown for each gas). These parameters are for display purposes only and cannot be modified from the 9215 screen.



NOTE: COF is the sole adjustable variable that can be used to influence the calculated carbon potential; with other parameters (Probe mV and Temperature) being fixed. As such COF can be increased/decreased to compensate for differences with a furnace, atmosphere composition, etc. The table below shows how changes to COF will result in different calculated carbon potentials.

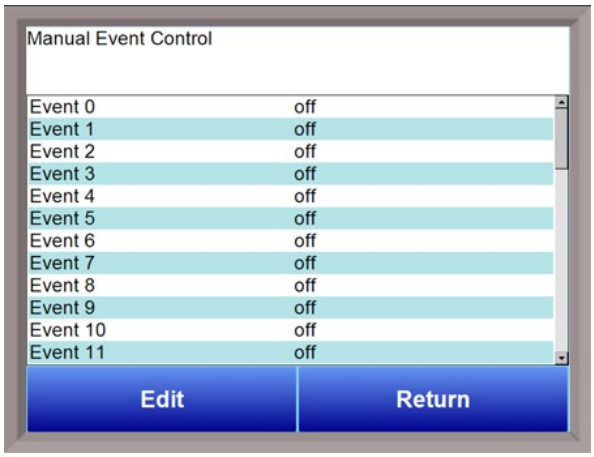
Note: Default COF is set to 200.

COF	Prove mV	Probe Temp	Carbon
190	1100 mV	1700°F	0.44
200	1100 mV	1700°F	0.46
210	1100 mV	1700°F	0.48

Manual Event Control

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

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



WARNING!

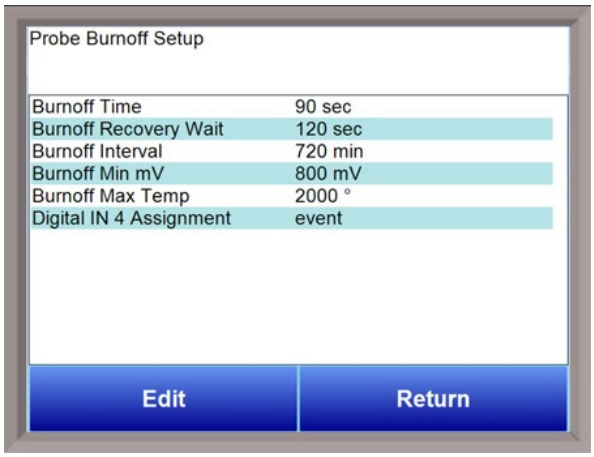
Before assigning or changing events, be certain that you are familiar with the function of the event whose status you are going to change. Changing the status of an event without knowledge of the result can lead to hazardous situations.

Shutdown

The Shutdown selection will display a screen asking whether or not to shut down the interface of the Series 9215. When the operator interface is shutdown, the Series 9215 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 shutdown the Series 9215 Controller***.

Probe Burnoff Setup

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



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

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

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.

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

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

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

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

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

PID Loop Setup

This menu allows you to adjust tuning parameters for each Process Variable loop.

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 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**.

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%.

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**.

IN1 high limit stops ctrl
If input 1's high limit is reached, then all outputs are turned off. The value can either be **Yes** or **No**.

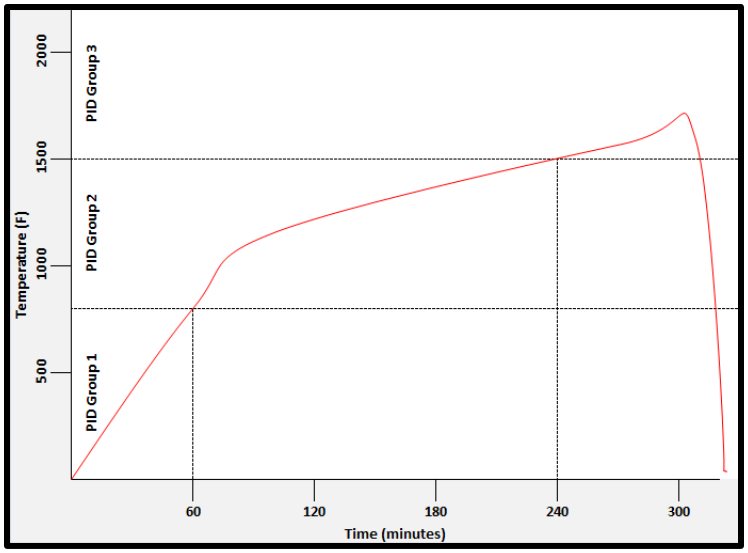
IN2 high limit stops ctrl
If input 2's high limit is reached, then all outputs are turned off. The value can either be **Yes** or **No**.

IN3 high limit stops ctrl
If input 3's high limit is reached, then all outputs are turned off. The value can either be **Yes** or **No**.

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, *not* Setpoint or Ramp Temperature.

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, *not* Setpoint or Ramp Temperature.

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**.

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.

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 Level 1 Control and Ramp 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.

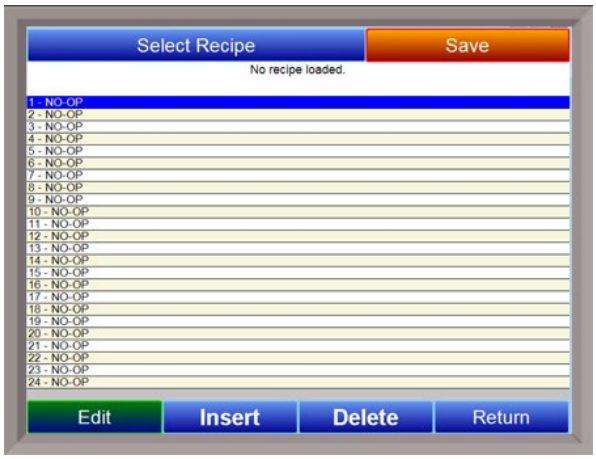
Ramp Level 2 Control is only active if the Ramp Level 1 control is active.

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.

Output rate change
This option causes the 9215 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.

Recipe Edit

This option will allow the user to edit a recipe that is stored on the 9215 controller.
The **Select Recipe** button will allow the user to select which recipe to load (**1** – **300**). Once the recipe has been selected, the recipe will be displayed on the screen.
The higher recipe steps can be viewed by holding a finger or stylus on the screen and scrolling up or down.
To edit a specific step, highlight that step and press the **Edit** button. This will allow the user to select a different Opcode to use, or to change the information entered for the current Opcode. See Chapter 4 – OPCODES for more information on each Opcode and its purpose.

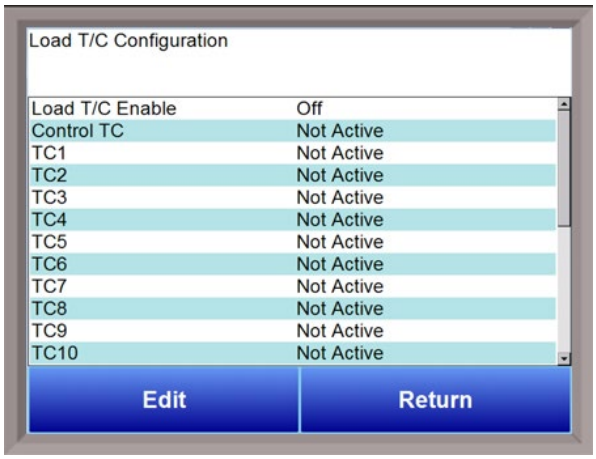


To insert a step into the program, highlight the step number for the step, and press the **Insert** button. The user will have to confirm the insert. Once this has been confirmed, the user will be able to select the Opcode to use. *Note: Inserting a step will push every step after down one, so an Opcode at step 24 will be lost*.
To remove a step from the recipe, highlight the step number to remove, and press the **Delete** button. The user will have to confirm the delete. Once the delete has been confirmed, the step will be deleted and every step after will be moved up one step. Blank step numbers will be replaced with a NO-OP Opcode.
Press the **Save** button to save the changes that have been made. The recipe can be saved as any valid recipe number (**1** – **300**). If the desired recipe number already contains a recipe, the user will have to confirm the save before the old recipe will be overwritten.
If the user wishes to delete an entire recipe, they have one of two options. First, they could load up the desired recipe and change every step to the NO-OP Opcode and save those changes; Or, they could save the 24-step "blank" (NO-OP) program that is loaded up when the *Recipe Edit* screen is first displayed as the desired program number. This will save the "blank" recipe to the desired recipe number location.
The **Return** button will return the user to the menu screen.

Load T/C Configuration

Configuration of any Load TCs must be completed under this menu item.

> **IMPORTANT!**
>
> It should also be noted that not all analog inputs on SRs to a 9215 will be load thermocouples. They are often used as a means to capture other data. Care MUST be taken with selecting which is a Load TC and which is not, as improperly selecting something that is not a Load TC may cause the program to run excessively long or not run long enough.



Load TC Enable

This value will manually toggle between **on**, **on + alarms**, and **off**.
On – T/C Enabled

On + Alarms – T/C Enabled, Programmer alarm114 provided if out of band (Default wait limits)
Off – T/C not enabled

Control TC
This value allows the user to set the TC to be part of the group of Load TCs that can hold the program if it is out of band. The values are **active** or **not active** (shown as blank).

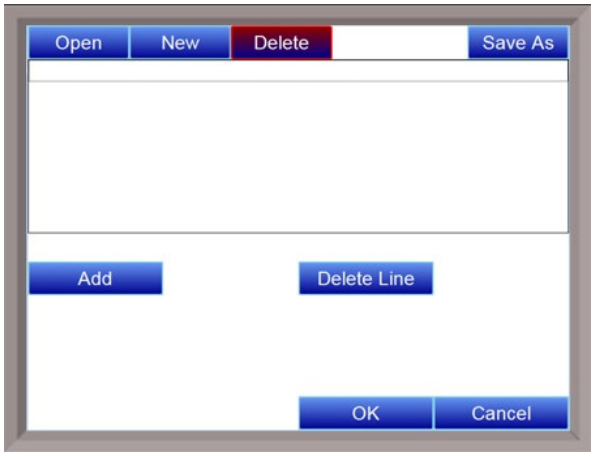
TC 1 – 27
This value allows the user to manually turn the T/C from **active** to **not active** to be part of the group of TCs that can hold the program if it is out of band.

Input 1 – 3
This value allows the user to assign analog inputs 1, 2, and 3 as Load TCs by selecting the **active** state for each input. (**Not active** means that the input is not set up as a Load TC.)

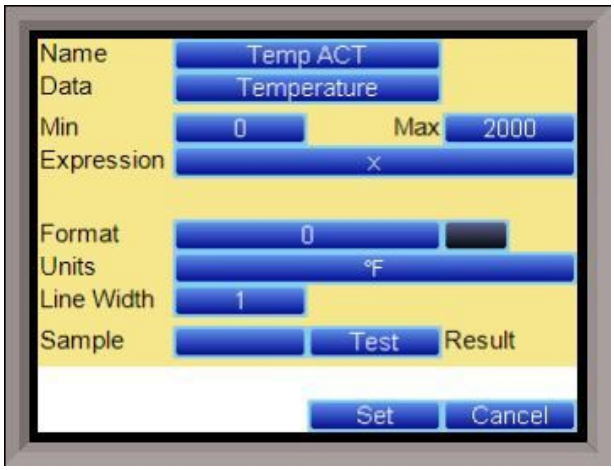
The **Return** button will return the user to the menu screen.

Trend Chart Edit

This menu option will allow the user to add, modify, or delete trend lines in a trend chart file, as well as the trend chart files themselves. The trend lines are the number of variables displayed on one screen. For example this could be a control, overtemp, or load thermocouple on a batch furnace. Or it could be one thermocouple from eight temper furnaces. There is not a maximum for template selections, but the number of variables displayed on one screen must be a consideration in this process. The buttons across the top of the screen – **Open**, **New**, **Delete**, **Save**, and **Save As** – deal with the trend chart files themselves, not the individual trend lines.



Open will allow the user to select a trend chart file to open up to edit.
New will create a new trend chart file to begin adding trend lines to.
Delete will delete a specified trend chart file.
Save will save all changes to the current trend chart file that have been made.
Save As will allow the user to save the current trend chart file as a new file with a different name.



Once a new trench chart file has been created, or one has been opened, trend lines can be added, modified, or deleted. **Add** will add a new trend line to the file. **Edit** will allow the user to edit the information for a specific trend line. **Delete Line** will delete the specified line from the chart file.
Adding or editing a trend line will involve the following parameters:
Name – the name of the input, for example "Temp ACT" which would be the actual temperature of the input. It is a good idea to shorten the names so that they still make sense, but do not take up as much space.
Data – This will determine where the data is coming from. The user can click on the box to select from the list of data logged points in the 9215. Some of the points have a name, such as "Temperature" or "Temperature SP", but others will just show the register in the 9215 that has been logged. Note that certain parameters are already setup and logged. For anything needed beyond this, you will need to contact SSi at (513) 772-0060 to get the register information. This register will need to be added to the Datalogging Setup in the screen

Configuration

This option will allow the user to set some general configuration settings.
The list of configurable items is:

- **Log Maintenance**
- **Programmer Alarm Text**
- **Event Text**
- **Auxiliary Analog Input Text**
- **Analog Output Text**
- **Compact Database**
- **Screen Communications**
- **Datalogging Setup**
- **Repair Database**
- **Device Configuration**
- **Recipe Configuration**
- **Product Activation**
- **Alarm Text**
- **Time Synchronization**
- **Probe Management**
- **Maintenance**
- **Toad TC Map**
- **Chart Settings**
- **Read/Write Data**

menu.

Min – the minimum displayed scale value on a chart.
Max – the maximum displayed scale value on a chart.

Expression – every input requires an expression to be calculated and displayed correctly. This is because the registers in the 9215 hold only integer values, so any value that requires a decimal point needs to be set up properly for the display. For example an expression for temperature would be x (1750 = 1750). For a value such as carbon or millivolts, the expression would be x * 0.01 (150 = 1.50) or x * 0.1 (805 = 80.5).
Format – the value displayed on the chart display of the operator interface. A short custom description can be added here. For example, to display one (1) decimal point, enter a value of "#0.0". For carbon values, enter a value of "#0.00" for 2 decimals. This would display a value like "0.81". Entering "#.00" would display a value of ".81". #0 or 0 will display integer values.
Color – The box next to the format box will allow the user to apply a color to the trend line to differentiate it from other trend lines on the chart.
Units – The type of units used for the trend.
Line Width – a numeric value for the thickness of the trend line. A 1 is a thin line; A higher value = thicker line width.
Sample – a number is entered here to test the expression and verify that formatting is correct.
Test – Press the test button to calculate the expression with the value entered in the sample parameter. For example with an expression of x*.1 and a value of 250 entered in the sample parameter will display a 25.0.
The **Set** button will save the values entered. The **Cancel** button will cancel the information and make no changes.

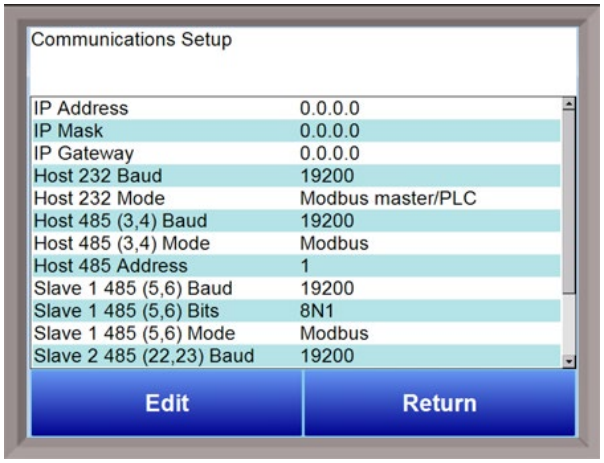
The **OK** button will close the screen and prompt the user to save any changes if changes have been made.

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

Communications Setup

Warning: Changes to this screen should not be made without consulting SSi at 513-772-0060. This screen will show the Ethernet and RS-232/RS-485 communications information for the 9215 controller.

Note about ADAM module support: Communications with ADAM analog input modules manufactured by Advantech are not supported as of 9215 firmware revision 2.34. To determine the firmware version of your 9215 instrument, use the *About* option in the main menu.



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.

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.

Host 232 Baud
This will set the baud rate for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

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

Host 232 Mode
This will set the mode for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:
Modbus/no PLC
Modbus master/PLC

Host 485 (3,4) Baud
This will set the baud rate for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

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

Host 485 (3,4) Mode
This will set the mode for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. This setting is fixed at **Modbus**.

Host 485 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**.

Slave 1 485 (5,6) Baud
This will set the baud rate for Slave 1 communications. The list of options is:

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

Slave 1 485 (5,6) Bits
This will set the data bits, parity, and stop bits (in that order). The list of options is:
8, none, 1
8, odd, 1

8, even, 1
8, none, 2

Slave 1 485 (5,6) Mode
This will set the mode for Slave 1 communications. This list of options is:
Modbus
Yokogawa
Modbus Host

Slave 2 485 (22,23) Baud
This will set the baud rate for Slave 2 communications. The list of options is:

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

Slave 2 485 (22,23) Bits
This will set the data bits, parity, and stop bits (in that order). The list of options is:
8, none, 1
8, odd, 1
8, even, 1
8, none, 2

Slave 2 485 (22,23) Mode
This will set the mode for Slave 2 communications. This list of options is:
Modbus
SSi Analog Input Board
Yokogawa

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

Host 232A Baud
This will set the baud rate for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

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

Host 232A Mode
This will set the mode rate for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. This setting is fixed at **Modbus**.

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

Slave Instrument Setup

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

This screen will allow the user to configure slave instruments. Of the 25 slave instrument slots, 13 are reserved. 4 others may have special uses. 8 slots are not reserved and may be configured as needed by the user. To set up a slave instrument, highlight the instrument number and click on the **Edit** button.

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

The following assignments must be used as specified if present:

Instruments 7 to 10: Valves 1 thru 4
Instruments 12 and 14: Analog input board
Instrument 13: O_2 sensor
Instrument 15: Telenav, analog input board TC extension wire curves
Instruments 16 and 17: MGA
Instruments 20, 21, 22, and 25: PLC support

The following assignments can be used if the specified application is not used.

Instrument 18: H_2 cell if the MGA is not used.
Instrument 19: Probe instrument such as a 9120.
Instrument 24: Quad analog output board.

The list of controllers includes the following **Atmosphere Controllers**:

- SSi AC20
- Yokogawa 750
- Honeywell UDC3300
- Dualpro LP1 Modbus
- Dualpro LP2 Modbus
- Dualpro LP1 MMI
- Dualpro LP2 MMI
- Eurotherm 2402
- Eurotherm 2500
- Carbpro v3.5
- Carbpro v3.0
- CarbPC
- 9200 LP1
- IR Base
- MGA

This list of controllers includes the following **Temperature Controllers**:

- SSi 7EK
- Yokogawa 750
- Honeywell UDC3300
- Dualpro LP1 Modbus
- Dualpro LP2 Modbus
- Dualpro LP1 MMI
- Dualpro LP2 MMI
- Eurotherm 2402
- Eurotherm 2500
- Unipro v3.5
- Unipro v3.0
- Carbpro v3.5 Slave
- Carbpro v3.0 Slave
- 10Pro
- DualPro IN C
- 9200 LP1
- 9200 LP2
- 9200 LP3
- 9100 LP2
- Eurotherm 2704 LP1
- Eurotherm 2704 LP2
- Eurotherm 2704 LP3
- VC BASE 1
- VC BASE 2
- VC BASE 3
- VC BASE 4
- AIPC
- SSi 7SL
- SSi eFlo
- UMC800 LP1
- SSi Quad AO1
- SSi Quad AO2
- SSi Quad AO3
- SSi Quad AO4
- Yokogawa UT350
- Yokogawa 750 Lp 2
- Yokogawa UP350
- Honeywell DCP551
- Ascon 08
- SSi X5
- SSi M4L
- SSi X5/timer
- SSi SPUD
- SSi AIB3
- SSi H_2 cell
- Flow Meter Short
- SSi O_2 remote
- SSi Dual Motor Board
- SSi Smart AIB3
- O_2 Block
- Waukee Valvetronic +

This list of controllers includes the following **Event Controllers**:

- SSi AC E
- Yokogawa 750E
- Mod Mux
- Dualpro E Modbus
- Dualpro E MMI
- Carbpro E v3.5
- Carbpro E v3.0
- Eurotherm 2500
- SSi 8-8
- SSi 9200E
- Micrologix PLC
- MCM Module
- PLC5 DF1
- SLC DF1

User devices User 1 – 15 can also be selected.

The number below the list is the address for the slave instrument. The range is **0** – **25**.

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

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

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

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

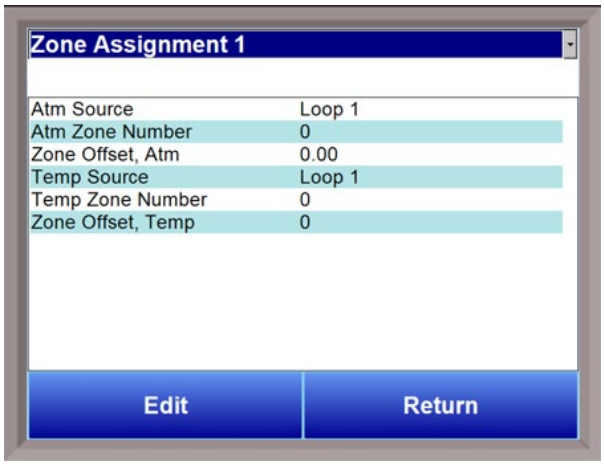
The **Return** button will return the user to the menu screen.

Zone Assignments

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

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

The zone assignment feature allows the 9215 program to change set points on all instruments of a multi-zone furnace. The 9215 has up to five temperature and atmosphere zone assignments available (**Zone Assignment 1** – **Zone Assignment 5**). Typically, the first zone is configured to the programmer's atmosphere or temperature instrument. That is the master set point that will be propagated to the other configured zone instrument set points on set point change. For example, the user may want to set 4 temperature zones from a recipe where the programmer temperature instrument is loop 2. In this case, zone 1 would be configured as loop 2. Subsequent zones would be configured as previously configured slave temperature controllers.



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

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

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

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

When using the multi-zone offset feature, the temperature controller assigned as instruments 1 and 2 should be in zones that will not be offset.

Atm Source

This will allow the user to set the atmosphere instrument for the zone assignment. The options are

Loop 1	Instrument 5	Instrument 12	Instrument 19
Loop 2	Instrument 6	Instrument 13	Instrument 20
Loop 3	Instrument 7	Instrument 14	Instrument 21
Instrument 1	Instrument 8	Instrument 15	Instrument 22
Instrument 2	Instrument 9	Instrument 16	Instrument 23
Instrument 3	Instrument 10	Instrument 17	Instrument 24
Instrument 4	Instrument 11	Instrument 18	Instrument 25

Atm Zone Number
This option will allow the user to set the zone number for the assignment. The range is 0 – 5.

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

Temp Source
This will allow the user to set the temperature instrument for the zone assignment. The options are:

Loop 1	Instrument 5	Instrument 12	Instrument 19
Loop 2	Instrument 6	Instrument 13	Instrument 20
Loop 3	Instrument 7	Instrument 14	Instrument 21
Instrument 1	Instrument 8	Instrument 15	Instrument 22
Instrument 2	Instrument 9	Instrument 16	Instrument 23
Instrument 3	Instrument 10	Instrument 17	Instrument 24
Instrument 4	Instrument 11	Instrument 18	Instrument 25

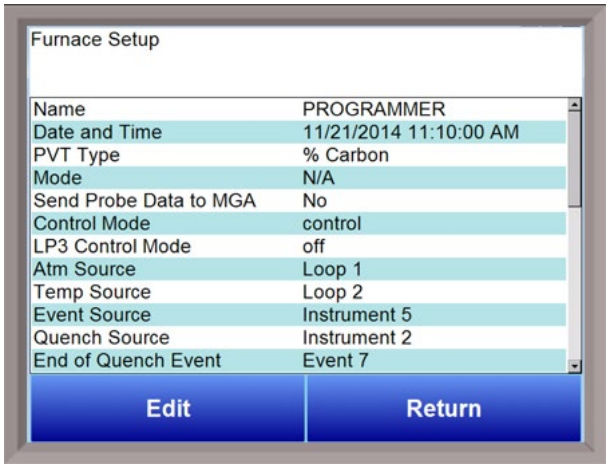
Temp Zone Number
This option will allow the user to set the zone number for the assignment. The range is 0 – 5.

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

Furnace Setup
The Furnace Setup 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.

Name
This is the name of the furnace.

Date and Time
This value is the current date and time on the 9215 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. Call SSi for further assistance.*



PVT Type

The following PVT types can be selected:
% Carbon **Multiloop** **Nitrider** **FNC**

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

Multiloop: Three loops of control can be assigned as selected.

Nitrider: This mode is used for Nitriding control. It calculates % Dissociated Ammonia (%DA) or Nitriding Potential (K_N) when connected to the H_2 sensor. This mode can be used with or without temperature control, depending on the mode setup. Loop 1 control can be

FNC: This mode is used for Ferritic Nitrocarburizing (FNC) control. It calculates %Dissociated Ammonia (%DA) or Nitriding Potential (K_N) when connected to the H_2 sensor. This mode can be used with or without temperature control, depending on the mode setup.

Mode
Modes become active with the selected PVT type is Nitrider or FNC. Following are the modes that can be selected for each of the two PVT Types.

Modes for PVT Type Nitrider	*Modes for PVT Type FNC*
H2 & Dissociation In this mode, the percent of dissociated NH_3 is calculated and used for monitoring or control. **H2 & Kn** In this mode, nitriding potential (K_N) is calculated and used for monitoring or control. **H2 & Super Kn** In this mode, super nitriding potential (Super K_N) is calculated and used for monitoring or control. Super K_N is based on a formula developed by SSi. Contact SSi at (513) 772-0060 for more information.	%C K_N Super K_N Carburizing potential K_C K_O

Send Probe Data to MGA
When this option is set to **yes**: If an MGA is connected (which is required for FNC), then the controller will send data on probe millivolts and temperature to the MGA. (When this option is set to **no,** no data will be sent.)

Control Mode
The possible selections are **Monitor** or **Control** . If Monitor mode is selected, the process variable is calculated, but not control action is performed. If Control mode is selected, the process variable is calculated <u>and</u> control is performed. This applies to loop 1 only. This option is ignored if the PVT Type is Multiloop.

LP3 Control Mode
This option allows you to select either **Temperature** or **Pressure Control** for Loop 3. *Pressure* refers to the furnace back pressure. This option is ignored if the PVT Type is Multiloop.

Atm Source, Temp Source, Event Source, and **Quench Source**
These selections are used by the recipe programmer to determine where to get associated data and where to send setpoint.

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 – 14**.

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 – 14**.

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. The list of possible values is: **none, Input 1 - 14**.

N2 Controlled by Valve 1, NH3 Controlled by Valve 2, D.A. Controlled By Valve 3, and **H2 Controlled by Valve 4**
These options are used to indicate which valves are being actively used. When a valve is not being used, then extraneous data is not used in the calculations.

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.

Clear Events/end of recipe
This switch will allow the user to clear the events out at the end of a recipe. The options are either **no** or **yes**.

Use MGA Suggested Factor
Possible values are **yes** or **no**. If **yes** is selected, then the CO Factor used in %C calculation is taken from the MGA. For this option to be used, the MGA must also be in COF Adjust Mode.

Event time configuration
Possible values are **Event 1 active to event 2 active** or **Event 2 active time.** The controller can measure a time interval in 1/10 of a second. This option determines whether that time is measured based on the time between and event 1 and event 2 going active or just the time that event 1 is active.

Digital Input 3 is FNC Select
Possible values are **yes** or **no**. If set to yes, then digital input 3 can be used to select the FNC mode.

PVT Type When FNC Selected
Possible values are **Nitrider** or **FNC**. The FNC mode allows switching from %Carbon to either Nitrider or FNC.

Carburize Atmosphere Instrument
This selection is used when switching from FNC mode to %Carbon mode via the digital input or a PLC request. When the FNC mode switches from %C to FNC (or Nitrider), the recipe programmer atmosphere instrument is set to internal (0). If not, the selection specifies what external instrument is the atmosphere instrument when in %C mode. This feature is used only if the value is not zero and only when switching from FNC mode to %C mode by the digital input or a PLC request. It is not used when the HMI changes the PVT Type.

Nitrider calc includes diluents
Possible values are **yes** or **no**. When set to yes, this option enables Super K_N calculation.

MGA In Passive
Possible values are **yes** or **no**. If set to yes, then the controller assumes the MGA measuring gas entering the furnace is writing its data to the 9215 (note that the MGA must be set up as Modbus master for this setting). If set to no, then the controller queries the MGA for the data (note that the MGA must be set up as Modbus slave for this setting).

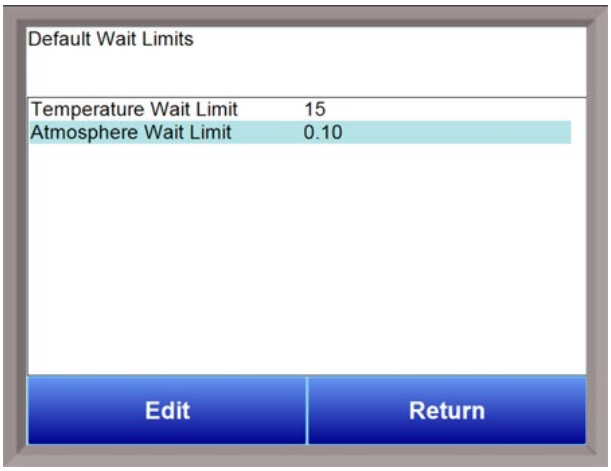
MGA Out Passive
Possible values are **yes** or **no**. If set to yes, then the controller assumes the MGA measuring gas exiting the furnace is writing its data to the 9215 (note that the MGA must be set up as Modbus master for this setting). Because MGA out data is critical to FNC calculations, a setting of yes is not recommended. If set to no, then the controller queries the MGA for the data (note that the MGA must be set up as Modbus slave for this setting).

Probe Source

Possible values are **Internal, Programmer ATM Instrument,** or **Probe Instrument (19)**. This option selects whether the oxygen probe is connected to the 9215 (internal), from the recipe programmer ATM instrument, or from another slave instrument.

Default Wait Limits

The 9215 controller uses default wait limits in conjunction with recipe programs using the wait, wait up, or wait down feature, or guaranteed soaks, atmospheres, etc. The wait limits are in place to help make sure a recipe will not continue to the next step until the process variable is within the specified range. The wait limits are both plus and minus the value of the setpoint specified in the recipe.



Temp Wait Limit

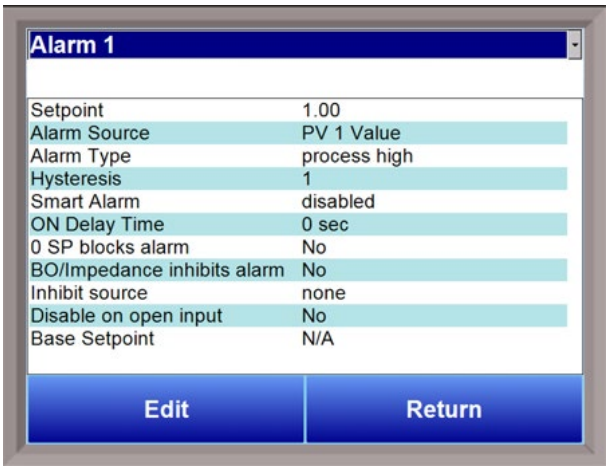
This is the specific wait limit for the temperature PV. The range is **0** to **4000**.

Atm Wait Limit

This is the specific wait limit for the atmosphere PV. The range is **0** to **40.**

Alarm Setup

The 9215 controller can be configured to use three (3) different alarms. Each of the alarms consists of an alarm setpoint, alarm source, alarm type, alarm hysteresis, smart alarm, ON delay time, and a 0 SP blocks alarm value. The alarms come from the factory with a default configuration dependent on the application but also can be modified prior to shipment to your facility or in the field by a supervisor. See the section Appendix D – Factory Default Settings for the 9215 Controller for more information on factory default settings for the alarms.



Setpoint

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

Alarm Type
This value is the type of alarm used. Options are:

- **Process High**
- **Process Low**
- **Band, Normally Open**
- **Band, Normally Closed**
- **Deviation, Normally Open**
- **Deviation, Normally Closed**

These alarm types are described in more detail below:

A process high alarm is active when the alarm source is greater than the alarm setpoint. A process low alarm is active when the alarm source is less than the alarm setpoint. Band and deviation alarms apply to sources that are the process variable of a control loop. They compare the control loop process variable minus the control loop setpoint to the alarm setpoint. The control loop process variable minus the control loop setpoint is called the deviation.

For a band alarm the absolute value of the deviation is compared to the alarm setpoint. For a band Normally open, the alarm is active if the absolute value of the deviation is greater than the alarm setpoint. For a band Normally closed, the alarm is active if the absolute value of the deviation is less than the alarm setpoint.

If the alarm setpoint for a deviation alarm is positive, then only a positive deviation is tested for the alarm. Likewise, if the alarm setpoint is negative only a negative setpoint is tested for the alarm.
A deviation, normally open alarm is active if the deviation is greater than the alarm setpoint in the direction of the alarm setpoint sign. A deviation, normally closed alarm is active until the deviation is greater than the alarm setpoint in the direction of the alarm setpoint sign.

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

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

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

Smart Alarm
This value is a display of the Smart Alarm status. A smart alarm is an alarm that works with a Process Variable (PV), and, when enabled, it will not be active until the PV is within band of the setpoint. The alarm sounding - if active - will be disabled until within the SP band. When it is in band, the alarm will go active unless on delay time is set.

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

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

0 SP blocks alarms
This value will allow a 0 setpoint to block an alarm. The options are either **No** or **Yes**.

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

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

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

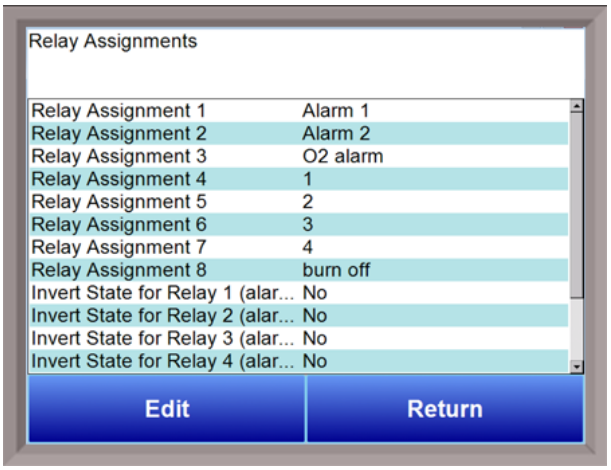
Disable on open input
An alarm can be disabled when an input the open in order to avoid false or unnecessary alarms. This option will allow the user to specify if the alarm is disabled when the input is open. The options are either **no** or **yes.**

Base Setpoint
This applies only if the alarm source is DA, K_N, Super K_N, %C, $\%O_2$, K_C, or K_O. Since these sources are not associated with a control loop, there is not a control loop setpoint to use with the band or deviation alarm types. This value will be used as the target setpoint for those alarm types.

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

Relay Assignments

The 9215 controller has eight relay outputs, as well as eight relay outputs for four additional modules. All of the relays have a positive common terminal and independent negative terminals. All of the relays are configured in a normally closed position except relay number eight, which has both a normally closed (NC) and a normally open (NO) terminal. These relays can be configured to work with events, alarms, loops, burnoff and alarm combinations.



Relay Output Terminals:
Relay Output 1 – terminals 7 and 8
Relay Output 2 – terminals 7 and 9
Relay Output 3 – terminals 7 and 10
Relay Output 4 – terminals 7 and 11
Relay Output 5 – terminals 7 and 12
Relay Output 6 – terminals 7 and 13
Relay Output 7 – terminals 7 and 14
Relay Output 8 – terminals 7 and 15 NC
Relay Output 8 – terminals 7 and 16 NO

Relay Output Choices

Loop 1 fwd	**IN1 Relay SP A**
Loop 1 rev	**IN1 Relay SP B**
Loop 2 fwd	**IN1 Relay SP C**
Loop 2 rev	**IN2 Relay SP A**
Loop 3 fwd	**IN2 Relay SP B**
Loop 3 rev	**IN2 Relay SP C**
Programmer alarm	**IN3 Relay SP A**
Alarm 1 – 3	**IN3 Relay SP B**
Event 0 – 15	**IN3 Relay SP C**
Burnoff	**IR sample solenoid**
	0 – 47 Programmer 1
	0 – 47 Programmer 2
	nothing

The "Alarm Combination" option will allow the user to select the specific combination of alarms to use. The options are: **Programmer**, **Alarm 1**, **Alarm 2**, **Alarm 3**, **Invert State for Relay**, and one of three options in a drop-down box: **TC Chk (Thermocouple Check)**, **EOQ (End of Quench)**, or **Programmer 2.**

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

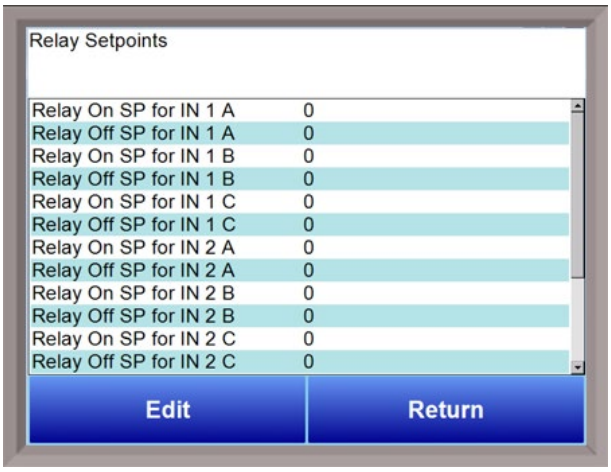
Invert State for Relay 1-8
Each of these options is used to make a relay normally closed for the inactive state. For example, if a relay is assigned to alarm 1, and no alarm is active, then the relay is open; if an alarm is active, then the relay contact is closed. If the reverse state is selected, and no alarm is active, the relay contact is closed; when an alarm is active, then the relay contact opens.

Relay Setpoints

The 9215 controller offers the user three pairs of configurable setpoints for each input. Each pair of setpoints allows the user to configure both **ON** and **OFF** trigger points. The values entered are in engineering units based on input configuration.

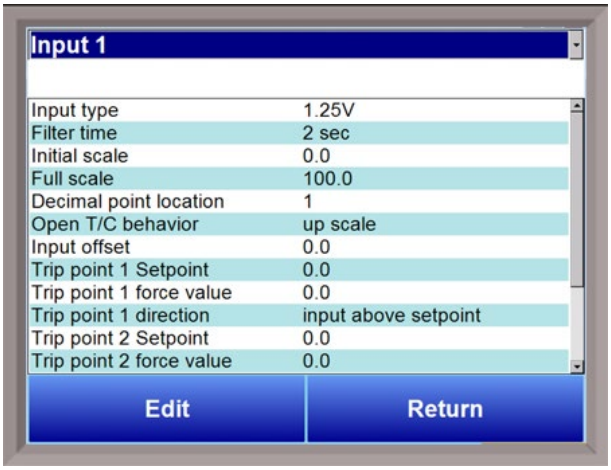
The relay setpoints can only be used once the relays are assigned as such in the Relay Assignments menu option.

The range is **–32768** to **32767**.



Analog Input Setup

The 9215 controller has three analog inputs. Each of the inputs comes with a factory default configuration dependent on the application. It can be modified prior to shipment to your facility or in the field by a technician or qualified/trained person with the proper security code. Before connecting your input source to the terminals, please verify that the input type is set up correctly. If the Input Type is not correct, do not connect the input source to the terminals, as damage can occur. Please consult SSi by calling (513) 772-0060 before making any changes.



<u>Analog Input Terminals</u>
Analog Input 1 – terminals 31 and 32
Analog Input 2 – terminals 29 and 30
Analog Input 3 – terminals 27 and 28

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 124 Ohm resistor will need to be placed on that specific input's terminals for reading this selection. If resistor is not placed on input, then damage could occur to the board.**

**** - 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 **30**. If the value is set above 30, the value will automatically be reset to 0.

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 T/C behavior
This is the open TC value. The options are: **up scale**, **down scale**, **one trip point**, and **two trip points**.

Input Offset
The input offset value is algebraically added to the input value to adjust the input curve on read-out. The range is **–32768** to **32767**.

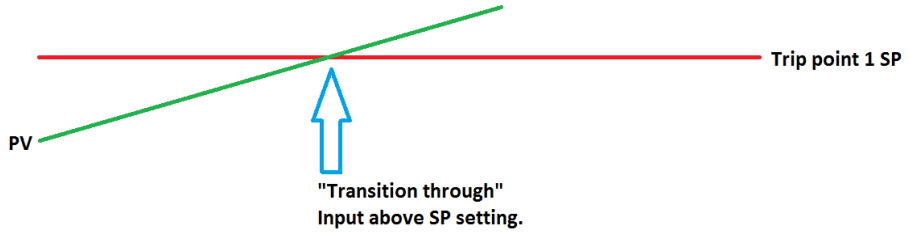
TRIP POINT EXPLANATION: Setting a trip point will force the value that the controller uses for calculations to a certain value as assigned by the operator. Once the **Trip Point Setpoint** is reached, the controller will begin reading the value as the **Trip Point Force Value,** regardless of what the 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.

<u>Trip Point 1 Setpoint</u>: This is the value at which the trip point will be activated, forcing the displayed value to the "force value" set below. This value must be something that the input can achieve.

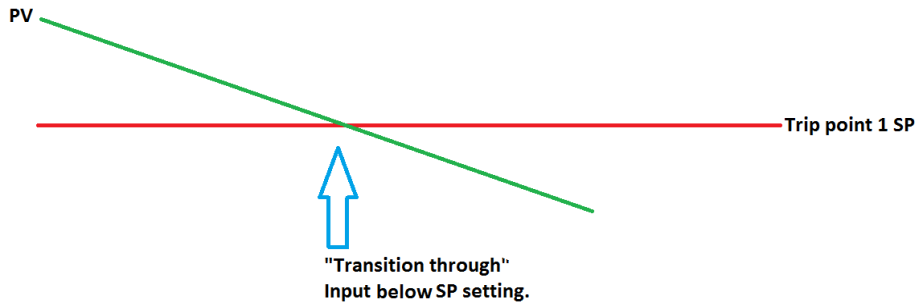
<u>Trip Point 1 Force Value</u>: This is the value that the input will be forced to display when the trip point SP (set above) has been achieved.

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

If you choose **input above SP** then the PV for the selected input will need to transition above the Trip Point 1 SP value set above.



If you choose **input below SP** then the PV for the selected input will need to transition below the trip point SP value set above.



Example (when OPEN INPUT is set for 1 trip point):

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

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

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

High Input Limit Setpoint
This is the setpoint for the high input limit. The range is **–32768** to **32767**.

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

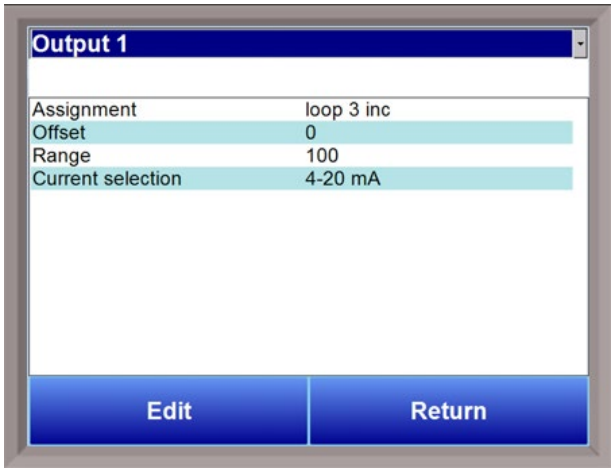
Custom Curve
This will allow the user to set the custom curve to use. The curves are set up through the C*urve Entry* menu option. The options are: **None**, **Curve 1** – **Curve 3**.

T/C Correction Curve
This will allow the user to set the T/C correction curve to use. The curves are set up through the *T/C Correction Curves* menu option. The options are: **None**, **Curve 1** – **Curve 3**.

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

Analog Output Setup

The 9215 controller has the option of six analog outputs. The outputs are ranged for a 4 – 20 milliamp signal or a 0 – 20 milliamp signal. Each output comes with a factory default configuration dependent on the application. Each output can be modified prior to shipment to your facility or in the field by a supervisor.



Analog Output Terminals
Analog output 1 – terminals 24 and 25
Analog output 2 – terminals 25 and 26
Analog outputs 3, 4, 5, and 6 are enabled by use of an SSi QuadDAC board that connects to two RS485 terminals on the 9215 (terminals 5 and 6 for Slave 1, terminals 22 and 23 for Slave 2).

Use the Communications Setup menu to configure communication parameters.

Assignment

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

PV 1 retrans	Not assigned	Programmer DAC 5
Loop 1 inc	O2 offset log	Programmer DAC 6
Loop 1 dec	SP1 retrans	Prog 2 Quench speed (0-1000=0-100%)
Loop 1 combo	SP2 retrans	Programmer 2 DAC 1
PV 2 retrans	SP3 retrans	Programmer 2 DAC 2
Loop 2 inc	Programmer ID number	Programmer 2 DAC 3
Loop 2 dec	Programmer Valve 1 SP	Programmer 2 DAC 4
Loop 3 combo	Programmer Valve 2 SP	Programmer 2 DAC 5
PV 3 retrans	Programmer Valve 3 SP	Programmer 2 DAC 6
Loop 3 inc	Programmer Valve 4 SP	Programmer 2 ID number
Loop 3 dec	Prog 1 Quench speed (0-1000=0-100%)	Programmer 2 Valve 1 SP
Loop 3 combo	Programmer DAC 1	Programmer 2 Valve 2 SP
Input 1 retrans	Programmer DAC 2	Programmer 2 Valve 3 SP
Input 2 retrans	Programmer DAC 3	Programmer 2 Valve 4 SP

Input 3 retrans	Programmer DAC 4	Disabled

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.

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

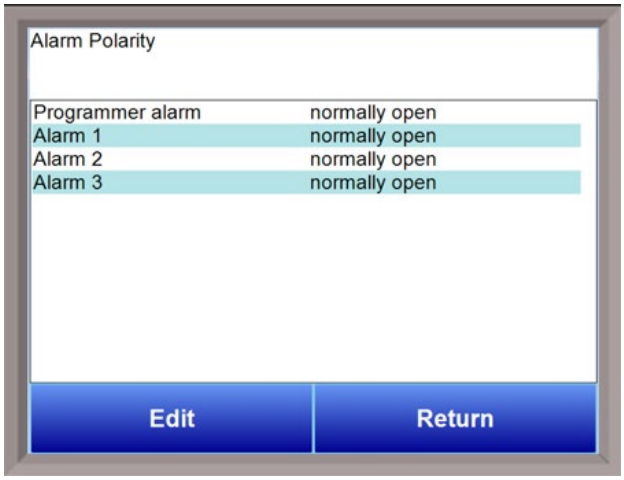
Example: if 4 – 20 mA = 800 mV - 1200 mV
Offset = 800 (starting point)
Range = 400

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

Alarm Polarity
This option will allow the user to set up the polarity of the alarms, or determine whether the Normally Closed option or the Normally Open option makes the alarm active.

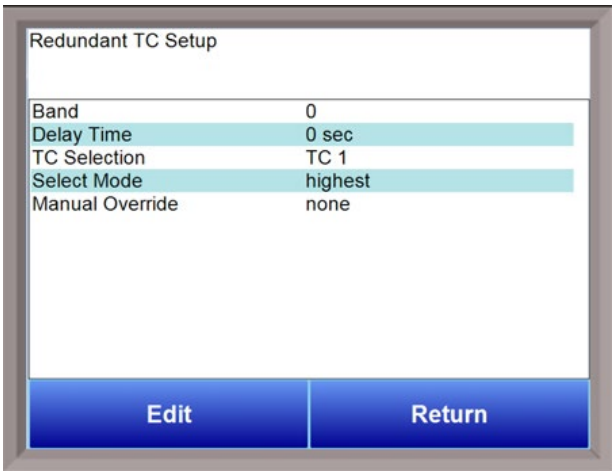
The alarms to configure are: **Programmer Alarm**, **Alarm 1**, **Alarm 2**, and **Alarm 3**. The options for each alarm are: **Normally Open** or **Normally Closed**.

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



Redundant TC Setup

This option allows the operator to choose which TC to control in a redundant TC setup. The redundant TC setup allows for two thermocouples to be used and measured from. This option can be configured so that the higher or lower is automatically selected or in manual mode so that the operator can choose which TC to use.



Band
The Band lets the user set how far apart the values of the TCs in the redundant setup can be before an alarm is activated. The alarm can be assigned under the Relay Assignment menu option. The range for this is -4000 to 4000.

Delay Time
This is the time in seconds that will pass once the TCs go out of band before an alarm is activated to prevent excessive, unnecessary alarming. The range is **0 to 3200 seconds.**

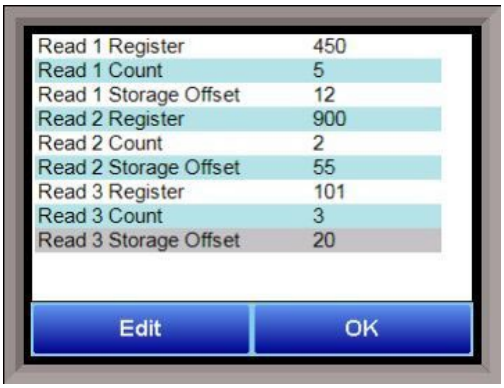
TC Selection
To change this option from TC 1, the select mode must be in manual.

Select Mode
This allows the operator to choose whether the highest or lowest TC will automatically be chosen, or whether it will be manually chosen by the operator. The options are **highest**, **lowest**, and **manual.**

Manual Override
If the 9215 has redundant TC active, then digital inputs 2 and 3 can manually override the system and force the selected TC to be TC 1 if input 1 is active or TC 2 if TC 2 is active. If both input 1 and input 2 are active, input 1 will take precedence and make TC 1 active.

Generic Instrument Setup

The generic instrument's data will be stored in certain registers on the host instrument, such as the 9215 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 9215 controller, instrument 2's allotment is from register 1100 to 1199 on the 9215 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**.

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

Read 1 Register, Read 2 Register, Read 3 Register
The Read *X* Register field will be the register in the 9215 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 9215 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**.

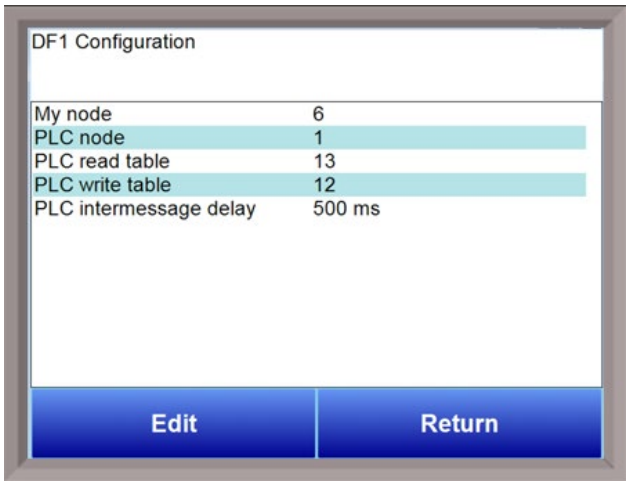
Output Type
The Output Type will determine what kind of the output value will be. The options are: **Integer**, **Big Endian**, **Big Endian Byte Swap**, **Little Endian**, or **Little Endian Byte Swap**.

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**.

DF1 Configuration

This option allows the information data from the 9215 to be sent to the PLC DF1 Register map.



My Node:
This option will allow the user to select the node. This node must not exist anywhere else on the computer's network. The range is **0** to **30000**.

PLC node:
This option will allow the user to select the PLC node. This must be the node address of a PLC. The range is **0** to **30000**.

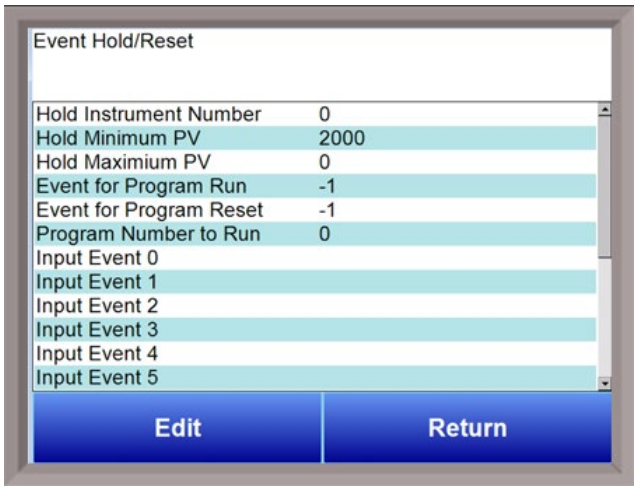
PLC read table:
This option will allow the user to select the PLC read table. The range is **8** to **255**.

PLC write table:
This option will allow the user to select the PLC write table. The range is **8** to **255**.

PLC intermessage delay:
This is the delay time (in milliseconds) between requests sent to the PLC from the 9215 controller. The request can be for any read or write transaction between the PLC and the 9215. The range is 51 - 5000.

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

Clicking on this value will display an input box from which the user can select a new value. The range is **0** to **25**.

Hold Minimum PV

Clicking on this value will display an input box from which the user can select a new value. The range is **-32768** to **32767**.

Hold Maximum PV

Clicking on this value will display an input box from which the user can select a new value. The range is **-32768** to **32767**.

Event for Program Run

Clicking on this value will display an input box from which the user can select a new value. The range is **–1** (Disable) to **15**.

Event for Program Reset

Clicking on this value will display an input box from which the user can select a new value. The range is **–1** (Disable) to **15**.

Program Number to Run

This is the recipe number to run. The range is: **0** – **300**.

Input Event 0 - 15

The input box for these events has two drop-down lists. The top list contains **active** and **inactive**, and the bottom list contains **closed** and **open**.

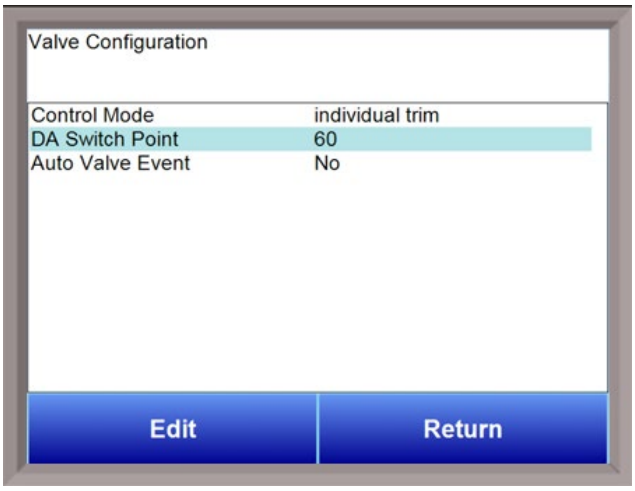
The **Return** button will return the user to the menu screen.

Valve Configuration

Control Mode

This determines how the 9215 will adjust gas flows if required for %Dissociation. This will display a screen that will allow the user to select the mode. The choices are:

- Individual Trim
- Flow
- Ratio
- Auto



DA Switch Point

This selection determines the control switch point for switching the atmosphere display from %Dissociation to K_N. This will display a numeric keypad that can range from **0** to **100**.

Auto Valve Event

This will allow the user to turn the valve event on or off with a running program using the *Set Valve* opcode. This can be either **On** or **Off**.

Valve Setup

Valve 1 – 4

This option will allow the user to set up the valves for the 9215. There is a choice of four valves.

Initial scale

The Initial Scale option will allow the user to set the initial scale for the valve. This value must be less than or equal to the **Valve Max** value.

Full scale

This option will allow the user to set the full scale for the vale. This value must be less than or equal to the **Valve Max** value.

Trim Enable

This option will allow the user to set the trim enable option for the valve. The options are **Yes** or **No**.

Setpoint

The Setpoint option will allow the user to set the target setpoint for the valve. This value must be less than or equal to the **Valve Max** value.

Trim Range

This option will allow the user to set the trim range for the valve. This value must be less than or equal to the **Valve Max** value.

Initial SP Scale

This option will allow the user to set the initial scale for the setpoint. This value must be less than or equal to the **Valve Max** value.

Full SP Scale
This option will allow the user to set the full scale for the setpoint. This value must be less than or equal to the **Valve Max** value.

Valve Max
This option will allow the user to set the maximum flow rate for the valve. The range is **0** to **32767**.

Deviation setpoint
This option will allow the user to set the deviation setpoint for the valve. The range is **0 (OFF)** to **32000**.

Deviation alarm delay
This option will allow the user to set the deviation alarm delay, listed in 1/10th of minutes. The range is **0** to **32000**. *Note: The alarm delay is entered in 1/10th of a minute intervals, but it is displayed in seconds, so 3/10 of a minute = 18 seconds*.

Gas Type
This option will determine the gas type for the valve.

Valve Decimal Place
This option will set the decimal place for the valve. The range is **0** through **4**.

Flow Signal
This selects the source of the flow data for the selected valve

- **RS-485** means that a flow instrument is assigned to the instrument number assigned to the selected valve (e.g., slave instruments 7 to 10 are for valves 1 to 4).

- **PLC without local scaling** means the data is read from the PLC locations as if they are in Engineering units.

- **PLC with local scaling** means the data read from the PLC is in raw A/D counts and must have zero and span values defined in the controller.

- **SSI AIB /4 -20MA** means an analog input board is used to read the flows: Input 1 for valve 1, input 2 for valve 2, etc.

Note 1: For all selections except RS-485, the flow setpoints are sent to an analog output board at instrument 24: Output 1 for valve 1, output for valve 2, etc.

Note 2: All selections are mutually exclusive and can occur in any combination.

Tracking Mode (Valves 3-4)

Note about tracking: Valves 1 and 2 track based upon the type of control or nitrider setup. Valves 3 and 4 can be set to no tracking, track total flow, or track NH_3. Only settings for valves 3 and 4 can be changed.

When valve 3 or valve 4 is selected, the tracking mode can be selected among **none** (no tracking), **% of total flow** (% of the total flow of the three non-selected valves) and **% of NH_3 flow** (% of NH_3 flow among the NH_3 valves).

In the case of % of total flow:
- If <u>both</u> valves 3 and 4 and set to track % of total flow, <u>only</u> valves 1 and 2 are included in the total flow calculation.

- If valve 3 is set to track % of total flow, but valve 4 is not set to track % of total flow, % of total flow will be calculated from valves 1, 2, and 4.
- If valve 4 is set to track % of total flow, but valve 3 is not set to track % of total flow, % of total flow will be calculated from valves 1, 2, and 3.

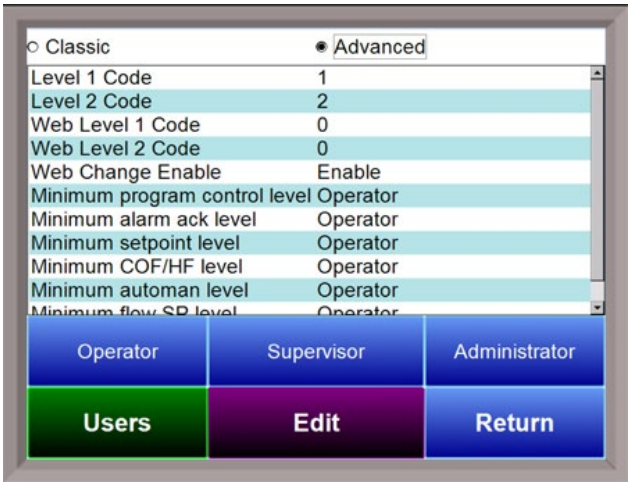
Tracking Percent (Valves 3-4)

Note about tracking: Valves 1 and 2 track based upon the type of control or nitrider setup. Valves 3 and 4 can be set to no tracking, track total flow, or track NH_3. Only settings for valves 3 and 4 can be changed.

When valve 3 or valve 4 is selected, this option can be used to set a percentage of the tracking source as the setpoint for the valve. The possible range is **0.0 to 100.0 percent**. An example of how the tracking percent option can be used is as follows: Assume that the tracking mode is % of NH3 flow and that the tracking percent is 50%. Also assume that NH3 is flowing 86 units. In that example, the setpoint for the valve will be 43 units.

Security

This screen will allow the user to set up the security protocols for the system, as well as set up users for the system. *Note – The "Classic" view will hide the **Users** button and only the Level 1 and Level 2 code will be accepted.* There are three levels of menus in the 9215 controller: Operator, Supervisor, Administrator, and SSi Special.



Operator Level

These are functions typically handled by a furnace operator and do not require a passcode.

Supervisor Level

These are functions typically used by a supervisor and require a level 1 passcode. The user name for the Level 1 code for Touchscreen is "Supervisor". The "Level 1 Code" range and the "Web Level 1 Code" range is **0 to 32767**. If a value outside that range is entered for the code, the code will be automatically set to 1. Note: A negative number may be entered for the level 1 passcode, but it is not considered valid. A negative number will be set to 1 upon restart of the system.

Administrator

These are functions typically used by an administrator and require a level 2 passcode. The user name for the Level 2 code for Touchscreen is "Administrator". The "Level 2 Code" range and the "Web Level 2 Code" range is **0** to **32767**. If a value outside that range is entered for the code, the code will be automatically set to 2. Note: A negative number may be entered for the level 2 passcode, but it is not considered valid. A negative number will be set to 2 upon restart of the system.

Web Change Enable

This option will determine if changes can be made over the 9215's web page. The options for this are: **Enable** or **Disable**.

Minimum Program Control Level
This option will allow the user to determine which security level will be the minimum level for program (recipe) control. The options are: **Operator**, **Supervisor**, or **Administrator**.
Example: If **Supervisor** is selected, then only a supervisor-level or higher can control the program.

Minimum Alarm Acknowledge Level
This option will allow the user to determine which security level will be the minimum level for alarm acknowledgement. The options are: **Operator**, **Supervisor**, or **Administrator**.
Example: If **Supervisor** is selected, then only a supervisor-level or higher can acknowledge an alarm.

Minimum Setpoint Level
This option will allow the user to determine which security level will be the minimum level for sending a setpoint down. The options are: **Operator**, **Supervisor**, or **Administrator**.
Example: If **Supervisor** is selected, then only a supervisor-level or higher can send a setpoint.

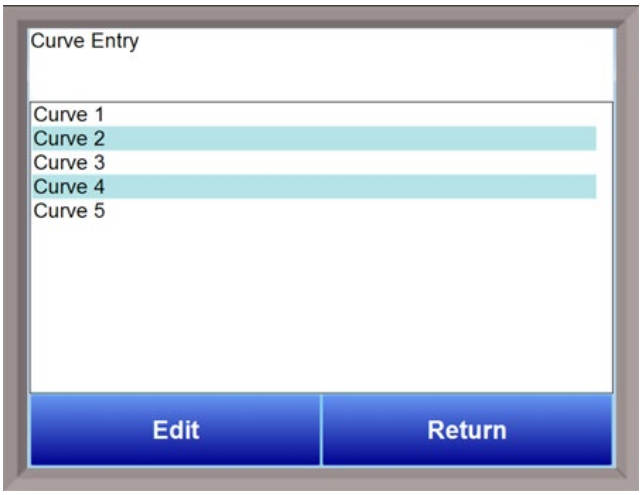
Minimum COF/HF Level
This option will allow the user to determine which security level will be the minimum level for modifying the Carbon Factor or the Hydrogen Factor. The options are: **Operator**, **Supervisor**, or **Administrator**.
Example: If **Supervisor** is selected, then only a supervisor-level or higher can modifying CO Factor or H Factor.

Minimum Automan Level
This setting determines which security level will be the minimum level for changing the output mode to Auto or Manual.
The options are: **Operator**, **Supervisor**, or **Administrator**.

Minimum flow SP level
This setting sets the minimum access level to adjust the flow setpoint.
The options are: **Operator**, **Supervisor**, or **Administrator**.

Curve Entry

Most types of inputs that are used in SSi controllers are already setup with a curve built for most every type of thermocouple available, certain vacuum sensors, etc. However, if an application calls for an input without a standard curve, the curve can be built using this option. Voltages can be paired with corresponding values to create a sensor curve based off of a provided equation or data. This allows the controller to make appropriate readings from the sensor.



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

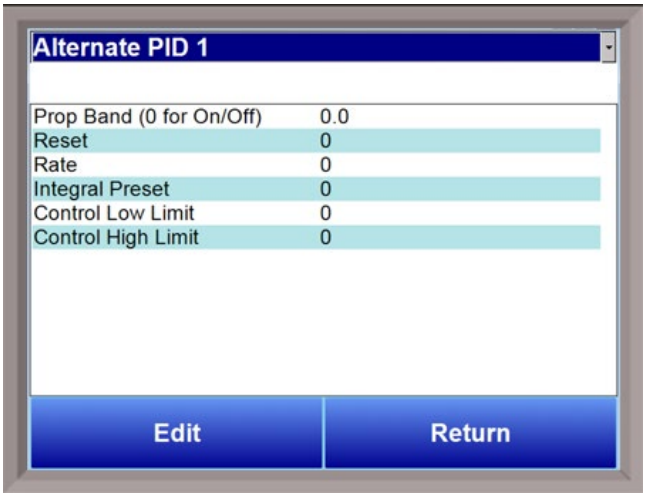
Thirty-two points can be assigned by selecting one of the points and pressing **Edit.** This allows the operator to change the **Millivolts** and the corresponding **Value** by clicking on each option. Pressing **OK** will save the point. Note that all 32 points do not need to be entered; however, the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

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

Alternate PID Setup

IMPORTANT!

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



The Alternate PID Setup menu option allows for up to 16 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.

There is a choice of PID 1 – 16, and Loop 1 Set 1 -3, Loop 2 Set 1 – 3, and Loop 3 Set 1 – 3.

NOTE: The feature of PID Auto Switch is disabled for the entire duration of a 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.

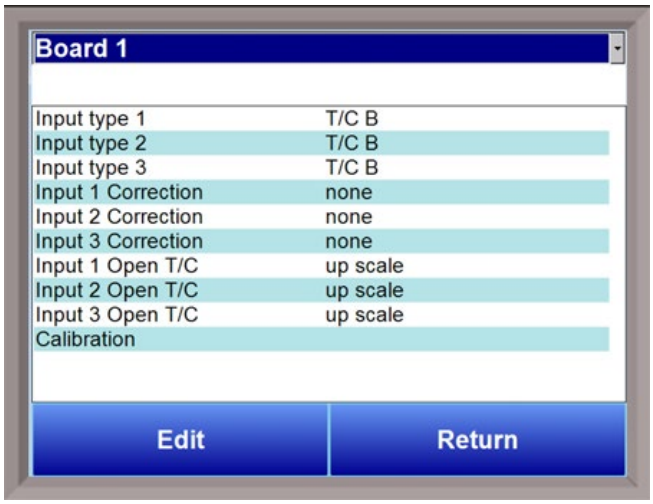
Integral Preset
This is the integral preset value. This field provides an offset for the starting point for PID control, also referred to as "Load Line" or "Manual Reset". The range is **–100** to **100**.

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

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

Aux Analog Input Setup
The Auxiliary Analog Input Setup menu option allows the user an input selection of three inputs per board, three input corrections per board, and three input open T/Cs per board. There are eight (8) boards 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 3
This will select the input types for the board. The options are:

T/C B	160 mV	40 mV
T/C C	T/C R	20 mV
T/C E	T/C S	4-20 mA/124Ω
T/C J	T/C T	4-20 mA/62Ω
T/C K	2.5 volts	25 volts
T/C N	1.25 volts	12.5 volts
T/C NNM	80 mV	

Input 1 Correction – Input 3 Correction
This option will set a correction curve for the input. The options for the input corrections are: **not used**, **Curve 1 – Curve 3**.

Input 1 Open T/C – Input 3 Open T/C
This option will allow the user to set the direction of the open T/C for each input. The options are: **Up Scale** or **Down Scale**.

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

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

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

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

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

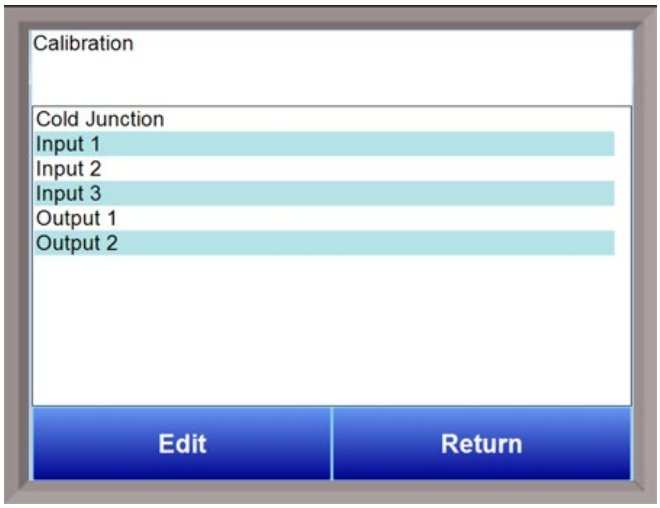
TC Type mV Range Chart

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

T	65

Calibration

For calibration videos involving the touch screen, visit http://www.supersystems.com/tech-videos.



Overview

The 9215 can be calibrated using the Touchscreen interface. Before performing this procedure on a newly installed controller, the unit needs to be powered on for at least 30 minutes for a warm up period.
The series 9215 has three analog inputs. Each range has a zero and span calibration value. A cold junction trim value must be calibrated for thermocouple inputs. There are two analog outputs each with a zero and span value.
To calibrate an input or output, select the desired option and continue. *Note – Even though the "Cold Junction" option is listed first, the inputs and outputs should have the zero and span calibration performed BEFORE performing a cold junction calibration.*

Equipment needed

A certified calibrator(s) with the ability to input and read millivolts, milliamps and thermocouples is required. The appropriate connection leads are also required. A 24VDC 75-watt power supply is required.

Notes

Input 1 – terminals 31 and 32
Input 2 – terminals 29 and 30
Input 3 – terminals 27 and 28
Output 1 – terminals 24 and 25
Output 2 – terminals 25 and 26

Zero Calibration - Inputs

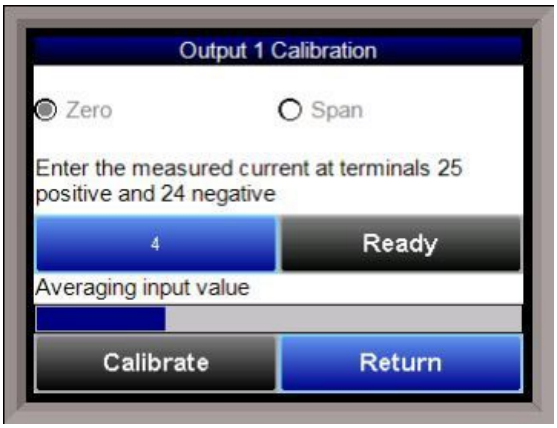
To perform a zero calibration, click on the "Zero" option - The circle will be filled in with a dot for the selected option. For a zero calibration, the recommended value to source is **0 mV**.

Click on the **Calibrate** button to begin the calibration. A progress bar will be displayed along the bottom of the screen giving the progress of the calibration.

Span Calibration - Inputs

To perform a span calibration, click on the "Span" option - The circle will be filled in with a dot for the selected option. For a span calibration, the recommended value is 90 % of the full range. For example, if the range is 80 mV, then the span should be **72 mV**. The recommended value can be changed by clicking on the value, and entering the new value that way.
Click on the **Calibrate** button to begin the calibration.

A progress bar will be displayed along the bottom of the screen giving the progress of the calibration.



Zero Calibration - Outputs
To perform a zero calibration, click on the "Zero" option - The circle will be filled in with a dot for the selected option. When ready to start the calibration, click on the **Ready** button. The user will then have to measure the current at the appropriate output terminals and enter that value on the button next to the **Ready** button by clicking on that value button and entering the value.
Click on the **Calibrate** button to begin the calibration.
A progress bar will be displayed along the bottom of the screen giving the progress of the calibration.

Span Calibration - Outputs
To perform a span calibration, click on the "Span" option - The circle will be filled in with a dot for the selected option. When ready to start the calibration, click on the **Ready** button. The user will then have to measure the current at the appropriate output terminals and enter that value on the button next to the **Ready** button by clicking on that value button and entering the value.
Click on the **Calibrate** button to begin the calibration.
A progress bar will be displayed along the bottom of the screen giving the progress of the calibration.

Cold Junction Calibration

NOTE: Perform zero and span calibrations (see previous sections) before following this procedure.
The "Cold Junction" option will allow the user to perform a cold junction trim on the 9215 analog input board.

To determine if a cold junction adjustment is needed, hook up the calibrator with the appropriate T/C wire attached (reference the specific input under the "Analog Input Setup" menu), then source a temperature to the input. It is best to use an operating temperature to source; for example, if the furnace typically runs at 1700 °F, then 1700 °F should be sourced to the input. Source a range of temperatures – this will help determine whether any difference in readings is linear.

NOTE: This value is NOT the temperature displayed on the "Cold Junction Calibration" menu option – rather, this is the value displayed on the main screen above set point and output.

If the displayed value does not equal the value being sourced, then a Cold Junction Calibration may be necessary. To begin, note the difference between the displayed temperature and the sourced temperature. This is the adjustment that will be made in the "Cold Junction" menu. For example:

Source Temp	Displayed Temp	Difference	Cold Junction Adjustment	Current Temp of Terminals	New Temp of Terminals
1700	1711	11 High	-11	72	61

In this situation, the displayed temperature on the main screen is 11° higher than the sourced input. Therefore, 11° must be subtracted from the current "temperature of terminals" reading. Tap the blue box below "Enter temperature of terminals" and enter the appropriate value (in this case, 61).

Click on the "Calibrate" button to begin the calibration.

After 30 minutes, verify the calibration by again sourcing a temperature to the input and checking the displayed temperature reading on the main display. It is recommended to perform this calibration check after every cold junction calibration.

Click on the Return button to close down the screen

Configuration

This option will allow the user to set some general configuration settings.
The list of configurable items is:

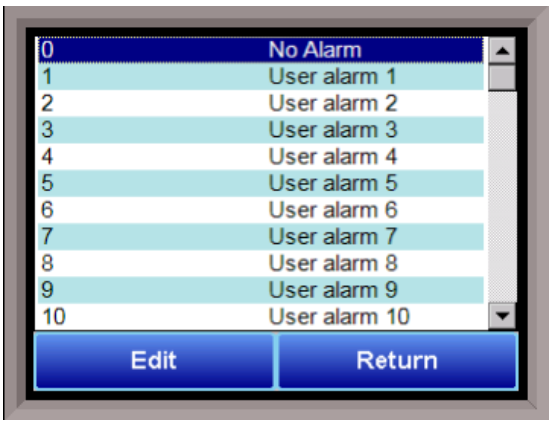
- Log Maintenance
- Programmer Alarm Text
- Event Text
- Auxiliary Analog Input Text
- Analog Output Text
- Compact Database
- Screen Communications
- Datalogging Setup
- Repair Database
- Device Configuration
- Recipe Configuration
- Product Activation
- Alarm Text
- Time Synchronization
- Probe Management
- Maintenance
- Toad TC Map
- Chart Settings
- Read/Write Data

Log Maintenance

This option will allow the user to purge, or delete, log files, starting from a specific date. All log files from on or before the selected date will be purged. The user can purge log files from the **Alarm Log**, **Event Log**, or **System Log**.

NOTE: The touch screen may require a login to access this menu.

Programmer Alarm Text



This option will allow the user to modify the text for

Programmer Alarm 1 – Programmer Alarm 99.
Programmer alarms are internal, non-modifiable alarms that are triggered with the Alarm opcode in a recipe. Each alarm is initially labeled by the text "User Alarm #." However, these labels can be changed to the operator's preference. To change the text displayed for an alarm, open the Configurator program, open the Settings, and select the controller to edit. Under Alarm Text, double click any alarm number, enter the new text to be displayed, and hit Ok. User Alarm 0 is not an alarm; it is used to turn off a user alarm. It functions the same way as the acknowledge button.

Event Text
This menu option will allow the user to configure the text for the input and output events for the 9215. Select whether to edit the Input events or the Output Events. *Note – The list of events can take a few seconds to load*. The screen will refresh after the list has been loaded. There are a total of 31 input events, and 47 output events. Highlight the event to be changed and click on the **Edit** button. This action will display the on-screen keyboard, which will allow the user to modify the event text. To save the changes to the event text, click on the **Save** button. Clicking on the **Return** button will not save any of the changes made. *Note – Clicking on the **Save** button will not close the Edit Event Text screen*. A save must be performed before switching from the input events to the outputs events, and vice versa. It is also recommended that after you return to the main overview screen, you perform a shutdown using the 9215 menu, and then restart the screen. This will save the registry correctly.

Auxiliary Analog Input Text
This option will allow the user to modify the text for Auxiliary Analog Inputs 1-24. Highlight the event to be changed and click on the **Edit** button. This action will display the on-screen keyboard, which will allow the user to modify the text. To save the changes to the text, click on the **Save** button. Clicking on the **Return** button will not save any of the changes made.

Analog Output Text
This option will allow the user to modify the text for Analog Outputs. Highlight the event to be changed and click on the **Edit** button. This action will display the on-screen keyboard, which will allow the user to modify the text. To save the changes to the text, click on the **Save** button. Clicking on the **Return** button will not save any of the changes made.

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

Screen

IMPORTANT!

The touch screen will is configured by SSi prior to first use. Consult SSi before making changes to these settings. Cabling changes may be required.

This menu option will allow the user to determine how the Touchscreen will communicate with the 9215 instrument.
The Media option will be the type of connection the Touchscreen is using to connect to the 9215. The options are:

- COM1
- COM2
- COM3
- COM4
- Ethernet

If COM1 through COM4 is selected, the user will have to set the Address and the Baud rate as well. If Ethernet is selected, then user will have to enter the IP address of the 9215 instrument. The Address option is the slave address of the 9215 instrument for the COM port communications, or the Ethernet IP address for Ethernet communications. For the COM port communications, the address will range from 1 to 250. For Ethernet communications, the address must be supplied in a 999.999.999.999 format, or it will not be accepted.
The Baud option is the baud rate for the COM port communications. The options are:

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

Datalogging Setup

Note – Contact Super Systems before making any changes on this screen, since any changes made can have an adverse effect on the data being displayed.
This menu option will allow the user to modify which registers in the 9215 will be used as datalog data.

This list of data values is shown at the top of the screen.

Click on the **Add** button to add a new set of data values, or click on the **Edit** button to edit an existing set of data values. Click on the **Delete** button to delete a set of values. To add or edit data values, enter the initial offset of the register, as well as the number of sequential registers to read for. Using the example from the image, the data values added would be: 850, 851, 852, 853, and 854. Clicking on the **Save** button will save the new data value registers. *Note – The **Save** button must be clicked on to save any changes to the datalog data, including resetting the configuration*. Clicking on the **Cancel** button will cancel the action. Clicking on the **Reset** button will reset the values to the original configuration. *Note – any changes made to the data values will need a restart of the application before those changes will take effect*. Clicking on the **Descriptions** button will display any descriptions for the data values. The default description for a data value is the data value's register. So the default description for data value 25007 is "25007". Changing this to "Temperature", for example, would make it more descriptive. Register 25007 holds the actual temperature value for the 9215.

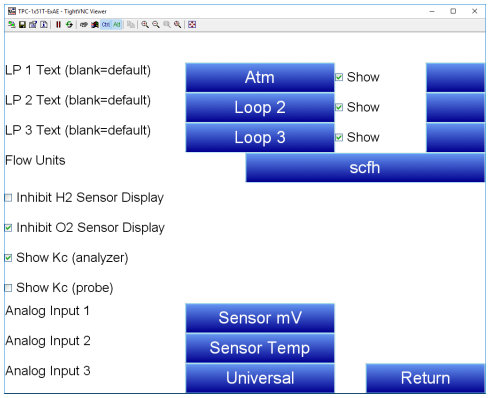
To add a new description, click on the **Add** button. To insert a new description, click on the **Insert** button. To delete a description, click on the **Delete** button. To edit an existing description, click on the **Edit** button. The Add or Insert feature will only create valid descriptions if there are existing data values without descriptions. Click on the **OK** button to save the description changes. Click on the **Return** button to cancel any changes and return to the previous screen.

Repair Database

This feature will make attempted repairs on all SQL databases associated with the screen. Clicking the **Repair Database** button will display a timer icon while the repair is taking place.

Device Configuration

This option allows the user to customize the text that will display with each loop (**Custom Loop 1, 2, 3 Text** fields), set the desired Flow Units, inhibit the H2 and O2 Sensor Displays, Show Kc for Analyzer and/or Probe, and customize the text for Analog Inputs 1-3. In order to customize text, click on the blue box next to the corresponding item number. A keypad will be displayed, and the appropriate text can be entered in. Press **enter** to save.



To select desired Flow Units, click on the blue box and select from the dropdown menu.

Use the checkboxes to select desired settings for Sensor Displays and Kc.

The **Programmers** option allows you to change the number of programmers managed by the 9215. The possible selections are 1 and 2.

The **Recipe Quick View** allows you to set an option, **RemainingTime,** that (when a recipe is running) will cause the current recipe number, step number, and time remaining to be displayed on the 9215 touch screen's main screen.

Recipe Configuration

Using this screen, operators can give names to recipes for easy access. The operator must first choose "Recipes on device access by name" from the drop down menu. Next, select the **Maintain Recipes** button. This screen will allow the operator to Edit and name recipes. Recipes can then be found by name under Recipe Edit.

Each recipe name must be set up with a recipe number in order to be viewable in SSi Configurator. If recipes are set up by name only in Recipe Configuration, you will not be able to view these recipes in SSi Configurator.

The **Compact Database** button will compact the mb.sdf database file that is located on the Touchscreen. When records are added, space is reserved in the database table for the maximum amount of characters, regardless of the actual number of characters in the record. Once the record is added, this space is not released. Instead, it will still be associated with the record, thereby adding to the total disk space and slowing down the communication time with the database. Compacting the database will free up this extra space, which will speed up the amount of time it takes the software to communicate with the database.

Product Activation

This feature is not yet available on the 9215.

Alarm Text

This menu option will allow the user to configure the text for the three main alarms on the 9215 as well as the PLC alarms. Highlight the alarm to be changed and click on the **Edit** button. This action will display the on-screen keyboard, which will allow the user to modify the alarm text. To save the changes to the alarm text, click on the **OK** button. Clicking on the **Cancel** button will forgo saving any of the changes made.

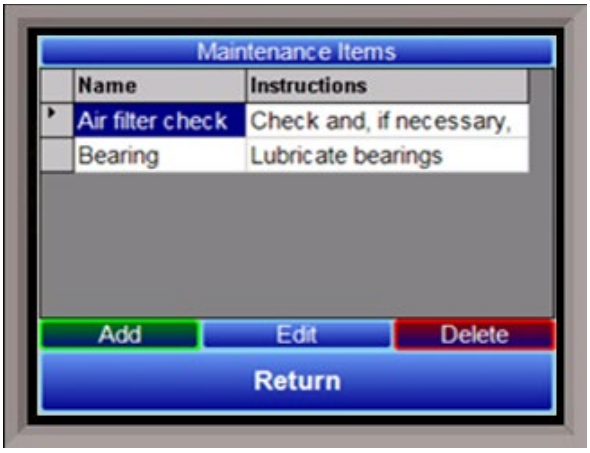
Time Synchronization
This option allows the user to set up the touch screen to sync the system time with an Internet-based time server.

Probe Management
This option allows the user to register a probe within the 9215 by entering its serial number. Doing so creates a tracking history of the probe burnoffs and impedance tests associated with it. Trends can be monitored this way and the impedance of the probe can be traced to help estimate its life expectancy.

Maintenance

Maintenance items are added from the Configuration -> Maintenance menu. To add a maintenance item, first tap the **Add** button. Use the selections to determine the type of maintenance item and corresponding details to add.

Use the **Edit** button from the **Maintenance Items** menu to edit an existing maintenance item. Use the **Delete** button to delete an item.

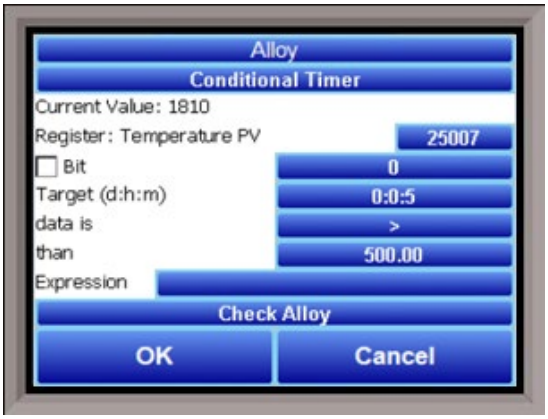


Types of Maintenance Items

The following types of maintenance items can be programmed: **Timed Event**, **Conditional Timer**, **Conditional Counter**, and **Totalizer.**

- Timed Event. A timed event is a maintenance event that is based on intervals of time. For example, assume a plant has burners that need to be inspected once per week. The Timed Event can be programmed to remind operators to perform this maintenance check. In the example shown, a Timed Event called "Burners" has been created. The **Interval** is Weekly, and the number of **Weeks** for which the maintenance item will remain active is 20. The **message** that will appear on the main 9215 touch screen is "Check condition of burners".

- Conditional Timer. The conditional timer maintenance event is based on the status of a selected controller register over a defined period of time. For example, a maintenance task may need to be performed when a register value is above a certain threshold for 1 hour. If the register value is above that threshold for 1 hour, a maintenance message will be displayed on the main 9215 screen.



  In the example shown, when the value for **Register** 25007 (Temperature PV) is **greater** (>) than 500.00 (**than** field) for 5 minutes (**Target**), a "Check Alloy" message will be displayed on the main screen for the 9215 touch screen.

  The **Expression** option allows you to program a scaled value that will be compared to the value entered in the **than** field. In the example shown at right, the value of the register will be multiplied by 0.1 (scaled to 10% of the original value) before it is compared to the value in the **than** column.

- Conditional Counter. The conditional counter is used to generate a Maintenance alert based on a register bit value changing a defined number of times. The **Register** is the register number that will be evaluated for changes. The first **Bit** setting is the bit number. The **Target** is the number of times that a change will need to take place before the Maintenance alert is triggered. The second **Bit** setting defines the change that will increase the Target count: On, Off, or Change. "Change" is any change from a previous state; therefore, a change from On to Off and a change from Off to On would cause the Target count to increase.

  In the example shown, register location 25009, bit 8 will be evaluated for a state change. After the state changes to On (second **Bit** setting) 5 times (**Target**), the maintenance alert will be triggered.

- Totalizer. The totalizer works as an accumulator that adds the value of a register to previously summed values. The Totalizer will add the register value to the accumulated value each minute. This feature be useful for monitoring repeated changes that result in the need for maintenance or inspection. One example may be a furnace door opening and closing as loads are charged and removed from the furnace.

  In the example shown, the value of **Register** 25029 will be monitored and added to previously summed values of the register every minute. After the Totalizer reaches 100 (**Target**), a maintenance alert "Check furnace door" will be displayed on the main 9215 screen.

  The **Expression** option allows you to program a scaled value that will be applied to the accumulated value. For example, if **.1* is entered as the Expression, the register value recorded each minute will be multiplied by 0.1; the scaled value will then be added to the existing sum.

  The figures below illustrate how the Totalizer works with and without an Expression applied.

Value of Selected Register at:					
First Minute	Second Minute	Third Minute	Fourth Minute	Fifth Minute	Totalized Value
5	20	6	5	11	47

Totalizer function <u>without</u> Expression applied

Value of Selected Register at:					
First Minute	Second Minute	Third Minute	Fourth Minute	Fifth Minute	Totalized Value
5	20	6	5	11	
Scaled Value with Expression **of *.1** applied:					
0.5	2.0	0.6	0.5	1.1	4.7

Totalizer function <u>with</u> Expression applied

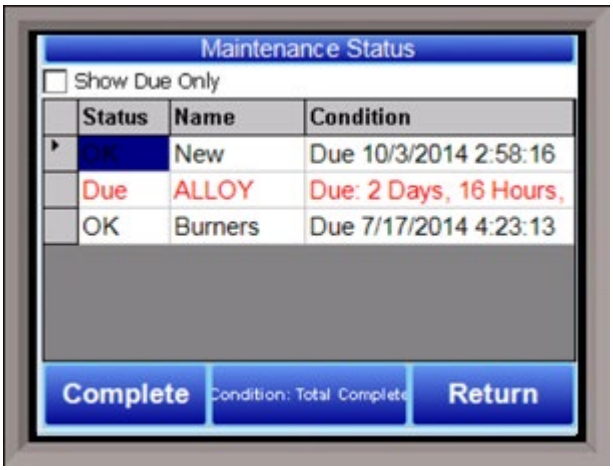
From the **Maintenance** menu (accessible from the main menu), you can view a list of scheduled and completed maintenance items.

Operator level access allows the user to monitor the **Status** of maintenance items and to use the **Maintenance Report** functions.

Supervisor level access provides all of the above functionality and the ability to **Edit Current Records**. Administrator level access provides all of the above, as well as the ability to **Edit Security Settings** for the maintenance menu.

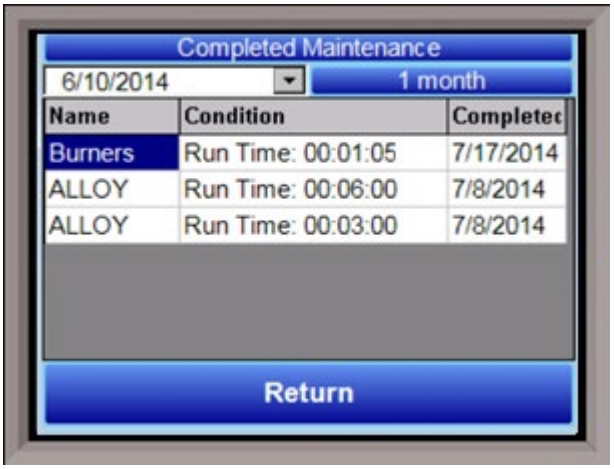
Status

The **Maintenance Status** screen provides the ability to view the status of maintenance items, mark items complete, and change the status condition format. If a maintenance item is not due, it will appear in black lettering. If the item is due, it will appear in red lettering. The **Show Due Only** checkbox, when checked, will cause only those items that need to be completed ("Due") to be displayed. When a maintenance line item is selected, the **Complete** button allows you to mark a maintenance item complete. The **Condition:** button allows you to change the status from Total Complete to Percent to Total.



Maintenance Report

The **Maintenance Report** window provides a log of maintenance items completed on a daily, weekly, or monthly basis beginning at a defined date.



Edit Current Records

With this option, you can edit existing maintenance records. The screen will display maintenance condition in a way similar to the Maintenance Status menu, except that red lettering is not used for items that are due; the condition types can be changed in the same way as on the Maintenance Status screen.

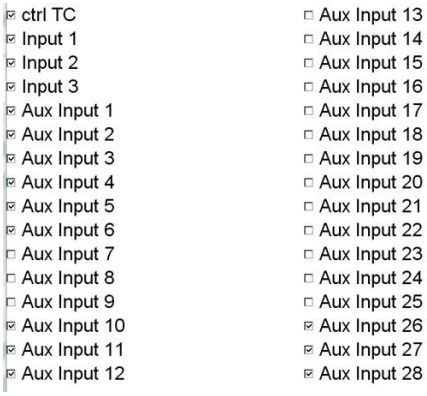
To edit an item, select the item and tap **Edit.** The **Edit Record** screen will appear, allowing you to change parameters of the record (such as start date) based on the type of maintenance item.

Edit Security Settings

Using this menu, you can change security settings for completing maintenance items and editing maintenance records. By default, both operators and supervisors can complete maintenance items, and only supervisors can edit records. (Of course, an administrator can do all of these. Administrator access is required to edit security settings.

To change a security setting, select the item in the **Allowed Item** list. Tap **Toggle Operator** to change the Operator value between True and False. Tap **Toggle Supervisor** to change the Supervisor value between True and False. If a value is true, it means that the corresponding access level is allowed to perform that function. If a value is false, it means that the corresponding access level is not allowed to perform that function.

Tap **Save** when finished updating settings.

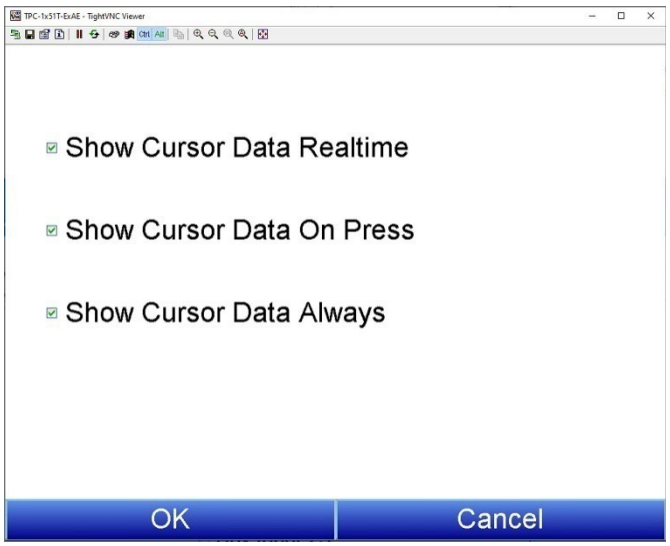


Load TC Map

Load TC Map allows the user to select which Load TCs will be available when using the LTC_SET opcode. Only those TCs selected on this screen will appear as an option when using the opcode. See the description of the LTC_SET opcode in Chapter 4 for more information.

Chart Settings

Chart Settings allows the user to set the default display behavior of the trend chart, specifically in regards to the cursor. See the Chart section for details on the display chart feature.

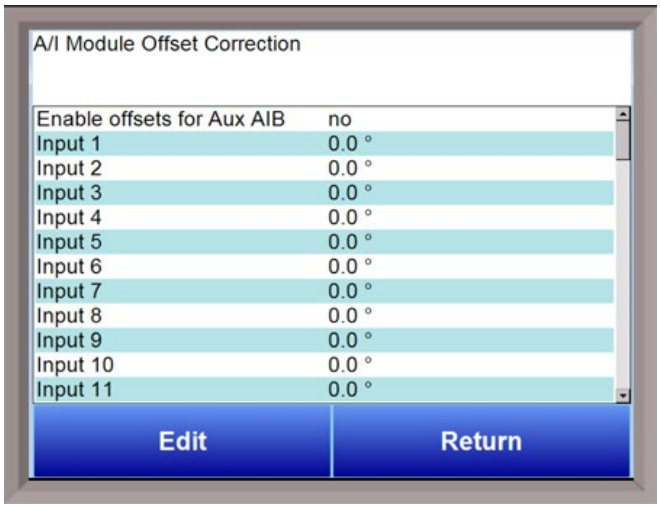


Read/Write Data

This menu option is protected by the SSi special passcode. Contact SSi at (513) 772-0060 to obtain this passcode before making any changes.
This menu option is used mainly for technical support reasons. It will read the registers from the 9215 and display those registers on the screen. The user will be able to read from and write to the 9215's registers. When the screen is first displayed, it will read the first 100 registers from the 9215 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. For instance, column "0" will start with register 0, which in the picture has a value of "101". The next value down is register 1, which has a value of "5". The next value down is register 2, which has a value of "1", etc. So, column "40", 4 values down is register is register 43, which has a value of "9999".
The number box in the top left of the screen is the beginning register to read from. This will default to 0 when the screen starts. To read registers 100 – 199, edit the value to read "100". *Note – changing the value will automatically begin the read process. This process could take a few seconds to complete*.
The "Write offset" value will allow the user to write a specific value listed in the "Write value" box to the register listed in the "Write offset" box. Click on the **Write** button to write the value to the register. Click on the **Return** button to return to the *Configuration* menu.

A/I Module Offset Correction

The Analog Input module offset correction menu option gives the user the ability to offset any input on any A/I module for up to forty (40) inputs. Input correction curves can also be applied to inputs 1 through 40. The offset can be in degrees + or -, and it is typically used to compensate for incorrect T/C wires.



Enable Offsets for Aux AIB
This option will determine if the offsets entered will be applied on the inputs. The options are: **Yes** or **No**.

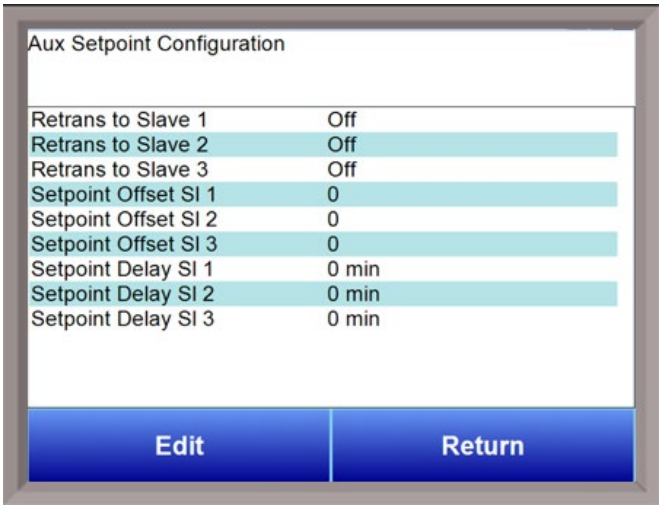
Input 1 – Input 40
This will be the offset for the specified input. The range of the offsets is **–50.0** to **50.0**.

Input 1 Correction – Input 40 Correction
This will allow the user to enter a correction curve, if desired, to inputs 1 through 40. The options are: **Not Used**, **Curve 1** – **Curve 7**.

Aux Setpoint Configuration

Aux Setpoint Configuration is an automatic setpoint retransmission with a corresponding custom offset and delay to one or more of the first 3 configured slave instruments. The delay is in minutes and is only active when the setpoint is dropped. This feature would most commonly be used to keep the alarm setpoint of an overtemp tracking the furnace's main setpoint (with offset). The delay allows the furnace time to cool below the level specified so that there is no overtemp alarm when the furnace is cooling.

Note: If the setpoint is 0, then the retransmission is blocked.

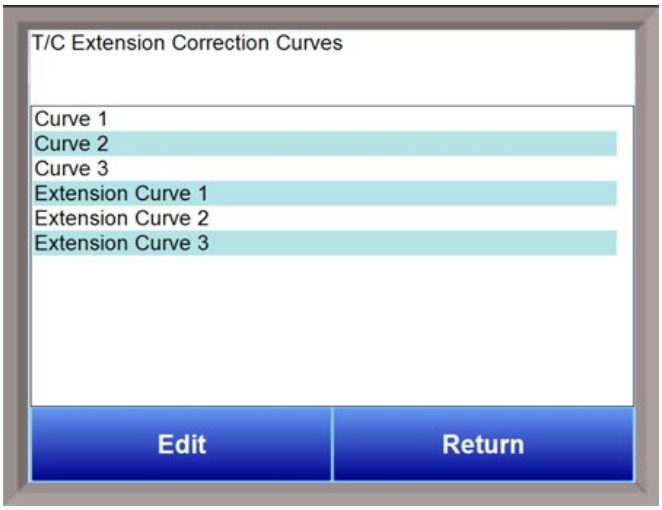


T/C Extension Correction Curves

This menu option will allow the user to set up to three TC correction curves for the 9215 controller, as well as three auxiliary correction curves (extension curves). Clicking on the desired curve will display the curve edit form. *Note: If the first "Temp" value and the first "Error" value are both zero, then the curve will not be set*. The user can enter up to ten "Temp"/"Error" combinations.

The range for the "Temperature" field is **–32768** to **32767**.

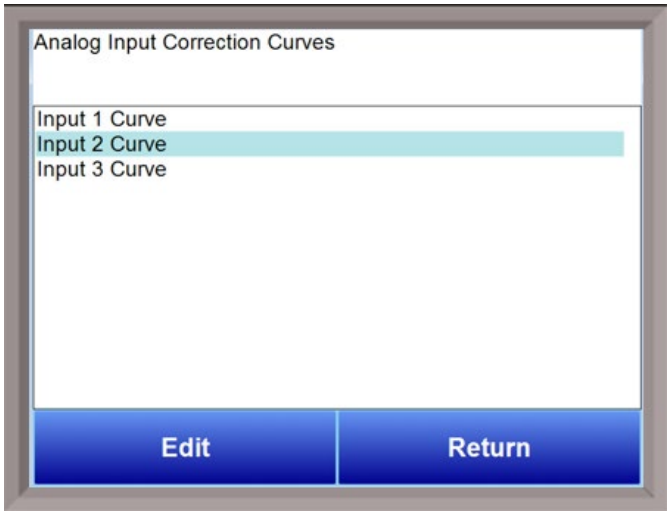
The range for the "Error" field is **–32768.000** to **32767.000**.



Analog Input Correction Curves

This option allows the user to edit a curve on an input 1,2, or 3 at a specific temperature point. Select the appropriate curve and press **Edit** to customize specific points.

Select the point to be changed, and press **Edit** again. Input the correct Temperature and Error, and press **OK** to save.

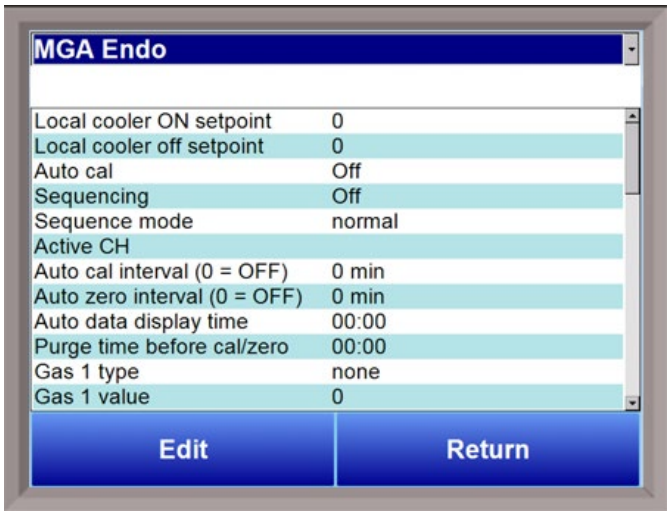


MGA Setup

The MGA Setup menu provides options for interfacing the 9215 controller with a multi-gas analyzer (MGA) from SSi.

MGA Endo / MGA Furnace
This setting is changed in a drop-down menu at the top of the screen. When MGA Endo is selected, the controller assumes that the MGA is connected to the endo gas going into the furnace. When MGA Furnace is selected, the MGA assumes that the MGA is connected to the exhaust gas leaving the furnace.

Local cooler ON setpoint / Local cooler off setpoint
When the internal temperature of the MGA reaches the ON setpoint, the cooler will be turned on. When the temperature drops below the OFF setpoint, the cooler will be turned off.



Auto cal
This option sets whether the auto calibration feature is ON or OFF.

Auto cal interval
The amount of time (in minutes) between auto span calibrations.

Auto zero interval
The amount of time (in minutes) between auto zero calibrations.

Auto data display time
When an auto zero or auto span is finished, the MGA display will show results for this amount of time.

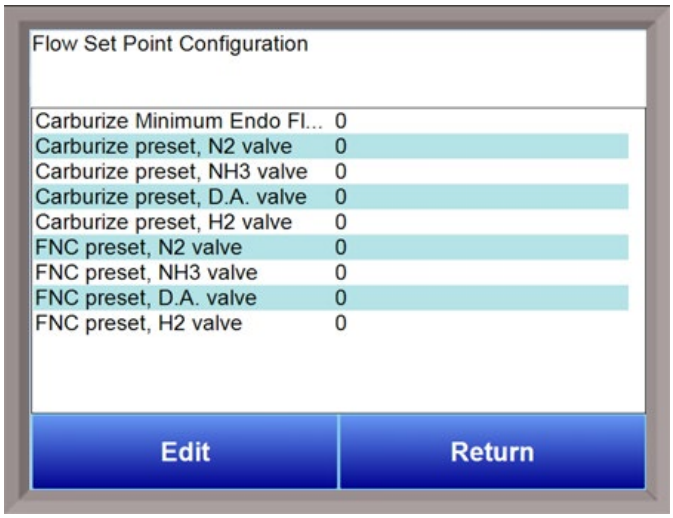
Purge time before cal/zero
This time is to make sure the zero or span gas has completely filled the MGA cell before performing the zero or span.

Gas 1 – 6 Information: Type, Value, Full Scale, Display Decimal Place, Source Decimal Place, and Units
The MGA can measure and display information for up to six gases on its screen.

- **Type** is the gas type for which information is being displayed as gas 1, 2, 3, 4, 5, or 6 (CO, CO_2, CH_4, etc.).
- **Value** is the gas reading.
- **Full scale** is the full scale range for the gas.
- **Display Decimal Place** indicates how many decimal places will be displayed.
- **Source Decimal Place** indicates the resolution of the actual source measurement.
- **Units** identifies the unit of measurement (usually percent).

Flow Set Point Configuration

This menu provides options for setting flow rate minimum and preset values.



Carburize Minimum Endo Flow

When in %Carbon mode (not Nitriding or FNC), this sets the minimum endothermic gas rate into the furnace. Either or both valve 3 and 4 must be set to endo valve type in order for this feature to work. If the endothermic gas target setpoint for valve 3 or 4 is less than this minimum, then the setpoint is set to the minimum. The controller will check both valves 3 and 4 and adjust the setpoints independently, if needed. If the value for this option is set to 0, then the feature is disabled (not used).

Valve presets (applies to Carburize preset – N_2, NH_3, D.A., and H_2 valves, and FNC preset – N_2, NH_3, D.A., and H_2 valves)

In total, there are eight (8) presets for valve setpoints used when switching between %C and FNC modes. Valves 1 is assumed to be for N_2, valve 2 for NH_3, valve 3 for D.A., and valve 4 for H_2.

Two basic principles are important for these options:

- When switching from FNC mode to %C mode, the Carburize presets are used.
- When switching from %C mode to FNC mode, the FNC presets are used.

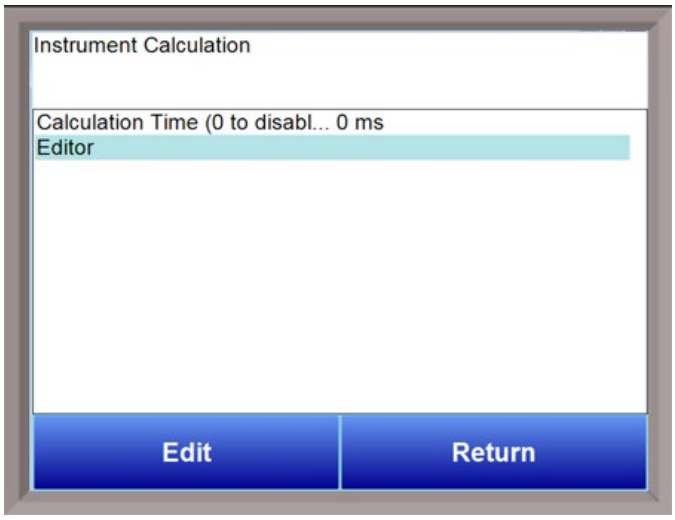
The preset for each valve can have one of three conditions:

1. The preset can be disabled, meaning the valve setpoint will not be changed.
2. The preset can be set to current flow, which means that the setpoint will be set to the actual flow through the valve when the switch occurs.
3. The preset can be set to a specific value, which will be applied to the specified valve when the mode switch occurs.

The presets are used only when the switch occurs from %C to FNC, or from FNC to %C. No changes to the valve setpoints will occur once the mode switch has taken place (unless the mode switches again).

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 9215's Modbus registers can be used as input variables in the equations without restriction. To protect the instrument, Modbus registers are restricted as output registers.
Modbus registers are designated by an upper or lower case "M" followed by a number.
Note – The standard Modbus routine is called to retrieve the Modbus variable, therefore a 0x8000 (-32768) will be returned for an invalid register.
Note – Modbus registers are stored with integer values, so adjustments will need to be made for decimal values.
If the instrument can have external analog input boards, or the instrument is a Video Recorder or DAQ, these inputs can be accessed directly as A1 through A40. By using the "A" designation, the Modbus register number is not needed and the variable is scaled to the correct value (decimals included) based on the input type specified.
In a Video Recorder, the slave instrument data slots can be defined as variables D1 through D32. D31 and D32 are extra slots and have no restrictions as output variables. D1 through D30 are shared with the first ten (10) slave instruments in groups of three (3) – PV, SP, PO – and caution should be used when assigning as outputs.
A line in the program of the instrument calculation must start with a variable or a keyword.
Variables must be followed by an equal sign (=) and then an expression. The expression can be a simple assignment (V1 = 3) or a variable operation variable as described below (V1 = M225 * 0.1).
Keywords *MUST* be entered in capital letters only.
The list of valid keywords is: **IF**, **ELSE**, **ENDIF**, **QUE**, **RLY**, and **END**.
"IF" must be followed by an expression which is a variable, relationship operator, then variable.
The list of valid relationship operators is: **>** (Greater Than), **<** (Less Than). **=** (Equals), **>=** (Greater Than or Equal To), **<=** (Less Than or Equal To), **!=** (Not Equal To), and **==** (Equal To). *Note – The "=" and "==" relationship operators are identical*.
The list of valid bitwise operators is: **&** (AND), **|** (OR), **^** (XOR), **<<** (Left Shift), and **>>** (Right Shift).
The result of the "IF" relationship test determines if the lines following the "IF" statement will be executed or not.
The "ELSE" and "ENDIF" must be on a line by themselves. "ELSE" will toggle the program based on the result of the "IF" test. "ENDIF" will close out the "IF".
Example:
IF V1 >= 30
V3 = V2 * 1.5

ELSE
V3 = 5
ENDIF
In this example, if the value in V1 is greater than or equal to 30, then the value of V3 will be the value of V2 multiplied by 1.5. If the value in V1 is less than 30, the value of V3 will be 5.
EVERY "IF" must have a closing "ENDIF". However, the "ELSE" is optional.
The "QUE" is used to send data to a slave instrument and must have three (3) variables separated by spaces. The first is the slave instrument number, the second is the register number, and the third is the data to send.
Example:
QUE 3 1129 V1
This example will send the value of V1 to register 1129 on instrument 3.
The "RLY" is used to control a relay if the relay assignment is 999. The "RLY" must be followed by a variable which is the relay number (**1** – **8**) and a relationship expression.
Example:
RLY 5 M554 < 2
This example would turn Relay 5 ON if the communication status for instrument 5 was bad.
The "END" keyword will stop the lines from running, and start over from line 1.
There are a few functions that are available as well. The list of valid functions is: **FSIN** (Sine), **FCOS** (Cosine), **FEXP** (Exponent), **FLOG** (Logarithm), **FLN** (Natural Logarithm), **FSQRT** (Square Root), **FABS** (Absolute Value), and **FPOW** (Power). The Sine and Cosine functions need to have the parameter in radians. A function must be in all caps and begin with an "F" and have a pair of parenthesis. An undefined function returns the value of the expression in the parenthesis. *Note – A pair of parenthesis by themselves is considered an undefined function*.
The instrument calculation has limited parsing ability. This is kept to variables, operation, variable – i.e. V1 = 12.25 * V2. Another example is M128 = V1/100.
A negative sign (-) in front of the number is considered part of the number – i.e. V1 = -2.55 + V2.
A variable to the parser is one of the following: a program variable (Vxx), a Modbus register (Mxxx), a number, or a function.
Example:
V1 = (V2 * 1.35) + (V3 * V4)
This example will multiple V2 by 1.35 and multiply V3 and V4 together, and add those two results and store that value in V1.
The maximum length of a program line is thirty-one (31) characters.
The following are the valid mathematical operators: + (Addition), - (Subtraction), * (Multiplication), / (Division), and % (Modulo Divide – integer only).
The difference between Division and Modulo Division is that Modulo will always return an integer value.
Example:
11 / 4 = 2.75
11 % 4 = 2 (The .75 will not be returned)

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

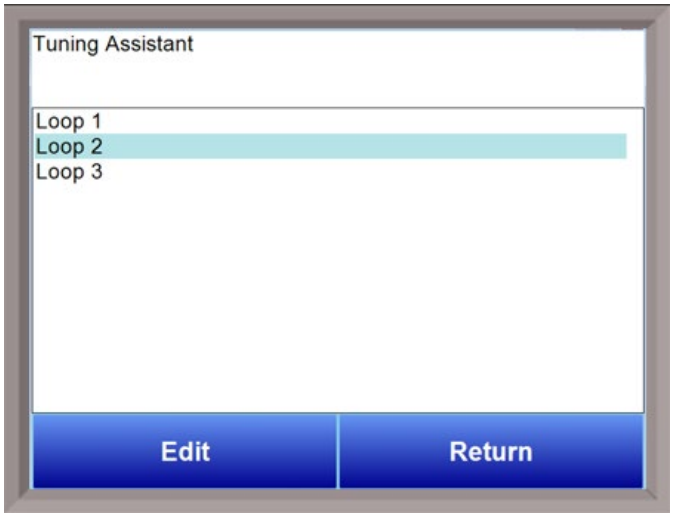
Editor

This option will display the screen where the calculations can be entered.
To edit a line, click on the **Edit** button. This will bring up the keyboard, which will allow the user to change the text for the calculation. If **Edit** is clicked on a blank line, a new calculation can be entered.
To Insert a blank line in between lines, select the line *BELOW* where the inserted line is going to go and click on the **Insert** button.
To delete a line, highlight the line and click on the **Delete** button.
To erase a line, highlight the line and click on the **Clear** button.

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 9215 controller. Select the loop to tune and click on the **Edit** button to auto tune that loop.

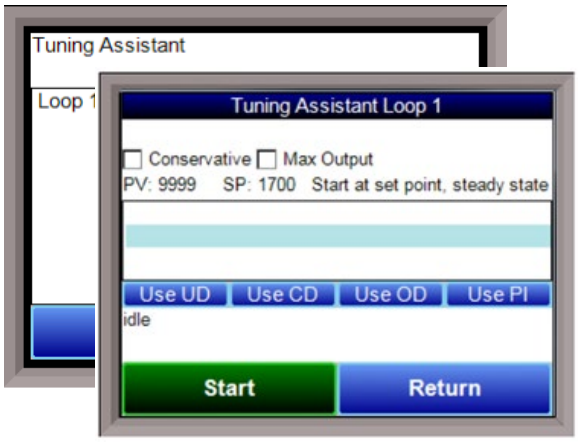
Note: The four buttons at the bottom of the screen: ***Use UD (Under Damped), Use CD (Critically Damped), Use OD (Over Damped),*** *and* ***Use PI*** *will be inaccessible until some PID settings are loaded into the PID settings list above the buttons*. The **Return** button in the bottom right of the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



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

The "Max Output" checkbox allows you to set a maximum output percentage; this feature is useful when output may need to be limited due to physical characteristics of the furnace.

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

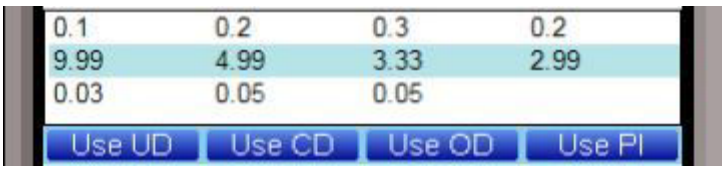


Pressing the **Start** button will begin the auto tune process. *Note: The process may take a few seconds to start*. The "Idle" line will change to display the process for the auto tune. The line will display a pointer value.

*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.

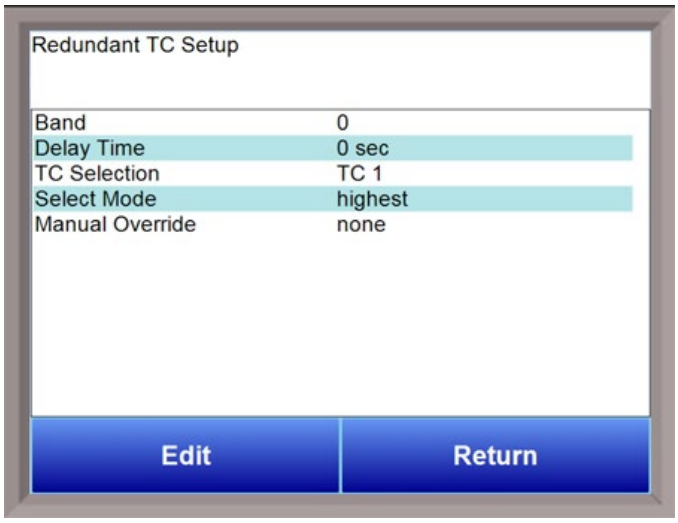
The critically damped values provide a balance between the underdamped and overdamped values with regard to time and overshoot.

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

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.

Redundant TC Setup

This option allows the operator to choose which TC to control in a redundant TC setup. The redundant TC setup allows for two thermocouples to be used and measured from. This option can be configured so that the higher or lower is automatically selected or in manual mode so that the operator can choose which TC to use.



Active
This setting enables or disables the Redundant TC feature. "Yes" enables the feature; "No" disables it.

Band
The Band lets the user set how far apart the values of the TCs in the redundant setup can be before an alarm is activated. The alarm can be assigned under the Relay Assignment menu option. The range for this is -4000 to 4000.

Delay Time
This is the time in seconds that will pass once the TCs go out of band before an alarm is activated to prevent excessive, unnecessary alarming. The range is **0 to 3200 seconds.**

TC Selection
To change this option from TC 1, the select mode must be in manual.

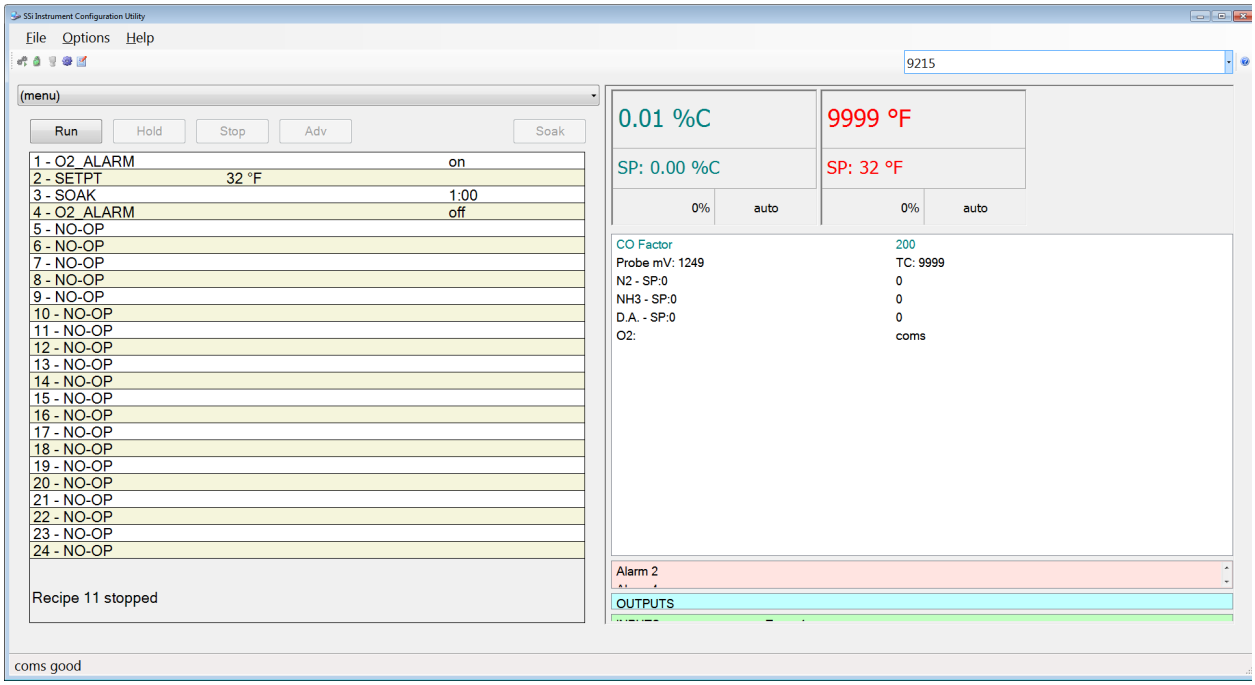
Select Mode
This allows the operator to choose whether the highest or lowest TC will automatically be chosen, or whether it will be manually chosen by the operator. The options are **highest**, **lowest**, and **manual.**

NOTE: If the 9215 has redundant TC active, then digital inputs 2 and 3 can manually override the system and force the selected TC to be TC 1 if input 1 is active or TC 2 if TC 2 is active. If both input 1 and input 2 are active, input 1 will take precedence and make TC 1 active.

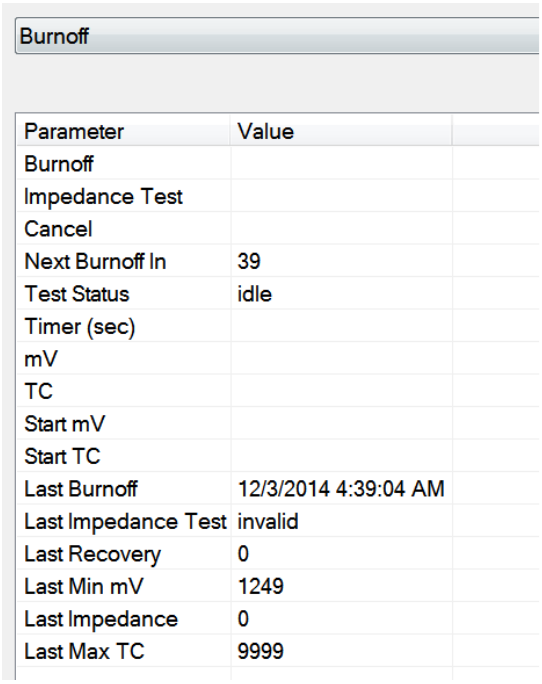
Manual Override
If the 9215 has redundant TC active, then digital inputs 2 and 3 can manually override the system and force the selected TC to be TC 1 if input 1 is active or TC 2 if TC 2 is active. If both input 1 and input 2 are active, input 1 will take precedence and make TC 1 active.

Chapter 3 – Configurator 2.0 Menus

The following section will detail the menus that are found with the Configurator 2.0 software for the 9215 controller.



Burnoff

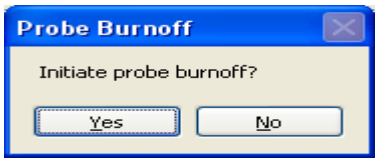


Burnoff

Parameter	Value
Burnoff	
Impedance Test	
Cancel	
Next Burnoff In	39
Test Status	idle
Timer (sec)	
mV	
TC	
Start mV	
Start TC	
Last Burnoff	12/3/2014 4:39:04 AM
Last Impedance Test	invalid
Last Recovery	0
Last Min mV	1249
Last Impedance	0
Last Max TC	9999

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

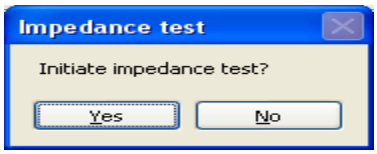
Burnoff:
Clicking on this value allows users to manually initiate burnoff procedure. The user will have to confirm this action



Configurator – Confirm burnoff

The "Test Status" will show that a burnoff is in progress.

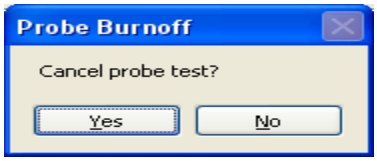
Impedance Test:
Clicking on this value manually turns on/off the impedance test (this can *only* be initiated manually). This test lasts 30 seconds. The user will have to confirm the action.



Configurator – Confirm impedance test

The "Test Status" will then become "Impedance Test".

Cancel:
Clicking on this value will manually turn off both the burnoff and the impedance test. The user will have to confirm this action.



Configurator – Confirm cancellation

Next Burnoff: (shown in minutes):
This value is a displayed calculation based on the burnoff time set in the *Probe Burnoff Setup* menu option. It displays the number of minutes until the next burnoff will be initiated.

Test Status:
This value displays the current testing status. The list of possible values are: **Burnoff**, **Burnoff Recovery**, **Idle**, **Impedance Recovery**, or **Impedance**

Timer:
This value shows the remaining time, in seconds, for the Burnoff / Impedance Test / Recoveries.

mV:
This value is a display of the current millivolt input value during a burnoff or impedance test.

TC:
This value is a display of the current probe thermocouple input value during a burnoff or impedance test.

Start mV:
This value is a display of the millivolt input value at the beginning of the Burnoff or impedance test.

Start TC:
This value is a display of the probe thermocouple value at the beginning of the burnoff or impedance test.

Last Burnoff:
This value shows the date and time of the last burnoff.

Last Impedance Test:
This value shows the date and time of the last Impedance test.

Last Recovery:
This value is a display of the time in seconds it took the millivolt input to return to 1% of the Start mV.

Last Min mV:
This value is a display of the minimum millivolts measured during the last burnoff or impedance test.

Last Impedance:
This value is a display of the measured resistance, in Kohms, after the last impedance test.

Last Max TC:
This value is a display of the maximum measured probe thermocouple input value during the last burnoff.

Slave Instruments

Slave Instruments

Parameter	Value
Instrument 1 [N/A]	0
Instrument 2 [N/A]	0
Instrument 3 [N/A]	0
Instrument 4 [N/A]	0

This page is a display of the current process variables of each of the slave instruments communicating with the 9215 controller. *Note: None of the values can be modified on this screen*.

For setup of the auxiliary instruments, go to the menu item

Slave Instrument Setup.

Auxiliary A/I

Auxiliary A/I

Parameter	Value
Input 1	100.0
Input 2	9999
Input 3	9999
[M1 | Bad | 0.0]TC 1	-32640
TC 2	-32640
TC 3	-32640
[M2 | Bad | 0.0]TC 4	-32640
TC 5	-32640
TC 6	-32640
[M3 | Bad | 0.0]TC 7	-32640
TC 8	-32640
TC 9	-32640
[M4 | Bad | 0.0]TC 10	-32640
TC 11	-32640

This menu option shows the process variables for the three analog inputs of the 9215 controller. It also shows the input types and any information from attached slave analog input modules. *Note: None of the values can be modified on this screen*.

MGA

MGA

MGA Endo

Parameter	Value
IR %C	0.00
IR CO Factor	0
IR Process Factor	0
IR equivalent mV	0
IR Temperature	0
Probe %C	0.00
Probe CO Factor	0
Probe Process Fa...	0
Probe mV	0
Probe Temperature	0
Pump	off
Status	OFF
Alarms	none

An SSi MGA (Multi-Gas Analyzer) can be set up as a slave instrument to the 9215. Refer to the

Slave Instrument Setup menu on page 107 for more information on how to configure a slave instrument from the touch screen.

A drop-down menu allows you to select the part of the process at which the gas is being analyzed. **MGA Endo** is for incoming gas. **MGA Furnace** is for outgoing gas.

Once an MGA is slaved, several parameters can be read from the MGA and displayed on the 9215 screen. These include **IR %C, IR CO Factor** (see note on pg 27), **IR Process Factor, IR equivalent mV, IR Temperature, Probe %C, Probe CO Factor, Probe Process Factor, Probe mV, Probe Temperature, Pump Status, Alarms,** and **Gas 1-6** (parameter value shown for each gas). These parameters are for display purposes only and cannot be modified from here.

Manual Event Control

Manual Event Control

Parameter	Value
Event 0	off
Event 1	off
Event 2	off
Event 3	off
Event 4	off
Event 5	off

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. A single click will display an input box that will allow the user to select either an **On** value or an **Off** value.

Clicking on the **OK** button will set the value, while clicking on the **Cancel** button will cancel the action.

Clicking on the "Value" section of the "Turn off all events" field will force all of the events to **Off** status. The user will have to confirm this action.

Clicking on the "Value" section of the "Turn ON all events" field will force all of the events to **On** status. The user will have to confirm this action.

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.

Probe Burnoff Setup

Probe Burnoff Setup

Parameter	Value
Burnoff Time (sec)	90
Burnoff Rec. Wait Time (sec)	120
Burnoff Interval (min)	720
Burnoff Minimum Millivolts	800
Burnoff Maximum Temperature	2000
Digital IN 4 Assignment	event

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.

This menu option allows the user to modify the settings that are associated with the probe burnoff (menu option *Burnoff*).

Burnoff Time:
This is the duration of the burnoff measured in seconds. SSi recommends a 90 second burnoff, and this will be the default value. However, it can be adjusted by the operator. Clicking on the value will allow the user to change the value.

Click on the **OK** button to set the new value, or click on the **Cancel** button to cancel.

Burnoff Recovery 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.

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.

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

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

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

PID Loop Setup

PID Loop Setup

Loop 1

Parameter	Value
Prop Band (0 for On/Off)	20.0
Reset	0.10
Rate	0.00
Mode	Dual Reverse
Integral Preset	0
Cycle Time	16
Setpoint Change Limit	OFF
Low Limit	-100
High Limit	100
0 set point stops control	yes
IN1 high input shuts down ctrl	no

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

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 is **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.

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 your SP.
Single – This has one relay which works in only one direction to achieve your 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** – **300**.

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%.

Low Limit
This is the low limit for the loop. The range is **–100** to **100**.

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**.

IN1 high limit shuts down ctrl
If input 1's high limit is reached, then all outputs are turned off. The value can either be **Yes** or **No**.

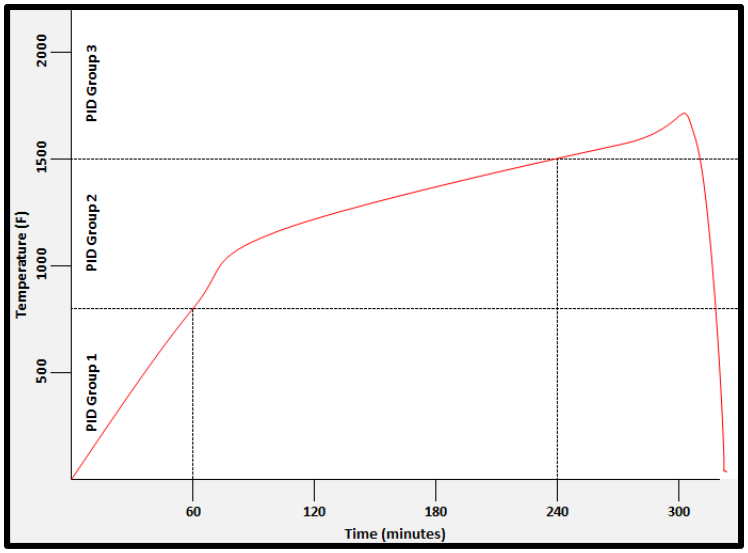
IN2 high limit shuts down ctrl
If input 2's high limit is reached, then all outputs are turned off. The value can either be **Yes** or **No**.

IN3 high limit shuts down ctrl
If input 3's high limit is reached, then all outputs are turned off. The value can either be **Yes** or **No**.

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

Switch Point PID 1 -> 2

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, *not* Setpoint or Ramp Temperature.

Switch Point PID 2 -> 3

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, *not* Setpoint or Ramp Temperature.

Setpoint Lower Limit
This is the lower limit of the setpoint. The range is **–100** to **100**.

Setpoint Upper Limit
This is the upper limit for the setpoint. The range is **–100** to **100**.

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.

Overshoot Control Logic (No/Yes)
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 (No/Yes)
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 Level 1 Control (No/Yes) and Ramp Level 2 Control (No/Yes)
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.

Event Run Program Setup

Event Run Program Setup

Parameter	Value
Program number to run	0

Program Number to Run
This is the recipe number to run. The range is: **0 – 300**.

Load T/C Configuration

Configuration of any Load TCs must be completed under this menu item.

> **IMPORTANT!**
>
> It should also be noted that not all analog inputs on SRs to a 9215 will be load thermocouples. They are often used as a means to capture other data. Care MUST be taken with selecting which is a Load TC and which is not, as improperly selecting something that is not a Load TC may cause the program to run excessively long or not run long enough.

Load T/C Configuration

Parameter	Value
Load TC Enable	off
Control TC	
TC 1	
TC 2	
TC 3	
TC 4	

Load TC Enable
This value will manually toggle between **on**, **on + alarms**, and off.
On – T/C Enabled
On + Alarms – T/C Enabled, Programmer alarm114 provided if out of band (Default wait limits)
Off – T/C not enabled

Control TC
This value allows the user to set the TC to be part of the group of Load TCs that can hold the program if it is out of band. The values are **active** or not **active** (shown as blank).

TC 1 – 27
This value allows the user to manually turn the T/C from **active** to **not active** to be part of the group of TCs that can hold the program if it is out of band.

Input 1 – 3
This value allows the user to assign analog inputs 1, 2, and 3 as Load TCs by selecting the active state for each input. (Not active means that the input is not set up as a Load TC.)

Port Setup

Warning: Changes to this screen should not be made without consulting SSi at 513-772-0060. This screen will show the Ethernet and RS-232/RS-485 communications information for the 9215 controller.

Note about ADAM module support: Communications with ADAM analog input modules manufactured by Advantech are not supported as of 9215 firmware revision 2.34. To determine the firmware version of your 9215 instrument, use the *About* option in the main menu.

Port Setup

Parameter	Value
Host 232 Baud	19200
Host 232 Mode	Modbus master/PLC
Host 485 (3,4) Baud	19200
Host 485 (3,4) Mode	Modbus
Host 485 Address	1
Slave 1 (5,6) Baud	19200
Slave 1 (5,6) Mode	Modbus
Slave 1 (5,6) Bits	8, None, 1
Slave 2 (22,23) Baud	19200
Slave 2 (22,23) Mode	SSi Analog Input Board
Slave 2 (22,23) Bits	default
232-2 Port Baud	19200
PLC Type	Micrologix Modbus

Host 232 Baud
This will set the baud rate for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

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

Host 232 Mode
This will set the mode for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:
Modbus/no PLC
Modbus master/PLC

Host 485 (3,4) Baud
This will set the baud rate for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

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

Host 485 (3,4) Mode
This will set the mode for RS-485 communications. This is necessary if the Touchscreen will be communicating through the Com ports. This setting is fixed at **Modbus**.

Host 485 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**.

Slave 1 485 (5,6) Baud
This will set the baud rate for Slave 1 communications. The list of options is:

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

Slave 1 485 (5,6) Bits
This will set the data bits, parity, and stop bits (in that order). The list of options is:
8, none, 1
8, odd, 1
8, even, 1
8, none, 2

Slave 1 485 (5,6) Mode
This will set the mode for Slave 1 communications. This list of options is:
Modbus
Yokogawa
Modbus Host

Slave 2 485 (22,23) Baud
This will set the baud rate for Slave 2 communications. The list of options is:

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

Slave 2 485 (22,23) Bits
This will set the data bits, parity, and stop bits (in that order). The list of options is:
8, none, 1
8, odd, 1
8, even, 1
8, none, 2

232-2 Port Baud
This will set the baud rate for RS-232 communications. This is necessary if the Touchscreen will be communicating through the Com ports. The list of options is:

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

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

Slave Instrument Setup

Slave Instrument Setup

Parameter	Value
Instrument 1	
Instrument 2	
Instrument 3	
Instrument 4	
Instrument 5	SSi 8-8 @ 222 on sla...
Instrument 6	User 2 @ 1 on slave 1
Instrument 7	
Instrument 8	
Instrument 9	
Instrument 10	
Instrument 11	
Instrument 12	Reserved
Instrument 13	SSi O2 Remote @ 1 ...
Instrument 14	Reserved
Instrument 15	
Instrument 16	MGA @ 13 on slave 1
Instrument 17	MGA @ 14 on slave 1
Instrument 18	
Instrument 19	
Instrument 20	Micrologix PLC @ 1 ...
Instrument 21	Micrologix PLC @ 1 ...
Instrument 22	Micrologix PLC @ 1 ...
Instrument 23	
Instrument 24	
Instrument 25	Micrologix PLC @ 1 ...
Instrument 26	error @ -32768 on un

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

This screen will allow the user to configure slave instruments. Of the 25 slave instrument slots, 13 are reserved. 4 others may have special uses. 8 slots are not reserved and may be configured as needed by the user. To set up a slave instrument, highlight the instrument number and click on the **Edit** button.

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

The following assignments must be used as specified:

Instruments 7 to 10: Valves 1 thru 4.
Instruments 12 and 14: Analog input board.

Instrument 15: Telenav, analog input board TC extension wire curves.
Instruments 16 and 17: MGA.
Instruments 20, 21, 22, and 25: PLC support.

The following assignments can be used if the specified application is not used.

Instrument 13: O_2 remote board.
Instrument 18: H_2 cell if the MGA is not used.
Instrument 19: Probe instrument such as a 9120.
Instrument 24: Quad analog output board.

The list of controllers includes the following **Atmosphere Controllers**:

- SSi AC20
- Yokogawa 750
- Honeywell UDC3300
- Dualpro LP1 Modbus
- Dualpro LP2 Modbus
- Dualpro LP1 MMI
- Dualpro LP2 MMI
- Eurotherm 2402
- Eurotherm 2500
- Carbpro v3.5
- Carbpro v3.0
- CarbPC
- 9200 LP1
- IR Base
- MGA

This list of controllers includes the following **Temperature Controllers**:

- SSi 7EK
- Yokogawa 750
- Honeywell UDC3300
- Dualpro LP1 Modbus
- Dualpro LP2 Modbus
- Dualpro LP1 MMI
- Dualpro LP2 MMI
- Eurotherm 2402
- Eurotherm 2500
- Unipro v3.5
- Unipro v3.0
- Carbpro v3.5 Slave
- Carbpro v3.0 Slave
- 10Pro
- DualPro IN C
- 9200 LP1
- 9200 LP2
- 9200 LP3
- 9100 LP2
- Eurotherm 2704 LP1
- Eurotherm 2704 LP2
- Eurotherm 2704 LP3
- VC BASE 1

- VC BASE 2
- VC BASE 3
- VC BASE 4
- AIPC
- SSi 7SL
- SSi eFlo
- UMC800 LP1
- SSi Quad AO1
- SSi Quad AO2
- SSi Quad AO3
- SSi Quad AO4
- Yokogawa UT350
- Yokogawa 750 Lp 2
- Yokogawa UP350
- Honeywell DCP551
- Ascon 08
- SSi X5
- SSi M4L
- SSi X5/timer
- SSi SPUD
- SSi AIB3
- SSi H_2 cell
- Flow Meter Short
- SSi O_2 remote
- SSi Dual Motor Board
- SSi Smart AIB3
- O_2 Block
- Waukee Valvetronic +

This list of controllers includes the following Event Controllers:

- SSi AC E
- Yokogawa 750E
- Mod Mux
- Dualpro E Modbus
- Dualpro E MMI
- Carbpro E v3.5
- Carbpro E v3.0
- Eurotherm 2500
- SSi 8-8
- SSi 9200E
- Micrologix PLC
- MCM Module
- PLC5 DF1
- SLC DF1

User devices User 1 – 15 can also be selected.

The number below the list is the address for the slave instrument. The range is 0 – 25.

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

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

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

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

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

Zone Assignments

Zone Assignments

Assignment 1

Parameter	Value
Atm Instrument	Loop 1
Atm Zone Number	0
Default Zone Offset, atm	0.00
Temp Instrument	Loop 1
Temp Zone Number	0
Default Zone Offset, temp	0

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

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

The zone assignment feature allows the 9215 program to change set points on all instruments of a multi-zone furnace. The 9215 has up to five temperature and atmosphere zone assignments available (**Zone Assignment 1 – Zone Assignment 5**). Typically, the first zone is configured to the programmer's atmosphere or temperature instrument. That is the master set point that will be propagated to the other configured zone instrument set points on set point change. For example, the user may want to set 4 temperature zones from a recipe where the programmer temperature instrument is loop 2. In this case, zone 1 would be configured as loop 2. Subsequent zones would be configured as previously configured slave temperature controllers.

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

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

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

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

When using the multi-zone offset feature, the temperature controller assigned as instruments 1 and 2 should be in zones that will not be offset.

Atm Source
This will allow the user to set the atmosphere instrument for the zone assignment. The options are

Loop 1	Instrument 5	Instrument 12	Instrument 19
Loop 2	Instrument 6	Instrument 13	Instrument 20
Loop 3	Instrument 7	Instrument 14	Instrument 21
Instrument 1	Instrument 8	Instrument 15	Instrument 22
Instrument 2	Instrument 9	Instrument 16	Instrument 23
Instrument 3	Instrument 10	Instrument 17	Instrument 24
Instrument 4	Instrument 11	Instrument 18	Instrument 25

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

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

Temp Source
This will allow the user to set the temperature instrument for the zone assignment. The options are:

Loop 1	Instrument 5	Instrument 12	Instrument 19
Loop 2	Instrument 6	Instrument 13	Instrument 20
Loop 3	Instrument 7	Instrument 14	Instrument 21
Instrument 1	Instrument 8	Instrument 15	Instrument 22
Instrument 2	Instrument 9	Instrument 16	Instrument 23
Instrument 3	Instrument 10	Instrument 17	Instrument 24
Instrument 4	Instrument 11	Instrument 18	Instrument 25

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

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

Furnace Setup

The Furnace Setup 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.

Furnace Setup

Parameter	Value
Name	PROGRAMMER
Date and Time	12/4/2014 4:22:35 PM
PVT Type	% Carbon
Mode	N/A
Send Probe data to MGA	no
Control Mode	control
LP3 control	off
Active SPP ATM Instrument	Loop 1
Active SPP TC Instrument	Loop 2
Active Event Instrument	Instrument 5
Active Quench Instrument	Instrument 2
End of quench event	7
Quench speed event	6
Quench run event	0
Quench hold event	none
N2 ctrl by Valve 1	yes
NH3 ctrl by Valve 2	yes
D.A. ctrl by Valve 3	yes
H2 ctrl by Valve 4	no
Temperature Mode	°F
Clear events/end of recipe	yes
Use MGA Suggested Factor	no
Local TC/non-FNC use PLC Temp	no
Event time configuration	Event 1 active to event 2 active
Digital Input 3 is FNC Select	yes
PVT Type When FNC Selected	Nitrider

Name
This is the name of the furnace.

Date and Time
This value is the current date and time on the 9215 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. Call SSi for further assistance.*

PVT Type
The following PVT types can be selected:
% Carbon Multiloop Nitrider FNC

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

Multiloop: Three loops of control can be assigned as selected.

Nitrider: This mode is used for Nitriding control. It calculates % Dissociated Ammonia (%DA) or Nitriding Potential (K_N) when connected to the H_2 sensor. This mode can be used with or without temperature control, depending on the mode setup. Loop 1 control can be

FNC: This mode is used for Ferritic Nitrocarburizing (FNC) control. It calculates %Dissociated Ammonia (%DA) or Nitriding Potential (K_N) when connected to the H_2 sensor. This mode can be used with or without temperature control, depending on the mode setup.

Mode
Modes become active with the selected PVT type is Nitrider or FNC. Following are the modes that can be selected for each of the two PVT Types.

Modes for PVT Type Nitrider	*Modes for PVT Type FNC*
H2 & Dissociation In this mode, the percent of dissociated NH_3 is calculated and used for monitoring or control. **H2 & Kn** In this mode, nitriding potential (K_N) is calculated and used for monitoring or control. **H2 & Super Kn** In this mode, super nitriding potential (Super K_N) is calculated and used for monitoring or control. Super K_N is based on a formula developed by SSi. Contact SSi at (513) 772-0060 for more information.	%C K_N Super K_N Carburizing potential K_C K_O

Send Probe Data to MGA
When this option is set to **yes**: If an MGA is connected (which is required for FNC), then the controller will send data on probe millivolts and temperature to the MGA. (When this option is set to **no,** no data will be sent.)

Control Mode
The possible selections are **Monitor** or **Control** . If Monitor mode is selected, the process variable is calculated, but not control action is performed. If Control mode is selected, the process variable is calculated <u>and</u> control is performed. This applies to loop 1 only. This option is ignored if the PVT Type is Multiloop.

LP3 Control Mode
This option allows you to select either **Temperature** or **Pressure Control** for Loop 3. *Pressure* refers to the furnace back pressure. This option is ignored if the PVT Type is Multiloop.

Atm Instrument, Temp Instrument, Event Instrument, and **Quench Instrument**
These selections are used by the recipe programmer to determine where to get associated data and where to send setpoint.

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** – **14**.

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** – **14**.

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** – **14**.

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. The list of possible values is: **none, Input 1 – 14.**

N2 Controlled by Valve 1, NH3 Controlled by Valve 2, D.A. Controlled By Valve 3, and **H2 Controlled by Valve 4**
These options are used to indicate which valves are being actively used. When a valve is not being used, then extraneous data is not used in the calculations.

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.

Clear events/end of recipe
This switch will allow the user to clear the events out at the end of a recipe. The options are either **no** or **yes**.

Use MGA Suggested Factor
Possible values are **yes** or **no**. If **yes** is selected, then the CO Factor used in %C calculation is taken from the MGA. For this option to be used, the MGA must also be in COF Adjust Mode.

Event time configuration
Possible values are **Event 1 active to event 2 active** or **Event 2 active time.** The controller can measure a time interval in 1/10 of a second. This option determines whether that time is measured based on the time between and event 1 and event 2 going active or just the time that event 1 is active.

Digital Input 3 is FNC Select
Possible values are **yes** or **no**. If set to yes, then digital input 3 can be used to select the FNC mode.

PVT Type When FNC Selected
Possible values are **Nitrider** or **FNC**. The FNC mode allows switching from %Carbon to either Nitrider or FNC.

Carburize Atmosphere Instrument
This selection is used when switching from FNC mode to %Carbon mode via the digital input or a PLC request. When the FNC mode switches from %C to FNC (or Nitrider), the recipe programmer atmosphere instrument is set to internal (0). If not, the selection specifies what external instrument is the atmosphere instrument when in %C mode. This feature is used only if the value is not zero and only when switching from FNC mode to %C mode by the digital input or a PLC request. It is not used when the HMI changes the PVT Type.

Nitrider calc includes diluents
Possible values are **yes** or **no**. When set to yes, this option enables Super K_N calculation.

MGA In Passive
Possible values are **yes** or **no**. If set to yes, then the controller assumes the MGA measuring gas entering the furnace is writing its data to the 9215 (note that the MGA must be set up as Modbus master for this setting). If set to no, then the controller queries the MGA for the data (note that the MGA must be set up as Modbus slave for this setting).

MGA Out Passive
Possible values are **yes** or **no**. If set to yes, then the controller assumes the MGA measuring gas exiting the furnace is writing its data to the 9215 (note that the MGA must be set up as Modbus master for this setting).

Because MGA out data is critical to FNC calculations, a setting of yes is not recommended. If set to no, then the controller queries the MGA for the data (note that the MGA must be set up as Modbus slave for this setting).

Probe Source
Possible values are **Internal, Programmer ATM Instrument,** or **Probe Instrument (19)**. This option selects whether the oxygen probe is connected to the 9215 (internal), from the recipe programmer ATM instrument, or from another slave instrument.

Default Wait Limits

Default Wait Limits

Parameter	Value
Temp Wait Limit	15
Atm Wait Limit	0.10

The 9215 controller uses default wait limits in conjunction with recipe programs using the wait, wait up, or wait down feature, or guaranteed soaks, atmospheres, etc. The wait limits are in place to help make sure a recipe will not continue to the next step until the process variable is within the specified range. The wait limits are both plus and minus the value of the setpoint specified in the recipe.

Temp Wait Limit
This is the specific wait limit for the temperature PV. The range is: **0** to **4000**.

Atm Wait Limit
This is the specific wait limit for the atmosphere PV. The range is **0** to **40.**

Alarm Setup

Alarm Setup
Alarm 1

Parameter	Value
Setpoint	1.00
Alarm Type	PV1 proc high
Hysteresis	1
Smart Alarm	disabled
ON Delay Time	0
0 SP blocks alarm	no
BO/Impedance inhibits alarm	no
Inhibit source	none
Disable on open input	no
Base Setpoint	N/A

The 9215 controller can be configured to use three (3) different alarms. Each of the alarms consists of an alarm setpoint, alarm source, alarm type, alarm hysteresis, smart alarm, ON delay time, and a 0 SP blocks alarm value. The alarms come from the factory with a default configuration dependent on the application but also can be modified prior to shipment to your facility or in the field by a supervisor. See the section Appendix D – Factory Default Settings for the 9215 Controller for more information on factory default settings for the alarms.

Setpoint
This value is the setpoint for the alarm. Clicking on this value will display an input box from which the user can select a new value. The range is from **–32767** to **32767**.

Alarm Type
This value is the type of alarm used. Options are:

- **Process High**
- **Process Low**
- **Band, Normally Open**
- **Band, Normally Closed**
- **Deviation, Normally Open**
- **Deviation, Normally Closed**

These alarm types are described in more detail below:

A process high alarm is active when the alarm source is greater than the alarm setpoint. A process low alarm is active when the alarm source is less than the alarm setpoint. Band and deviation alarms apply to sources that are the process variable of a control loop. They compare the control loop process variable minus the control loop setpoint to the alarm setpoint. The control loop process variable minus the control loop setpoint is called the deviation.

For a band alarm the absolute value of the deviation is compared to the alarm setpoint. For a band Normally open, the alarm is active if the absolute value of the deviation is greater than the alarm setpoint. For a band Normally closed, the alarm is active if the absolute value of the deviation is less than the alarm setpoint.

If the alarm setpoint for a deviation alarm is positive, then only a positive deviation is tested for the alarm. Likewise, if the alarm setpoint is negative only a negative setpoint is tested for the alarm.
A deviation, normally open alarm is active if the deviation is greater than the alarm setpoint in the direction of the alarm setpoint sign. A deviation, normally closed alarm is active until the deviation is greater than the alarm setpoint in the direction of the alarm setpoint sign.

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

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

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

Smart Alarm
This value is a display of the Smart Alarm status. A smart alarm is an alarm that works with a Process Variable (PV), and, when enabled, it will not be active until the PV is within band of the setpoint. The alarm sounding - if active - will be disabled until within the SP band. When it is in band, the alarm will go active unless on delay time is set.

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

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

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

BO/Impedance inhibits alarm
This option will allow the user to specify if a burnoff or impedance test will keep the alarm from sounding. The options are either **no** or **yes**.

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

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

Base Setpoint
This applies only if the alarm source is DA, K_N, Super K_N, %C, %O_2, K_C, or K_O. Since these sources are not associated with a control loop, there is not a control loop setpoint to use with the band or deviation alarm types. This value will be used as the target setpoint for those alarm types.

Relay Assignments

Relay Assignments

Parameter	Value
Relay 1	alarm 1
Relay 2	alarm 2
Relay 3	O2 Alarm
Relay 4	event 1
Relay 5	event 2
Relay 6	event 3
Relay 7	event 4
Relay 8	burn off

The 9215 controller has the option of using eight relay outputs. All of the relays have a positive common terminal and independent negative terminals. All of the relays are configured in a normally closed position except relay number eight, which has both a normally closed (NC) and a normally open (NO) terminal. These relays can be configured to work with events, alarms, loops, burnoff and alarm combinations.

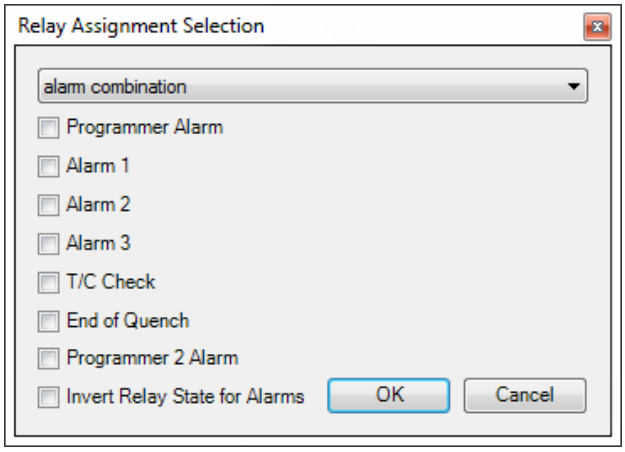
Relay Output Terminals
Relay Output 1 – terminals 7 and 8
Relay Output 2 – terminals 7 and 9
Relay Output 3 – terminals 7 and 10
Relay Output 4 – terminals 7 and 11
Relay Output 5 – terminals 7 and 12
Relay Output 6 – terminals 7 and 13
Relay Output 7 – terminals 7 and 14
Relay Output 8 – terminals 7 and 15 NC
Relay Output 8 – terminals 7 and 16 NO

Relay Output Choices

Loop 1 Fwd	Event 0 - 15	IN3 Relay SP A
Loop 1 Rev	Burnoff	IN3 Relay SP B
Loop 2 Fwd	IN1 Relay SP A	IN3 Relay SP C
Loop 2 Rev	IN1 Relay SP B	IR Sample Solenoid
Loop 3 Fwd	IN1 Relay SP C	Alarm Combination
Loop 3 Rev	IN2 Relay SP A	Programmer 1 Event 0 – 47
Programmer Alarm	IN2 Relay SP B	Programmer 2 Event 0 – 47
Alarm 1 - 3	IN2 Relay SP C	N/A

The "Alarm Combination" option will allow the user to select the specific combination of alarms to use.

The options are: **Programmer**, **Alarm 1**, **Alarm 2**, **Alarm 3**, **Invert Relay State for Alarms**, and one of three options: **T/C Check (Thermocouple Check)**, **EOQ (End of Quench)**, or **Programmer 2 Alarm.**



Relay Setpoints

Relay Setpoints

Parameter	Value
Relay ON SP for IN1 A	0
Relay OFF SP for IN1 A	0
Relay ON SP for IN1 B	0
Relay OFF SP for IN1 B	0
Relay ON SP for IN1 C	0
Relay OFF SP for IN1 C	0
Relay ON SP for IN2 A	0
Relay OFF SP for IN2 A	0
Relay ON SP for IN2 B	0
Relay OFF SP for IN2 B	0
Relay ON SP for IN2 C	0
Relay OFF SP for IN2 C	0
Relay ON SP for IN3 A	0
Relay OFF SP for IN3 A	0
Relay ON SP for IN3 B	0
Relay OFF SP for IN3 B	0
Relay ON SP for IN3 C	0
Relay OFF SP for IN3 C	0

The 9215 controller offers the user three pairs of configurable setpoints for each input. Each pair of setpoints allows the user to configure both **ON** and **OFF** trigger points. The values entered are in engineering units based on input configuration.

The relay setpoints can only be used once the relays are assigned as such in the Relay Assignments menu option.

The range is **–32768** to **32767**.

Analog Input Setup

Analog Input Setup

Input 1

Parameter	Value
Input Type	1.25 volts
Filter Time	2
Initial Scale	0.0
Full Scale	100.0
Decimal Point Location	1
Open Input	up scale
Input Offset	0.0
Trip Point 1 Setpoint	0.0
Trip Point 1 Force Value	0.0
Trip Point 1 Direction	input above setpoint
Trip Point 2 Setpoint	0.0
Trip Point 2 Force Value	0.0
Trip Point 2 Direction	input above setpoint
High Input Limit Setpoint	0.0
High Input Limit Hysteresis	0.0
Relay OFF SP for IN3 B	0
Relay ON SP for IN3 C	0
Relay OFF SP for IN3 C	0

The 9215 controller has three analog inputs. Each of the inputs comes with a factory default configuration dependent on the application. It can be modified prior to shipment to your facility or in the field by a technician or qualified/trained person with the proper security code. Before connecting your input source to the terminals, please verify that the input type is set up correctly. If the Input Type is not correct, do not connect the input source to the terminals, as damage can occur. Please consult SSi by calling (513) 772-0060 before making any changes.

Analog Input Terminals
Analog Input 1 – terminals 31 and 32
Analog Input 2 – terminals 29 and 30
Analog Input 3 – terminals 27 and 28

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 menu just below the main menu list. Clicking on the Value will display an input box, and then you can use the pull-down menu to select the desired parameter. Once selected, click *OK* and the displayed Input type under Value will be the current type. 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 124 Ohm resistor will need to be placed on that specific input's terminals for reading this selection. If resistor is not placed on input, then damage could occur to the board.**

**** - 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.**

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 with 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 **30**. If the value is set above 30, the value will automatically be reset to 0.

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 Input
This is the open TC value. Clicking on this value will toggle between **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 **–5000** to **5000**.

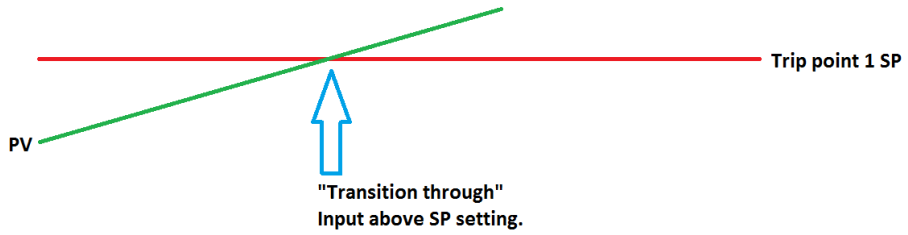
TRIP POINT EXPLANATION: Setting a trip point will force the value that the controller uses for calculations to a certain value as assigned by the operator. Once the **Trip Point Setpoint** is reached, the controller will begin reading the value as the **Trip Point Force Value,** regardless of what the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

Trip Point 1 Setpoint: This is the value at which the trip point will be activated, forcing the displayed value to the "force value" set below. This value must be something that the input can achieve.

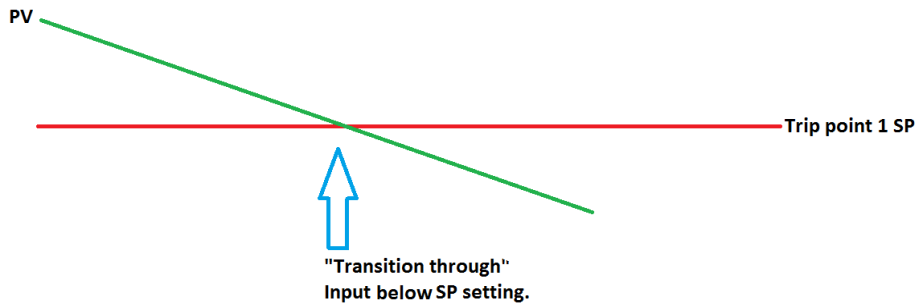
Trip Point 1 Force Value: This is the value that the input will be forced to display when the trip point SP (set above) has been achieved.

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

If you choose **input above SP** then the PV for the selected input will need to transition above the Trip Point 1 SP value set above.



If you choose **input below SP** then the PV for the selected input will need to transition below the trip point SP value set above.



Example (when OPEN INPUT is set for 1 trip point):

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

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

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

High Input Limit Setpoint
This is the setpoint for the high input limit. The setpoint cannot be assigned any value above this. The range is **–32768** to **32768**.

High Input Limit Hysteresis
This is the hysteresis for the high input limit. The hysteresis cannot be assigned any value above this. The range is **–32768** to **32768**.

Analog Output Setup

Analog Output Setup

Output 1

Parameter	Value
Assignment	loop 3 inc
Offset	0
Range	100
Current Selection	4 - 20 mA

The 9215 controller has the option of six analog outputs. The outputs are ranged for a 4 – 20 milliamp signal or a 0 – 20 milliamp signal. Each output comes with a factory default configuration dependent on the application. Each output can be modified prior to shipment to your facility or in the field by a supervisor.

Analog Output Terminals
Analog output 1 – terminals 24 and 25
Analog output 2 – terminals 25 and 26
Analog outputs 3, 4, 5, and 6 are enabled by use of an SSi QuadDAC board that connects to two RS485 terminals on the 9215 (terminals 5 and 6 for Slave 1,

terminals 22 and 23 for Slave 2). Use the menu to configure communication parameters.

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 just below the main menu. Clicking on this value will display an input box, and then you can use the pull-down menu to select the desired parameter. Once selected, click **OK** and the displayed assignment under Value will be the current assignment type. The following is a list of the options:

PV 1 retrans	Not assigned	Programmer 1 DAC 5
Loop 1 inc	O2 offset log	Programmer 1 DAC 6
Loop 1 dec	SP1 retrans	Prog 2 Quench speed (0-1000=0-100%)
Loop 1 combo	SP2 retrans	Programmer 2 DAC 1
PV 2 retrans	SP3 retrans	Programmer 2 DAC 2
Loop 2 inc	Programmer ID run	Programmer 2 DAC 3
Loop 2 dec	Valve 1 SP	Programmer 2 DAC 4
Loop 3 combo	Valve 2 SP	Programmer 2 DAC 5
PV 3 retrans	Valve 3 SP	Programmer 2 DAC 6
Loop 3 inc	Valve 4 SP	Disabled
Loop 3 dec	Prog 1 Quench speed (0-1000=0-100%)	
Loop 3 combo	Programmer 1 DAC 1	
Input 1 retrans	Programmer 1 DAC 2	
Input 2 retrans	Programmer 1 DAC 3	
Input 3 retrans	Programmer 1 DAC 4	

Combo example for carbon: 4 – 12 mA Air
12 – 20 mA Gas

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.

<u>Offset and Range when assigned to a control loop</u>

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

Passcode and Alarm

Passcode and Alarm

Parameter	Value
Level 1 Code	0
Level 2 Code	0
Web Level 1 Code	0
Web Level 2 Code	0
Web Change Enable	0
Programmer Alarm	normally open
Alarm 1	normally open
Alarm 2	normally open
Alarm 3	normally open
O2 Alarm	normally open

There are three levels of menus in the 9215 controller - Operator, Supervisor, and Administrator

Operator Level
These are functions typically handled by a furnace operator and do not require a passcode. When an operator is logged in, the lock on the toolbar will be blue - .

Supervisor Level
These are functions typically used by a supervisor and require a level 1 passcode. When a supervisor is logged in, the lock on the toolbar will be gold - . To change the level 1 passcode, or the web level 1 passcode, click on the "Level 1 Code" value (range is **0** to **32767**) or the "Web Level 1 Code" value (range is **0** to **9999**) and an input box will be displayed where the user can select a new value. Note: A negative number may be entered for the level 1 passcode, but it is not considered valid. A negative number will be set to 1 upon restart of the system.

Administrator
These are functions typically used by an administrator and require a level 2 passcode. When an administrator is logged in, the lock on the toolbar will be green - . To change the level 2 passcode or the web level 2 passcode, click on the "Level 2 Code" value (range is **–32768** to **32767**) or the "Web Level 2 Code" value (range is **0** to **9999**) and an input box will be displayed where the user can select a new value. Note: A negative number may be entered for the level 2 passcode, but it is not considered valid. A negative number will be set to 2 upon restart of the system.

Web Change Enable
This option will determine if changes can be made over the 9215's web page. Clicking on this value will toggle between a **1 (Yes)** and a **0 (No)**.

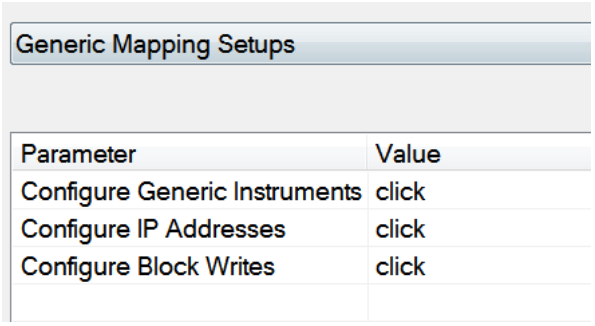
Programmer Alarm and Alarms 1-3 will allow the user to set up the polarity of the alarms, or determine whether the Normally Closed option or the Normally Open option makes the alarm active.

Programmer Alarm
Also available in this menu option is the availability to change the status of the relay contact with relation to alarms. As shipped, the relay contact is open with no alarm. The user can choose either **normally open** or **normally closed**.

Alarm 1 – Alarm 3
The user can choose either **normally open** or **normally closed**.

O2 Alarm
This selects the polarity of the alarm relay output for the O2 alarm. If the selection is normally open, then the assigned relay will be open for no alarm and closed for an alarm. If the selection is normally closed, then the assigned relay will be closed for no alarm and open for an alarm.

Generic Mapping Setups

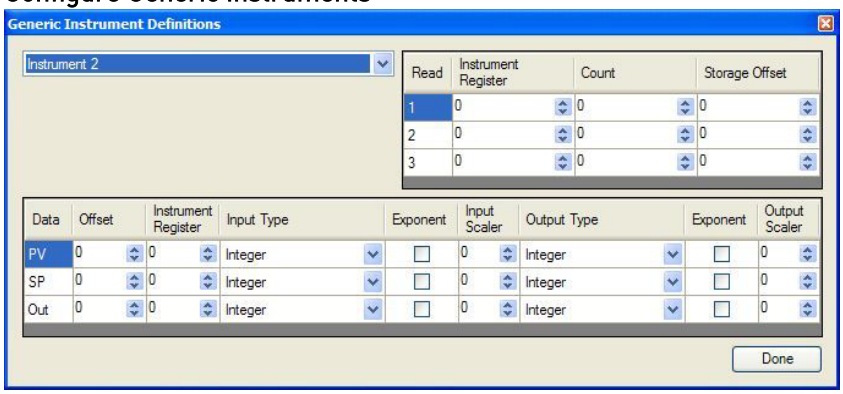


Generic Mapping Setups allows the user to configure settings for a generic instrument.

The generic instrument's data will be stored in certain registers on the host instrument, such as the 9215 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 9215 controller, instrument 2's allotment is from register 1100 to 1199 on the 9215 controller, etc.

The *Generic Instrument Setups* menu is split into three parts: Configure Generic Instruments, Configure IP Addresses, and Configure Block Writes.

Configure Generic Instruments



This screen is where the user can configure the main sections for each generic instrument. The drop-down box in the top left will select the generic instrument to set up. The options are: **Instrument 1** – **Instrument 16**.

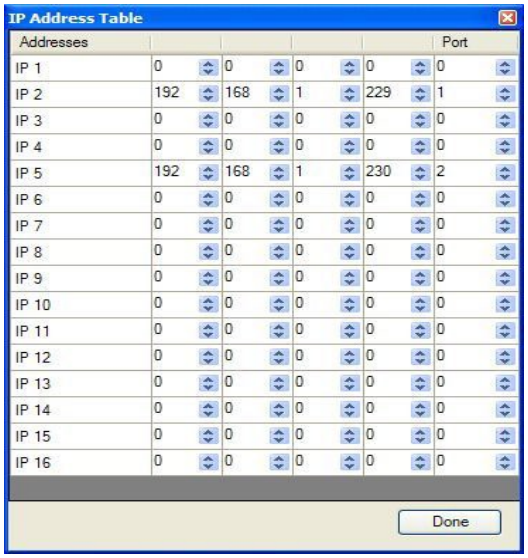
The three reads can be set up in the grid in the top of the form.
The Instrument Register field will be the register in the 9215 controller. The range is **0** – **32767**. The Count field will be the number of successive registers to read. The range is **0** – **100**. The Storage Offset field will be the offset in the generic instruments registers (1000 – 1099 for Instrument 1, 1100 to 1199 for Instrument 2, etc.). The range is **0** – **99**.

The setup for the PV (Process Variable), SP (Setpoint), and Out (Output) can be done in the grid in the bottom of the form. The Offset field is the instrument's offset. The range is **0** – **32767**. The Instrument Register field is the register in the 9215 controller. The range is **0** – **32767**. The Input Type field will determine what kind of type the value will be. The options are: **Integer**, **Big Endian**, **Big Endian Byte Swap**, **Little Endian**, or **Little Endian Byte Swap**. The Exponent field will determine if there is an exponent value. Checking the checkbox will indicate that there is an exponent. The Input Scalar field will determine the input scalar range. The range is **-128** – **127**. 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**. The Exponent field will determine if there is an exponent value. Checking the checkbox will indicate that there is an exponent. The Output Scalar field will determine the Output scalar range. The range is **-128** – **127**.

Click on the **Done** button to close down the screen and save the changes, or select a new instrument to configure another instrument.

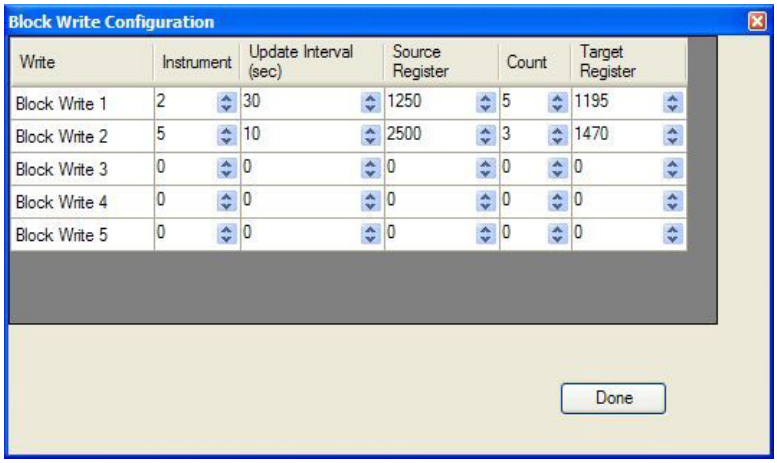
Configure IP Addresses

This screen will allow the user to set up the IP addresses for each of the generic instruments, as well as assign a port number for the instrument. The first four columns in the grid are for the IP address. The IP address follows the standard format, i.e., 192.168.1.230. To use this IP for instrument 5, **192** would be entered in the first column, **168** would be entered for the second column, **1** would be entered for the third column, and **230** would be entered in the fourth column. The port number would be entered in the fifth column, which also has the "Port" heading. The IP address columns have a range of **0** – **255**, and the Port column has a range of **0** – **32767**.



IP 1	0	0	0	0	0
IP 2	192	168	1	229	1
IP 3	0	0	0	0	0
IP 4	0	0	0	0	0
IP 5	192	168	1	230	2
IP 6	0	0	0	0	0
IP 7	0	0	0	0	0
IP 8	0	0	0	0	0
IP 9	0	0	0	0	0
IP 10	0	0	0	0	0
IP 11	0	0	0	0	0
IP 12	0	0	0	0	0
IP 13	0	0	0	0	0
IP 14	0	0	0	0	0
IP 15	0	0	0	0	0
IP 16	0	0	0	0	0

Configure Block Writes

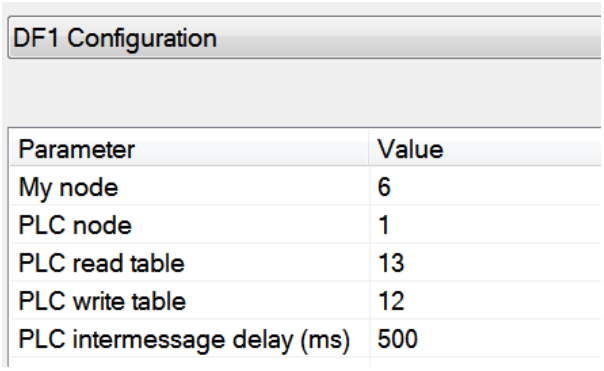


Write	Instrument	Update Interval (sec)	Source Register	Count	Target Register
Block Write 1	2	30	1250	5	1195
Block Write 2	5	10	2500	3	1470
Block Write 3	0	0	0	0	0
Block Write 4	0	0	0	0	0
Block Write 5	0	0	0	0	0

This screen will allow the user to configure up to five (5) block writes for the instruments.

The Instrument field is the instrument to use the write for. The range is **0** – **32**. The Update Interval field is the update time, in seconds, to perform the write. The range is **0** – **300** seconds. The Source Register field is the 9215 register where the values will come from. The range is **0** – **32767**. The Count field is the number of successive registers to read. The range is **0** – **80**. The Target Register field is the 9215 register to put the count into. The range is **0** – **32767**.

DF1 Configuration



Parameter	Value
My node	6
PLC node	1
PLC read table	13
PLC write table	12
PLC intermessage delay (ms)	500

This option allows the information data from the 9215 to be sent to the PLC DF1 Register map.

My node

This option will allow the user to select the node. This node must not exist anywhere else on the computer's network. The range is **0** to **30000**.

PLC node

This option will allow the user to select the PLC node. This must be the node address of a PLC. The range is **0** to **30000**.

PLC read table
This option will allow the user to select the PLC read table. The range is **8** to **255**.

PLC write table
This option will allow the user to select the PLC write table. The range is **8** to **255**.

PLC intermessage delay
This is the delay time (in milliseconds) between requests sent to the PLC from the 9215 controller. The request can be for any read or write transaction between the PLC and the 9215. The range is **51** to **5000**.

IP Address

IP Address

Parameter	Value
IP Address 1	192
IP Address 2	168
IP Address 3	1
IP Address 4	25
IP Address Mask 1	255
IP Address Mask 2	255
IP Address Mask 3	255
IP Address Mask 4	0
IP Address Gateway 1	192
IP Address Gateway 2	168
IP Address Gateway 3	1
IP Address Gateway 4	101

The IP Address menu item is a display of the current IP Address, IP Address Mask, and the IP Address Gateway of the 9215 controller. Each of these is divided into four octets when displayed on the screen. For example, IP Address 1 represents the first octet of the IP Address. IP Address 4 represents the fourth octet of the IP Address. The IP Address is made up of all four octets.

Please consult your Systems Administrator before changing this value as it can affect communications to the 9215 controller, communications between the controller and the PLC, communications between the controller and other devices on the network, or to data collection systems.

The range for each section (octet) of the three addresses is **0** to **255**. *Note – If the IP address of the controller is changed, then the IP address will have to be changed in the System Settings menu option -* *. Once the IP address has been changed, the communications will eventually go bad and stay bad until the settings have been updated.*

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.

Event Control

Event Control

Parameter	Value
Hold instrument number	0
Hold Minimum PV	2000
Hold Maximum PV	0
Input Event for Program Run	-1
Input Event for Program Reset	-1
Input Event 0	
Input Event 1	
Input Event 2	
Input Event 3	

The Event Control provides the user manual control of actual event outputs. This is useful when testing wiring and field devices. Programmer 1 and Programmer 2 event outputs can be controlled. The Programmer number is selected with the Programmer drop-down box under the menu box in Configurator.

Hold Instrument Number
Clicking on this value will display an input box from which the user can select a new value. The range is **0** to **25**.

Hold Minimum PV
Clicking on this value will display an input box from which the user can select a new value. The range is **0** to **4000**.

Hold Maximum PV
Clicking on this value will display an input box from which the user can select a new value. The range is **0** to **4000**.

Event for Program Run
Clicking on this value will display an input box from which the user can select a new value. The range is **-0** to **15**. A value of **-1** will disable this option.

Event for Program Reset
Clicking on this value will display an input box from which the user can select a new value. The range is **-0** to **15**. A value of **-1** will disable this option.

Input Event 0 – Input Event 15
The input box for these events has two drop-down lists. The top list contains **active** and **inactive**, and the bottom list contains **closed** and **open**.

Valve Configuration

Valve Configuration

Parameter	Value
Control Mode	ratio adjust
DA Switch Point	60
Auto Valve Event	no

Control Mode
This determines how the 9215 will adjust gas flows if required for %Dissociation. This will display a screen that will allow the user to select the mode. The choices are:

- Individual Trim
- Flow Adjust
- Ratio Adjust

DA Switch Point
This selection determines the control switch point for switching the atmosphere display from %Dissociation to K_N. This will display a numeric keypad that can range from **0** to **100**.

Auto Valve Event
This will allow the user to turn the valve event on or off with a running program using the *Set Valve* opcode. This can be either **On** or **Off**.

Valve Setup

Valve 1 – 4
This option will allow the user to set up the valves for the 9215. There is a choice of four valves.

Initial Scale
The Initial Scale option will allow the user to set the initial scale for the valve. This value must be less than or equal to the **Valve Max** value.

Full Scale
This option will allow the user to set the full scale for the vale. This value must be less than or equal to the **Valve Max** value.

Trim Enable
This option will allow the user to set the trim enable option for the valve. The options are **Yes** or **No**.

Setpoint
The Setpoint option will allow the user to set the target setpoint for the valve. This value must be less than or equal to the **Valve Max** value.

Trim Range
This option will allow the user to set the trim range for the valve. This value must be less than or equal to the **Valve Max** value.

Initial SP Scale
This option will allow the user to set the zero scale for the setpoint. This value must be less than or equal to the **Valve Max** value.

Full SP Scale
This option will allow the user to set the full scale for the setpoint. This value must be less than or equal to the **Valve Max** value.

Valve Max
This option will allow the user to set the maximum flow rate for the valve. The range is **0** to **32767**.

Deviation setpoint
This option will allow the user to set the deviation setpoint for the valve. The range is **0 (OFF)** to **32000**.

Deviation alarm delay
This option will allow the user to set the deviation alarm delay, listed in 1/10th of minutes. The range is **0** to **32000**. *Note: The alarm delay is entered in 1/10th of a minute intervals, but it is displayed in seconds, so 3/10 of a minute = 18 seconds*.

Gas Type
This option will determine the gas type for the valve. Certain gas types must be selected for certain valves:

Valve 1 – N_2 (Nitrogen)
Valve 2 – NH_3 (Ammonia)
Valve 3 – DA (Dissociated Ammonia), NH_3 (Ammonia), MISC (Other gas type), Endo (Endothermic gas), N_2 (Nitrogen), CO_2 (Carbon Dioxide), O_2 (Oxygen), NO_2 (Nitrogen Dioxide)
Valve 4 – H_2 (Hydrogen), NH_3 (Ammonia), MISC (Other Gas Type), Endo (Endothermic Gas), N_2 (Nitrogen), CO_2 (Carbon Dioxide), O_2 (Oxygen), NO_2 (Nitrogen Dioxide)

NOTE: If Endothermic gas is selected, a gas composition of 40% H_2 is assumed.

If working with an FNC/Nitriding application, gases *must* be set up as follows for K_N/DA atmosphere control:

Valve 1 – Nitrogen (N_2)
Valve 2 – Ammonia (NH_3)
Valve 3 – DA (if Dissociated Gas is available)

NOTE: DA gas *must* be set as **Valve 3** to be used for control if K_N or DA is set as the Atmosphere PV Type (see Furnace Setup).

Valve Decimal Place
This option will set the decimal place for the valve. The range is **0** through **4**.

Flow Signal
This selects the source of the flow data for the selected valve

- **RS-485** means that a flow instrument is assigned to the instrument number assigned to the selected valve (e.g., slave instruments 7 to 10 are for valves 1 to 4).

- **PLC without local scaling** means the data is read from the PLC locations as if they are in Engineering units.

- **PLC with local scaling** means the data read from the PLC is in raw A/D counts and must have zero and span values defined in the controller.

- **SSI AIB /4 -20MA** means an analog input board is used to read the flows: Input 1 for valve 1, input 2 for valve 2, etc.

Note 1: For all selections except RS-485, the flow setpoints are sent to an analog output board at instrument 24: Output 1 for valve 1, output for valve 2, etc.

Note 2: All selections are mutually exclusive and can occur in any combination.

Tracking Mode (Valves 3-4)

Note about tracking: Valves 1 and 2 track based upon the type of control or nitrider setup. Valves 3 and 4 can be set to no tracking, track total flow, or track NH_3. Only settings for valves 3 and 4 can be changed.

When valve 3 or valve 4 is selected, the tracking mode can be selected among **none** (no tracking), **% of total flow** (% of the total flow of the three non-selected valves) and **% of NH_3 flow** (% of NH_3 flow among the NH_3 valves).

In the case of % of total flow:

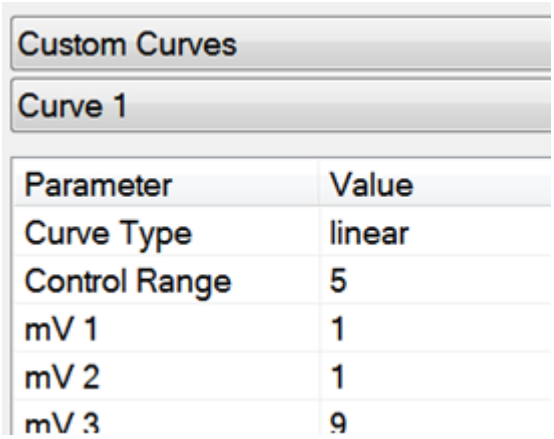
- If both valves 3 and 4 and set to track % of total flow, only valves 1 and 2 are included in the total flow calculation.
- If valve 3 is set to track % of total flow, but valve 4 is not set to track % of total flow, % of total flow will be calculated from valves 1, 2, and 4.
- If valve 4 is set to track % of total flow, but valve 3 is not set to track % of total flow, % of total flow will be calculated from valves 1, 2, and 3.

Tracking Percent (Valves 3-4)

Note about tracking: Valves 1 and 2 track based upon the type of control or nitrider setup. Valves 3 and 4 can be set to no tracking, track total flow, or track NH_3. Only settings for valves 3 and 4 can be changed.

When valve 3 or valve 4 is selected, this option can be used to set a percentage of the tracking source as the setpoint for the valve. The possible range is **0.0 to 100.0 percent**. An example of how the tracking percent option can be used is as follows: Assume that the tracking mode is % of NH3 flow and that the tracking percent is 50%. Also assume that NH3 is flowing 86 units. In that example, the setpoint for the valve will be 43 units.

Custom Curves



Most types of inputs that are used in SSi controllers are already setup with a curve built for most every type of thermocouple available, certain vacuum sensors, etc. However, if an application calls for an input without a standard curve, the curve can be built using this option. Voltages can be paired with corresponding values to create a sensor curve based off of a provided equation or data. This allows the controller to make appropriate readings from the sensor.

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

Most types of inputs that are used in SSi controllers are already setup with a curve built for most every type of thermocouple available, certain vacuum sensors, etc. However, if an application calls for an input without a standard curve, the curve can be built using this option. Voltages can be paired with corresponding values to create a sensor curve based off of a provided equation or data. This allows the controller to make appropriate readings from the sensor.

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

Thirty-two points can be assigned by selecting one of the points and pressing **Edit.** This allows the operator to change the **Millivolts** and the corresponding **Value** by clicking on each option. 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.

Curve Type
This is the type of curve. The options are **none** or **linear**.

Control Range
This is the control range for the curve. The range is **0** to **32000**.

mV*X*(1 – 32)
Clicking on this value will display an input box from which the user can select a new millivolt value. The range is from **0** to **32000**.

Alternate PID Setup

Alternate PID Setup

PID 1

Parameter	Value
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100

IMPORTANT!

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

The Alternate PID Setup menu option allows for up to 16 sets of PID values to be used on all two loops via the programmer. This menu option is frequently used if a different PID would be more suitable once a furnace reaches a certain temperature, oftentimes in vacuum applications. PID 1-16 can be loaded via a recipe using the PIDLOAD opcode. See the opcodes section for more information.

There is a choice of PID 1 – 16, and LP1 Set 1 -3, LP2 Set 1 – 3, and LP3 Set 1 – 3.

NOTE: The feature of PID Auto Switch is disabled for the entire duration of a 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 of values 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**.

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

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

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

SSi Analog Input Setup

SSi Analog Input Setup

Module 1

Parameter	Value
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used

The SSi Analog Input Setup menu option allows the user an input selection of three inputs per module, and three input corrections per module. There are eight modules available. It is configurable for voltage of T/C (universal input), and it is typically used for Load T/Cs 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 Type 0 – Input Type 2
This will select the input type for the module. The options are:

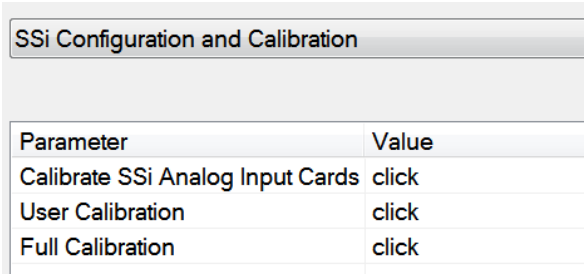
B	NNM	160 mV	
C	R	80 mV	
E	S	40 mV	
J	T	20 mV	25.6 volts**
K	2.56 volts	4-20 mA/124 Ω	12.8 volts**
N	1.28 volts	4-20 mA/62 Ω	

**** - 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.**

Input 0 Correction – Input 2 Correction
This option will set a correction curve for the input. The options for the input corrections are: **not used**, **Curve 1 – Curve 3**.

SSi Configuration and Calibration

Overview
The series 9215 can be calibrated using the Instrument Configurator software supplied with the system. Before performing this procedure on a newly installed controller, the unit needs to be powered on for at least 30 minutes for a warm up period.



SSi Configuration and Calibration

Parameter	Value
Calibrate SSi Analog Input Cards	click
User Calibration	click
Full Calibration	click

The series 9215 has three analog inputs. Each range has a zero and span calibration value. A cold junction trim value must be calibrated for thermocouple inputs. There are two analog outputs each with a zero and span value.

Equipment needed

A certified calibrator(s) with the ability to source and read millivolts, milliamps and thermocouples is required. The appropriate connection leads are also required. The operator interface method requires a PC with the Configurator software loaded. An Ethernet crossover cable is required.

Notes

Input 1 – terminals (-) 31 and (+) 32
Input 2 – terminals (-) 29 and (+) 30
Input 3 – terminals (-) 27 and (+) 28
Output 1 – terminals (-) 24 and (+) 25
Output 2 – terminals (-) 25 and (+) 26

Calibrate Aux Analog Input

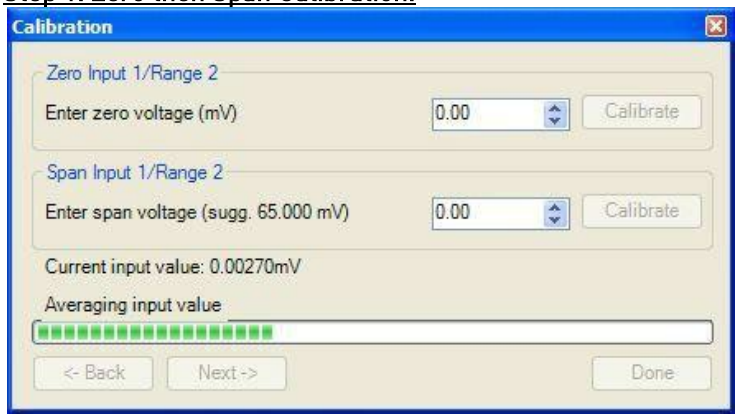
If an SSi analog input board is set up, then this menu option will be visible. For information on how to calibrate an SSi analog input board, see the **Calibrate Aux Analog Input** section located at the end of this section.

User Calibration

NOTE: This section details how to calibrate the 9215 inputs. For instructions on calibrating an SSi analog input board, see the **Calibrate Aux Analog Input** section.

Click on the "click" value next to the "9215 User Calibration" field to start the user calibration. The Calibration screen will be displayed. For complete calibration of Analog Inputs start with step #1, Zero and Span Calibration. The Cold Junction Calibration should be performed **AFTER** the user has calibrated all of the inputs and, if needed, outputs.

Step 1. Zero then Span Calibration.



The second screen (Zero/Span Calibration), and all of the subsequent screens, will allow the user to zero and span calibrate the inputs and outputs for the 9215 controller (cold junction calibration will be performed as a final step).

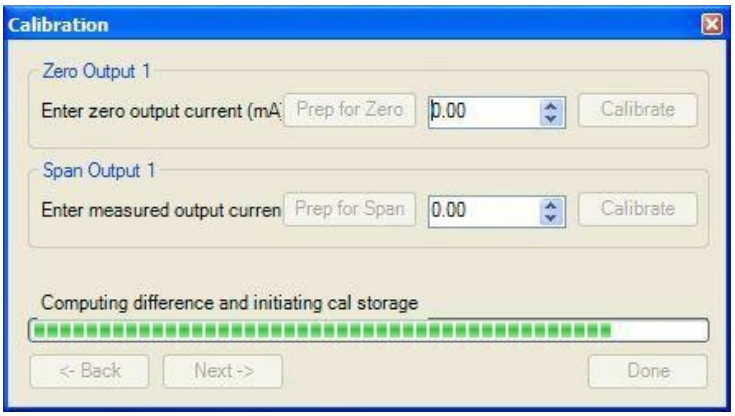
For a zero calibration, a value of 0 mV will need to be sourced to the input or inputs.

In the "Zero Input X/Range Y" section, enter the zero voltage and click on the Calibrate button. This will calibrate the zero range. The progress of the calibration will be shown in the progress bar at the bottom of the screen.

For a span calibration, a value of 90% of the full range (or the adjusted value) will need to be sourced to the input or inputs.

In the "Span Input X/Range Y" section, enter the span voltage that you are sourcing in and click on the Calibrate button. A suggested value will be supplied. This will calibrate the span range. The progress of the calibration will be shown in the progress bar at the bottom of the screen. Repeat these steps for all of the inputs.

Clicking on the Next -> button will display the next screen(s) for the user calibration. Clicking on the <- Back button will display the previous screen(s).

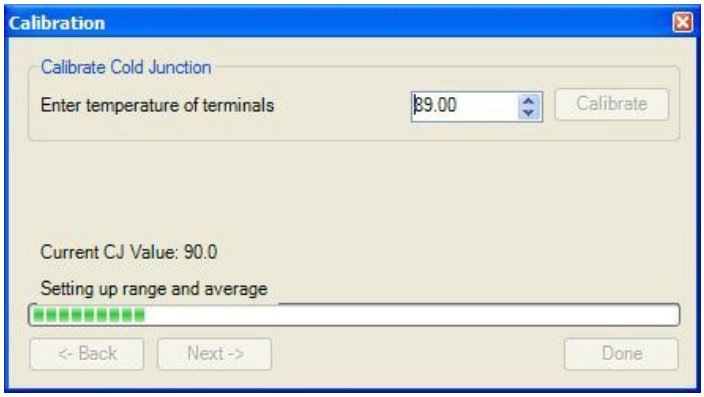


To calibrate the zero range for the outputs, you must first attach your measuring device.
In the "Zero Output X" section, click on the Prep for Zero button. Let the unit output what it has set for the zero measurement, then enter what you are measuring coming out of the terminals. Once entered, click on the Calibrate button and let the procedure finish. The progress of the calibration will be shown in the progress bar at the bottom of the screen.

In the "Span Output X" section, click on the Prep for Span button. Let the unit output what it has set for the span measurement, then enter what you are measuring coming out of the terminals. Once entered, click on the Calibrate button and let the procedure finish. The progress of the calibration will be shown in the progress bar at the bottom of the screen. Repeat these steps for all of the outputs.
Once all of the inputs and outputs have been calibrated, return to the first screen for cold junction calibration, if necessary.

Step 2. Cold Junction Calibration.

NOTE: Perform zero and span calibrations (see previous section) before following this procedure.



The "Cold Junction" option will allow the user to perform a cold junction trim on the 9215 analog input board.

To determine if a cold junction adjustment is needed, hook up the calibrator with the appropriate T/C wire attached (reference the specific input under the "Analog Input Setup" menu), then source a temperature to the input. It is best to use an operating temperature to source; for example, if the furnace typically runs at 1700 °F, then 1700 °F should be sourced to the input. Source a range of temperatures – this will help determine whether any difference in readings is linear.

NOTE: This value is NOT the temperature displayed on the "Cold Junction Calibration" menu option – rather, this is the value displayed on the main screen along with set point and output.

If the displayed value does not equal the value being sourced, then a Cold Junction Calibration may be necessary. To begin, note the difference between the displayed temperature and the sourced temperature. This is the adjustment that will be made in the "Cold Junction" menu. For example:

Source Temp	Displayed Temp	Difference	Cold Junction Adjustment	Current Temp of Terminals	New Temp of Terminals
1700	1711	11 High	-11	72	61

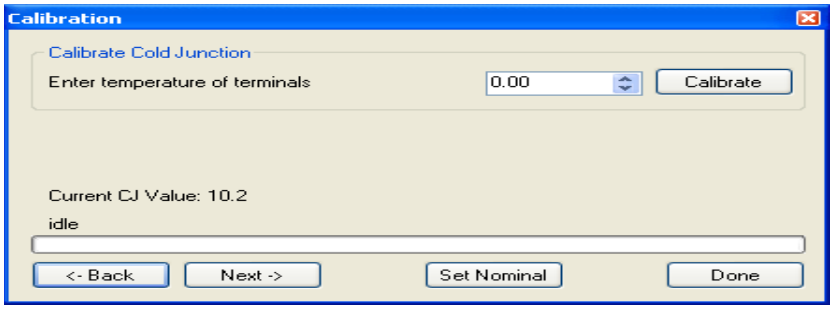
In this situation, the displayed temperature on the main screen is 11° higher than the sourced input. Therefore, 11° must be subtracted from the current "temperature of terminals" reading. Use the up and down arrows to adjust the "Enter temperature of terminals" input box to the appropriate value (in this case, 61).

Click on the "Calibrate" button to begin the calibration.

After 30 minutes, verify the calibration by again sourcing a temperature to the input and checking the displayed temperature reading on the main display. It is recommended to perform this calibration check after every cold junction calibration.

Click on the **Done** button to close down the screen.

Full Calibration



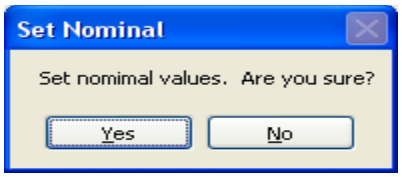
NOTE: Full calibration is performed by SSi. The below information is provided for reference only.

The *Calibration* screen for the Full Calibration menu option is identical in function and layout to the User Calibration's *Calibration* screen. The only difference is the Full Calibration's *Calibration* screen contains more screens. This list of screens is listed below in sequential order. Screens only found in the Full Calibration menu option are displayed in *Italics*. Screens only found in the User Calibration menu option are displayed in **bold**.

1. Cold Junction
2. *Zero/Span Input 0/Range 0*
3. *Zero/Span Input 0/Range 1*
4. *Zero/Span Input 0/Range 2*
5. *Zero/Span Input 0/Range 3*
6. *Zero/Span Input 1/Range 0*
7. Zero/Span Input 1/Range 1
8. *Zero/Span Input 1/Range 2*
9. *Zero/Span Input 1/Range 3*
10. *Zero/Span Input 2/Range 0*
11. *Zero/Span Input 2/Range 1*
12. *Zero/Span Input 2/Range 2*
13. Zero/Span Input 2/Range 3
14. **Zero/Span Input 3/Range 2**

15. *Zero/Span Input 1 Range Jumper*
16. *Zero/Span Input 2 Range Jumper*
17. *Zero/Span Input 3 Range Jumper*
18. Zero/Span Output 1
19. Zero/Span Output 2

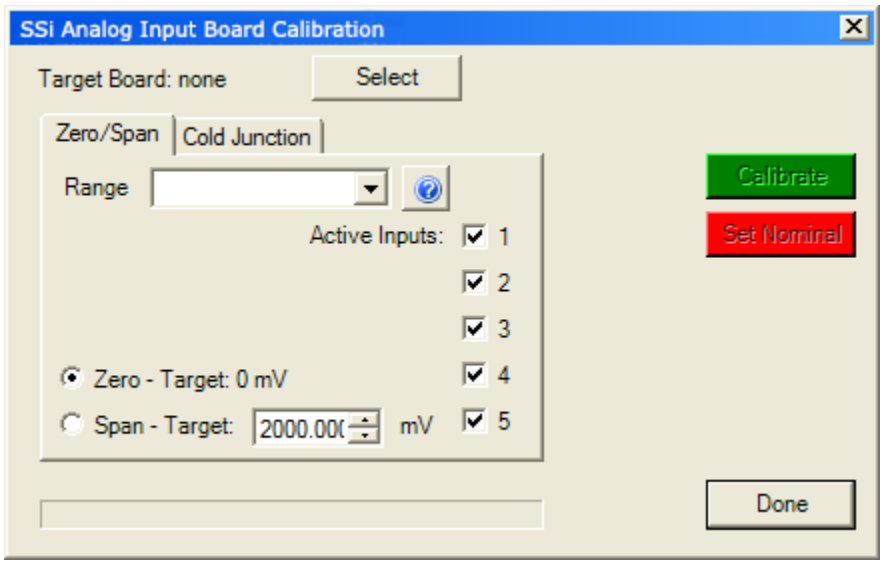
The *Calibration* screen for the Full Calibration menu option also has a **Set Nominal** button, which will set nominal values for the current screen. The user will have to confirm the action.



Clicking on the **Yes** button will set the nominal values, and clicking on the **No** button will cancel the action. Click the **Done** button to close the screen down.

Calibrate Aux Analog Input

NOTE: This section details how to calibrate an SSi analog input board, **not the 9215 inputs themselves**. For instructions on calibrating the 9215 inputs through configurator, see the User Calibration section.



If an SSi analog input board is applicable, then this menu option will be visible. The Calibration menu screen will allow the user to calibrate the zero, span, and cold junction trim value for all of the inputs on each board.

The **Select** button will allow the user to select one of the current boards to calibrate.

Select the appropriate board and click on the **OK** button. Clicking on the **Cancel** button will not select the board to calibrate. *Note: A board must be selected for calibration to begin.*

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

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

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

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

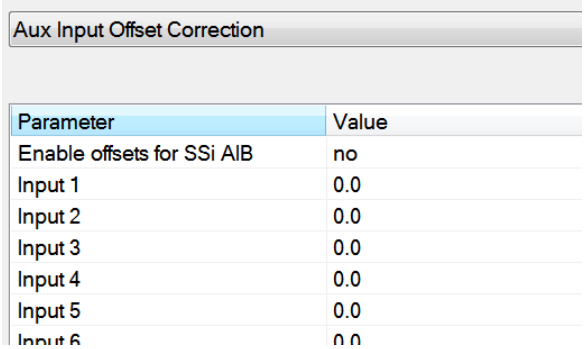
Below is a listing of the suggested ranges for the various TC types.

TC Type mV Range Chart

TC Type	Range in mV
B	20mV
C	40mV
E	80mV
J	80mV
K	80mV
N	80mV
NNM	80mV
R	40mV
S	20mV
T	20mV

Click the **Done** button to close the screen down.

Aux Input Offset Correction



This menu option will allow the user to enter offsets for the auxiliary inputs and apply any correction curves as needed. The offset can be in degrees + or -, and it is typically used to compensate for incorrect T/C wires.

Enable Offsets for SSi AIB
This will enable the use of offsets for any analog input boards. The options are: **Yes** or **No**.

Input 1 – Input 40
This is where the actual offsets will be entered for each input. The range is **-50.0** – **50.0**.

Input 0 Correction – Input 39 Correction
This is where any correction curve can be applied for each input. *Note – The input names for the corrections are offset by 1, so Input 0 is actually Input 1, Input 39 is actually Input 40, etc.* The options are: **Not Used**, **Curve 1**, **Curve 2**, or **Curve 3**.

Aux Setpoint Configuration

Aux Setpoint Configuration

Parameter	Value
Retrans to Slave 1	Off
Retrans to Slave 2	Off
Retrans to Slave 3	Off
Setpoint Offset Sl 1	0
Setpoint Offset Sl 2	0
Setpoint Offset Sl 3	0
Setpoint Delay Sl 1	0
Setpoint Delay Sl 2	0
Setpoint Delay Sl 3	0

See the menu option

Slave Instrument Setup for configuration prior to using Aux Setpoint Configuration. Aux Set Point Configuration is an automatic set point retransmission with a corresponding custom offset and delay to one or more of the first 3 configured slave instruments. The delay is in minutes and is only active when the set point is dropped. This feature would most commonly be used to keep the alarm set point of an overtemp tracking the furnace's main set point (with offset). The delay allows the furnace time to cool below the level specified so that there is no overtemp alarm when the furnace is cooling.

Retrans to Slave 1 – Retrans to Slave 3
This option will determine which control loop to use as the retransmission value.
The options are:
Off
Loop 1
Note – If the setpoint is 0, then the retransmission is blocked.

Setpoint Offset Sl 1 – Setpoint Offset Sl 3
Values entered will take the decimal point of the PV into account, but each value is entered in whole numbers:
Carbon: 1 = 0.01
Temperature: 1 = 1
This option will apply the offset when retransmitting the value from the control loop. The range is **–32768** to **32767**.

Setpoint Delay Sl 1 – Setpoint Delay Sl 3
This is measured in seconds. This option will set the number of seconds to delay before retransmitting the value from the control loop. The range is **–32768** to **32767**.

TC Extension Correction Curves

TC Extension Correction Curves

Parameter	Value
Curve 1	click
Curve 2	click
Curve 3	click

This menu option will allow the user to set up to three TC correction curves for the 9215 controller. Clicking on the "click" value for a curve will display the curve edit form. *Note: If the first "Temperature" value and the first "Error" value are both zero, then the curve will not be set.* The user can enter up to ten "Temperature"/"Error" combinations. The range for the "Temperature" field is **–300** to **9999**. The range for the "Error" field is **–30.000** to **30.000**.

NOTE: Curves are interpolated between points in order to provide a smooth transition between those points. For example:

Point	Temp	Error
1	100	0
2	300	2

In the above setup, temperatures would read as follows:

Actual Temperature	Displayed Temperature
100	100
150	150.5
200	201
250	251.5
300	302

MGA Setup

The MGA Setup menu provides options for interfacing the 9215 controller with a multi-gas analyzer (MGA) from SSi.

MGA Setup

MGA Endo

Parameter	Value
Local cooler ON setpoint	2
Local cooler off setpoint	2
Auto cal	off
Sequencing	ON
Sequence mode	normal
Active CH	
Auto cal interval (min) (0 = OFF)	2
Auto zero interval (min) (0 = OFF)	2
Auto data display time	0:00
Purge time before cal/zero	0:00
Gas 1 type	none
Gas 1 value	0

MGA Endo / MGA Furnace
This setting is changed in a drop-down menu at the top of the screen. When MGA Endo is selected, the controller assumes that the MGA is connected to the endo gas going into the furnace. When MGA Furnace is selected, the MGA assumes that the MGA is connected to the exhaust gas leaving the furnace.

Local cooler ON setpoint / Local cooler off setpoint
When the internal temperature of the MGA reaches the ON setpoint, the cooler will be turned on. When the temperature drops below the OFF setpoint, the cooler will be turned off.

Auto cal
This option sets whether the auto calibration feature is ON or OFF.

Auto cal interval
The amount of time (in minutes) between auto span calibrations.

Auto zero interval
The amount of time (in minutes) between auto zero calibrations.

Auto data display time
When an auto zero or auto span is finished, the MGA display will show results for this amount of time.

Purge time before cal/zero
This time is to make sure the zero or span gas has completely filled the MGA cell before performing the zero or span.

Gas 1 – 6 Information: Type, Value, Full Scale, Display Decimal Place, Source Decimal Place, and Units
The MGA can measure and display information for up to six gases on its screen.

- **Type** is the gas type for which information is being displayed as gas 1, 2, 3, 4, 5, or 6 (CO, CO_2, CH_4, etc.).
- **Value** is the gas reading.
- **Full scale** is the full scale range for the gas.
- **Display Decimal Place** indicates how many decimal places will be displayed.
- **Source Decimal Place** indicates the resolution of the actual source measurement.
- **Units** identifies the unit of measurement (usually percent).

Flow Set Point Configuration

This menu provides options for setting flow rate minimum and preset values.

Flow Set Point Configuration

Parameter	Value
Carburize Minimum Endo Flow	0
Carburize preset, N2 valve	0
Carburize preset, NH3 valve	0
Carburize preset, D.A. valve	0
Carburize preset, H2 valve	0
FNC preset, N2 valve	0
FNC preset, NH3 valve	0
FNC preset, D.A. valve	0
FNC preset, H2 valve	0

Carburize Minimum Endo Flow
When in %Carbon mode (not Nitriding or FNC), this sets the minimum endothermic gas rate into the furnace. Either or both valve 3 and 4 must be set to endo valve type in order for this feature to work. If the endothermic gas target setpoint for valve 3 or 4 is less than this minimum, then the setpoint is set to the minimum. The controller will check both valves 3 and 4 and adjust the setpoints independently, if needed. If the value for this option is set to 0, then the feature is disabled (not used).

Valve presets (applies to Carburize preset – N_2, NH_3, D.A., and H_2 valves, and FNC preset – N_2, NH_3, D.A., and H_2 valves)
In total, there are eight (8) presets for valve setpoints used when switching between %C and FNC modes. Valves 1 is assumed to be for N_2, valve 2 for NH_3, valve 3 for D.A., and valve 4 for H_2.

Two basic principles are important for these options:

- When switching from FNC mode to %C mode, the Carburize presets are used.
- When switching from %C mode to FNC mode, the FNC presets are used.

The preset for each valve can have one of three conditions:

1. The preset can be disabled, meaning the valve setpoint will not be changed.
2. The preset can be set to current flow, which means that the setpoint will be set to the actual flow through the valve when the switch occurs.
3. The preset can be set to a specific value, which will be applied to the specified valve when the mode switch occurs.

The presets are used only when the switch occurs from %C to FNC, or from FNC to %C. No changes to the valve setpoints will occur once the mode switch has taken place (unless the mode switches again).

Instrument Calculation

Instrument Calculation

Parameter	Value
Calculation Time (0 = disabled)	0
Configure Instrument Calculations	click

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 9215's Modbus registers can be used as input variables in the equations without restriction. To protect the instrument, Modbus registers are restricted as output registers.
Modbus registers are designated by an upper or lower case "M" followed by a number.
Note – The standard Modbus routine is called to retrieve the Modbus variable, therefore a 0x8000 (-32768) will be returned for an invalid register.
Note – Modbus registers are stored with integer values, so adjustments will need to be made for decimal values.
If the instrument can have external analog input boards, or the instrument is a Video Recorder or DAQ, these inputs can be accessed directly as A1 through A40. By using the "A" designation, the Modbus register number is not needed and the variable is scaled to the correct value (decimals included) based on the input type specified.
In a Video Recorder, the slave instrument data slots can be defined as variables D1 through D32. D31 and D32 are extra slots and have no restrictions as output variables. D1 through D30 are shared with the first ten (10) slave instruments in groups of three (3) – PV, SP, PO – and caution should be used when assigning as outputs.
A line in the program of the instrument calculation must start with a variable or a keyword.
Variables must be followed by an equal sign (=) and then an expression. The expression can be a simple assignment (V1 = 3) or a variable operation variable as described below (V1 = M225 * 0.1).
Keywords *MUST* be entered in capital letters only.
The list of valid keywords is: **IF**, **ELSE**, **ENDIF**, **QUE**, **RLY**, and **END**.
"IF" must be followed by an expression which is a variable, relationship operator, then variable.
The list of valid relationship operators is: **>** (Greater Than), **<** (Less Than). **=** (Equals), **>=** (Greater Than or Equal To), **<=** (Less Than or Equal To), **!=** (Not Equal To), and **==** (Equal To). *Note – The "=" and "==" relationship operators are identical*.
The list of valid bitwise operators is: **&** (AND), **|** (OR), **^** (XOR), **<<** (Left Shift), and **>>** (Right Shift).
The result of the "IF" relationship test determines if the lines following the "IF" statement will be executed or not.
The "ELSE" and "ENDIF" must be on a line by themselves. "ELSE" will toggle the program based on the result of the "IF" test. "ENDIF" will close out the "IF".
Example:

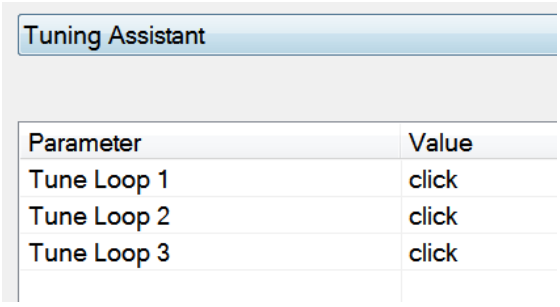
```
IF V1 >= 30
V3 = V2 * 1.5
ELSE
```

V3 = 5
ENDIF
In this example, if the value in V1 is greater than or equal to 30, then the value of V3 will be the value of V2 multiplied by 1.5. If the value in V1 is less than 30, the value of V3 will be 5.
EVERY "IF" must have a closing "ENDIF". However, the "ELSE" is optional.
The "QUE" is used to send data to a slave instrument and must have three (3) variables separated by spaces. The first is the slave instrument number, the second is the register number, and the third is the data to send.
Example:
QUE 3 1129 V1
This example will send the value of V1 to register 1129 on instrument 3.
The "RLY" is used to control a relay if the relay assignment is 999. The "RLY" must be followed by a variable which is the relay number (**1** – **8**) and a relationship expression.
Example:
RLY 5 M554 < 2
This example would turn Relay 5 ON if the communication status for instrument 5 was bad.
The "END" keyword will stop the lines from running, and start over from line 1.
There are a few functions that are available as well. The list of valid functions is: **FSIN** (Sine), **FCOS** (Cosine), **FEXP** (Exponent), **FLOG** (Logarithm), **FLN** (Natural Logarithm), **FSQRT** (Square Root), **FABS** (Absolute Value), and **FPOW** (Power). The Sine and Cosine functions need to have the parameter in radians. A function must be in all caps and begin with an "F" and have a pair of parenthesis. An undefined function returns the value of the expression in the parenthesis. *Note – A pair of parenthesis by themselves is considered an undefined function*.
The instrument calculation has limited parsing ability. This is kept to variables, operation, variable – i.e. V1 = 12.25 * V2. Another example is M128 = V1/100.
A negative sign (-) in front of the number is considered part of the number – i.e. V1 = -2.55 + V2.
A variable to the parser is one of the following: a program variable (Vxx), a Modbus register (Mxxx), a number, or a function.
Example:
V1 = (V2 * 1.35) + (V3 * V4)
This example will multiple V2 by 1.35 and multiply V3 and V4 together, and add those two results and store that value in V1.
The maximum length of a program line is thirty-one (31) characters.
The following are the valid mathematical operators: + (Addition), - (Subtraction), * (Multiplication), / (Division), and % (Modulo Divide – integer only).
The difference between Division and Modulo Division is that Modulo will always return an integer value.
Example:
11 / 4 = 2.75
11 % 4 = 2 (The .75 will not be returned)

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

Configure Instrument Calculations
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.

Tuning Assistant



The tuning assistant will allow the user to automatically generate the PID settings for a specific loop. Click on the "click" value to start the tuning assistant. *Note: It is recommended to change the temperature setpoint immediately prior to initiating an auto tune. The tuning assistant will begin tuning once there is a 10% range difference between the actual temperature and the setpoint.*

The user can select the loop to tune from the Tuning Assistant. Loop 1 is the primary temperature loop; Loops 2 and 3 can be tuned if necessary. When you select "click" to open the Tuning Assistant, you will see which loop you are tuning as well as the PV and SP. When "Minimize Overshoot" is checked the Tuning Assistant will suggest more conservative PID values in an effort to control overshoot. The "Limit Output to x%" checkbox allows you to set a maximum output percentage; this feature is useful when output may need to be limited due to physical characteristics of the furnace.

Click on the **Start** button to begin the auto tune process. *NOTE: The process may take up to 30 seconds to start depending on the difference between actual temperature and setpoint not being within 10%*. Once the process has started, the "Idle" line will change to "Tuning: Pointer xx". This means that the tuning process is working. 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 "Tuning: Pointer xx" line will read "Idle" again, and the list underneath will be populated with suggested PID settings. *NOTE: Clicking on the **Done** button while the tuning is in progress will close down the screen, but the user will have to confirm the action. However, clicking on the **Abort** button will simply abort the calibration process*.

Each column for the PID settings relates to the button below. For example, the second column is the PID settings for the Critically Damped values. The user can accept only one set of numbers. To select a set of values, click on the corresponding button. For example, to accept the critically damped values, click on the **Accept Critically Damped** 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 are considered the "optimum" values because they are a balance between the under damped and over damped values with regards to time and overshoot. The PI values are just the proportional band and the reset value (the *P* and the *I* from *PID*). This could be applicable in an atmosphere loop, where the rate will not have much effect.

Once a set of values has been accepted, the user can press the **Done** 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.

Redundant TC Setup

Redundant TC Setup

Parameter	Value
Active	no
Band	20
Delay Time (min)	1
TC Selection	TC 1 (Input 2)
Select Mode	highest

This option allows the operator to choose which TC to control in a redundant TC setup. The redundant TC setup allows for two thermocouples to be used and measured from. This option can be configured so that the higher or lower is automatically selected or in manual mode so that the operator can choose which TC to use.

Active
This setting enables or disables the Redundant TC feature. "Yes" enables the feature; "No" disables it.

Band
The Band lets the user set how far apart the values of the TCs in the redundant setup can be before an alarm is activated. The alarm can be assigned under the Relay Assignment menu option. The range for this is **-4000 to 4000**.

Delay Time
This is the time in seconds that will pass once the TCs go out of band before an alarm is activated to prevent excessive, unnecessary alarming. The range is **0 to 3200 seconds.**

TC Selection
To change this option from TC 1, the Select Mode must be in manual.

Select Mode
This allows the operator to choose whether the highest or lowest TC will automatically be chosen, or whether it will be manually chosen by the operator. The options are highest, lowest, and manual.

NOTE: If the 9215 has redundant TC active, then digital inputs 2 and 3 can manually override the system and force the selected TC to be TC 1 if input 1 is active or TC 2 if TC 2 is active. If both input 1 and input 2 are active, input 1 will take precedence and make TC 1 active.

Manual Override
If the 9215 has redundant TC active, then digital inputs 2 and 3 can manually override the system and force the selected TC to be TC 1 if input 1 is active or TC 2 if TC 2 is active. If both input 1 and input 2 are active, input 1 will take precedence and make TC 1 active.

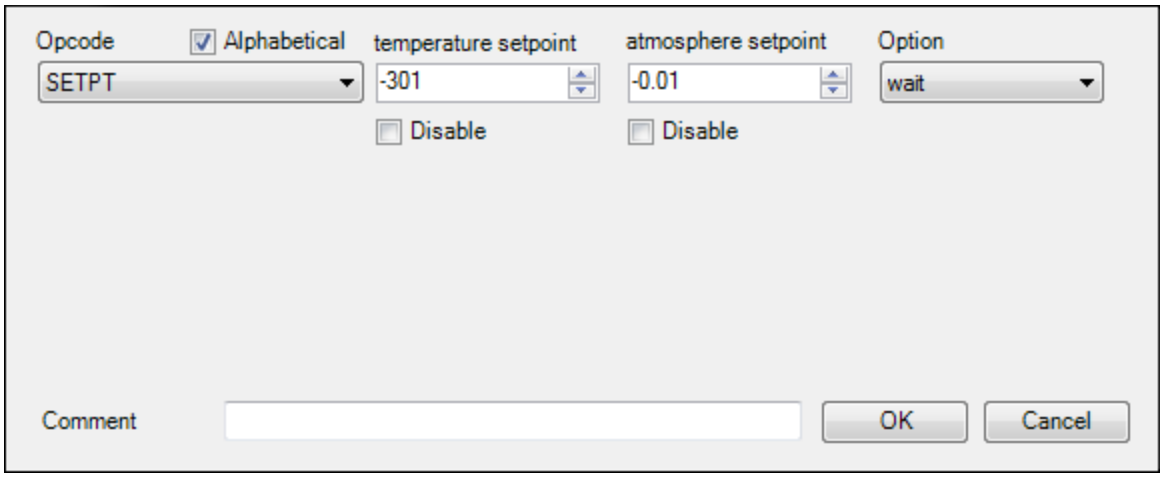
Programmer Description

The Series 9215 Recipe Programmer provides a convenient operator interface and recipe programmer.

The programmer uses enhanced opcodes that reduce the number of steps required for a program. Each step may consist of: an opcode, a temperature value column, an atmosphere value column, and an option value column. The opcode determines how and if each of the three values is used.

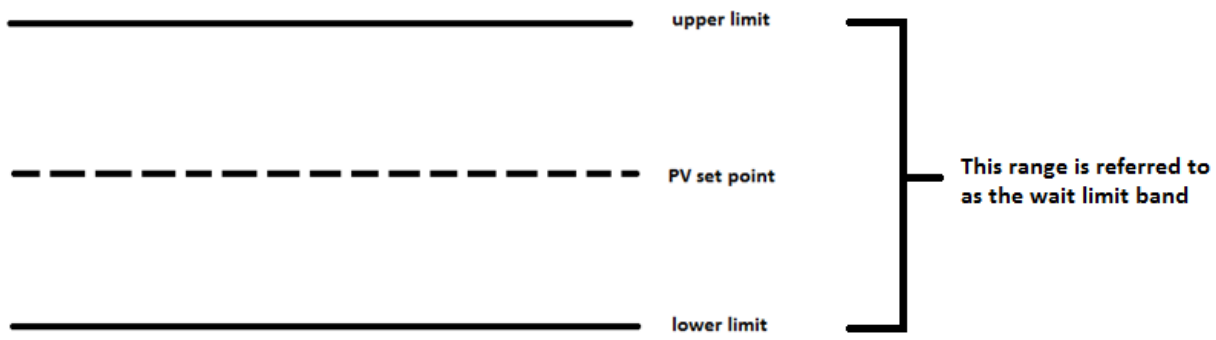
An explanation of wait, wait up, and wait down options can be found at the end of this chapter.

Each opcode will be listed in the following format for readability:
Opcode
Temperature Value Column Atmosphere Value Column Option Value Column
Description


Opcode
Alphabetical
temperature setpoint
atmosphere setpoint
Option
SETPT
-301
-0.01
wait
Disable
Disable
Comment
OK
Cancel

Wait

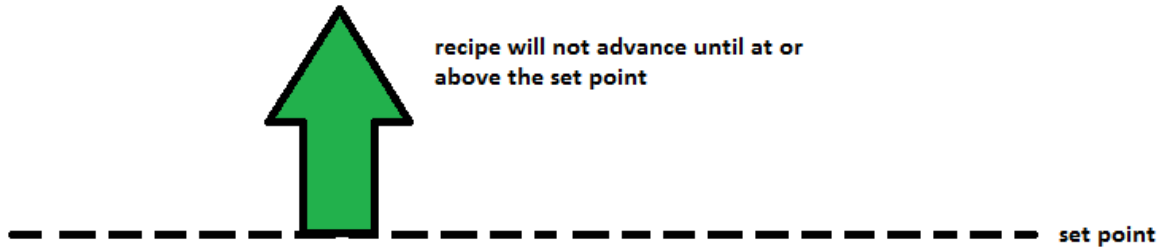
When using the option **wait** with a set point Opcode, the recipe will not advance to the next step until the PV value falls within the **wait limit band**. The wait limit band is defined as Set Point plus/minus the **active** tolerance. The active tolerance begins each recipe as the value defined as the **default wait limit**; this can be changed using the **SET_WAIT** opcode.



For example, assume a Set Point of 1500° and a wait limit of 15°. Using the **SETPT** opcode paired with a **wait** option, the recipe will not advance until the temperature PV is between 1485°-1515°.

Wait Up

When using the option **wait up** with a set point opcode, the recipe will not advance to the next step until the PV value reaches or exceeds the set point. The recipe will then continue to the next step.

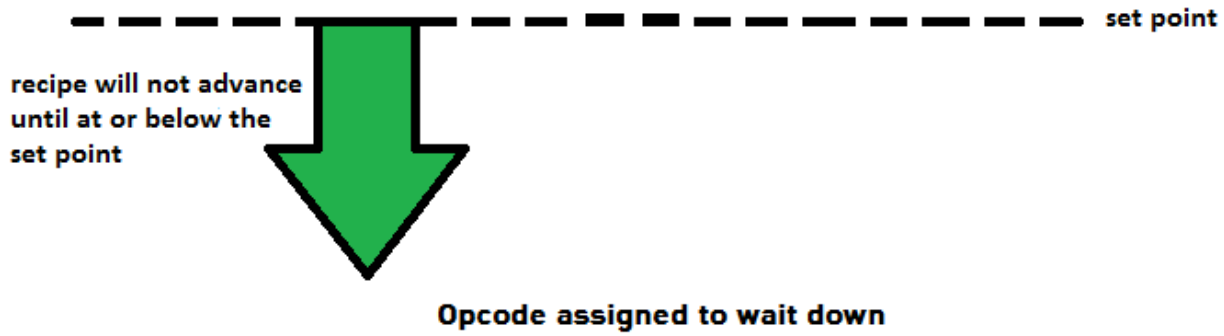


Opcode assigned to wait up

For example, if the PV is temperature with a set point of 1500° and the wait limit is 15°, the recipe will not advance until the PV is at or above 1500°.

Wait Down

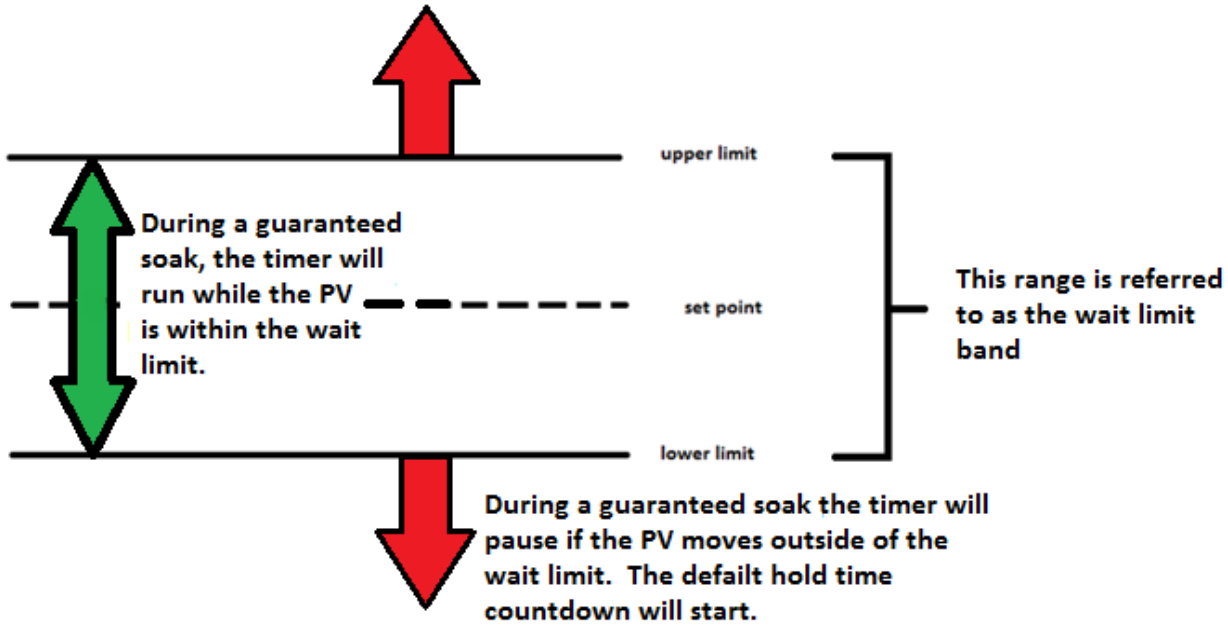
When using the option **wait down** with a set point opcode, the recipe will not advance to the next step until the PV value reaches or falls below the set point. The recipe will then continue to the next step.



For example, if the PV is temperature with a 1500° set point and the wait limit is 15°, the recipe will not advance until the PV is at or below 1500°.

Wait in a Guaranteed Soak

During a **guaranteed soak** in a recipe the timer will continue to count down while the PV value is within the **wait limit band**. If the value of the PV moves outside of this range, the timer will pause until the PV value falls back within the **wait limit band**.

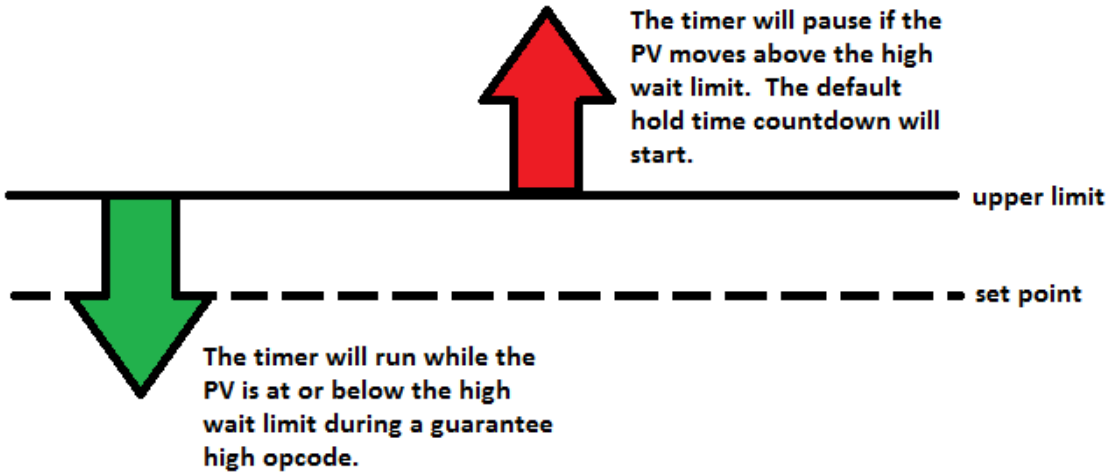


If the PV value moves outside of the **wait limit band,** the recipe will pause and a new timer will begin. This timer is called the **Default Hold Time** and can be found and adjusted in the **Menu** under **Furnace Setup**. This timer will keep track of the amount of time the PV value has been outside of the **wait limit.** If the PV value fails to move back into the **wait limit band** within the **Default Hold Time**, the programmer alarm will be activated. Once the PV value moves back within the **wait limit band**, the soak timer will resume.

For example, if the PV is temperature with a set point of 1500° and the wait limit is 15°, the recipe timer will run only while the temperature is 1485°-1515°. If the PV moves outside of this range, the recipe timer will pause and the Default Hold Time countdown will begin. The recipe timer will resume once the PV moves back into the range of 1485°-1515°.

Guarantee High Assignment

An opcode with a **GH** prefix stands for **guarantee high**. During a recipe, a **guarantee high** will allow the recipe timer to run only while the PV is at or below the **upper limit**. The **upper limit** is the value of the **set point** plus the **wait limit.**



Opcode with a guarantee high

If the PV moves above the **upper limit,** the recipe will pause and a new timer will begin. This timer is called the **Default Hold Time** and can be found and adjusted in the **Menu** under **Furnace Setup.** This timer will keep track of the amount of time the PV has been above the **upper limit**. If the PV fails to move below the **upper limit** within the **Default Hold Time,** the programmer alarm will be activated. Once the PV moves below the **upper limit**, the recipe timer will resume.

For example, if the PV is temperature with a 1500° set point and the wait limit is 15°, the recipe timer will continue to run as long as the PV is at or below 1515°. If the PV moves above 1515°, the recipe timer will pause and the Default Hold Time countdown will begin. The recipe timer will resume once the PV moves back to 1515° or below.

Sample Event Assignments

Events can be assigned to cycle any relay on and off. In the example below, Event 6 could cause a buzzer to go off or a light to turn on, signaling the end of a cycle. However, this is strictly an example. Events are customizable per the system.

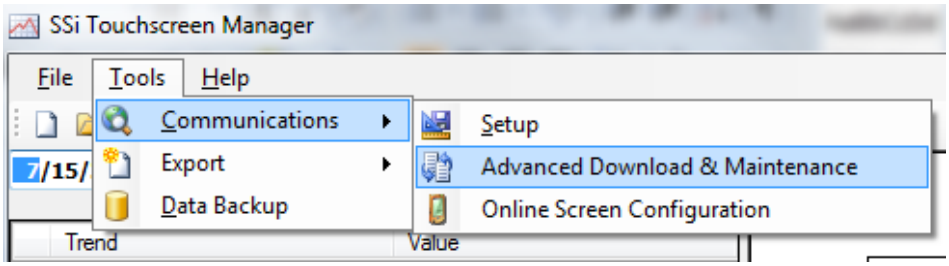
The following list is an example of how the operator could setup under System Management in Configurator some of the vacuum event assignments.

Event 0	Spare
Event 1	Cycle Running/Start Pump Down
Event 2	Spare
Event 3	Vacuum Cool
Event 4	Partial Pressure
Event 5	Gas Fan Cool
Event 6	End of Cycle
Event 7	Spare
Event 8	Spare
Event 9	Spare
Event 10	Static Cool

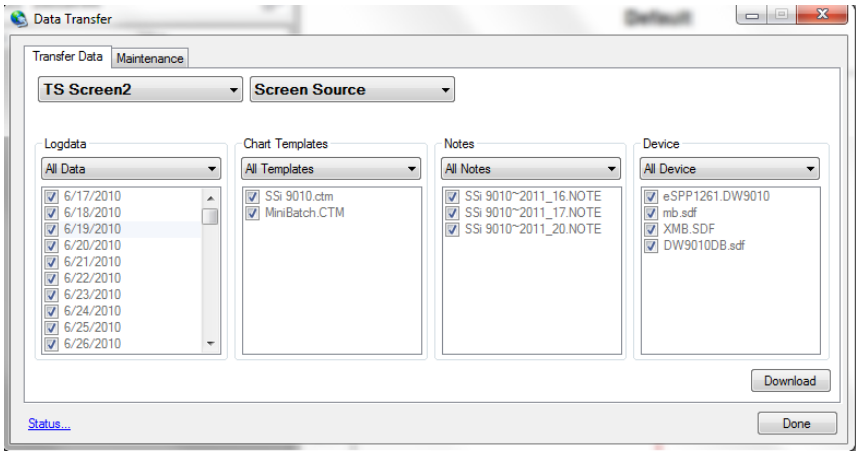
Flash Card Management

This section will show the user how to pull logged data from the operator interface using TS Manager.

From the TS Manager home screen, select Tools → Communications → Advanced Download & Maintenance



The Transfer Data tab is used to download data from the selected touch screen. The specified recorder is identified on the drop down list from the main TS Manager Screen.
There are 2 ways to synchronize data. This can be done using the Screen as the source of the data (network connection) or Disk source (flash card from the screen). *Note: Users can also download data from the main TS Manager screen using the "Download Data" button on the top right corner.*

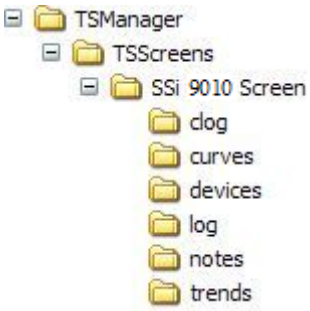


Synchronization will pull all Log Data, Chart Templates, Notes, and Devices that were entered on the screen onto the computer that is running TS Manager. The data will be stored in the TSManager directory under the screen name.

Log Data – Users can use the drop down list to select: All Data, Selected Data, or Skip. The check boxes are used to select which data gets included for the download when the Selected Data is selected, or which data gets skipped when the Skip option is selected.

Chart Templates – User can use the drop down list to select: All Templates, Selected Templates, or Skip. The check boxes are used to select which templates get included for the download when the Selected Templates is selected, or which templates get skipped when the Skip option is selected.

Notes - User can use the drop down list to select: All Notes, Selected Notes, or Skip. The check boxes are used to select which notes get included for the download when the Selected Notes is selected, or which notes get skipped when the Skip option is selected.



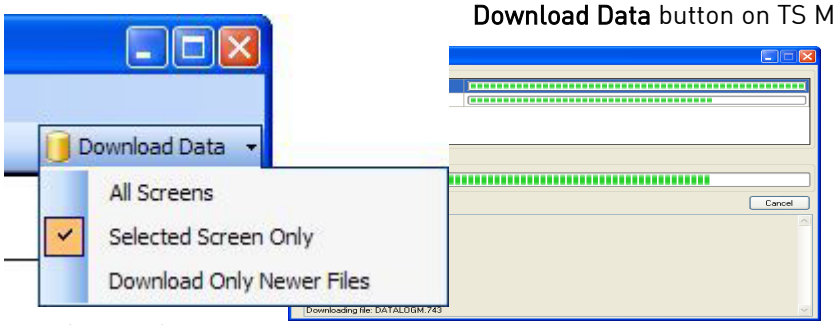
Devices – Users can use the drop down list to select: All Device, Selected Device, or Skip. The check boxes are used to select which devices get included for the download when the Selected Device is selected, or which devices get skipped when the Skip option is selected.

The **Download** button

is used to start the synchronization process.

Note: A file that is downloaded will overwrite any existing file.

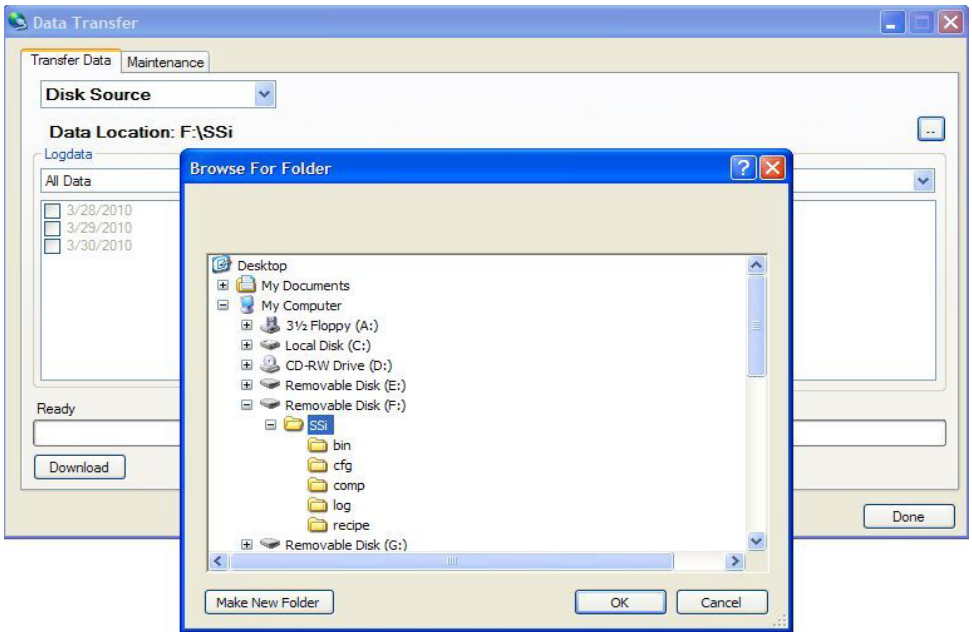
Download Data button on TS Manager main screen.



Clicking on the down arrow will give the user the ability to: download data from all of the touch screen definitions, download data from the selected screen, only download newer files. Clicking on the button will begin the download progress. If there are multiple screens, then each screen will be displayed along with the progress of each download. Clicking on the "Show Details" link will expand the screen and show any download details. The link will then say "Hide Details", which will shrink the screen and not provide any details. If there are any errors with downloading, then there will be an "X" next to the screen with the issue. The error will be listed in the details section. If the download is successful, then the download screen will close when the download is finished.

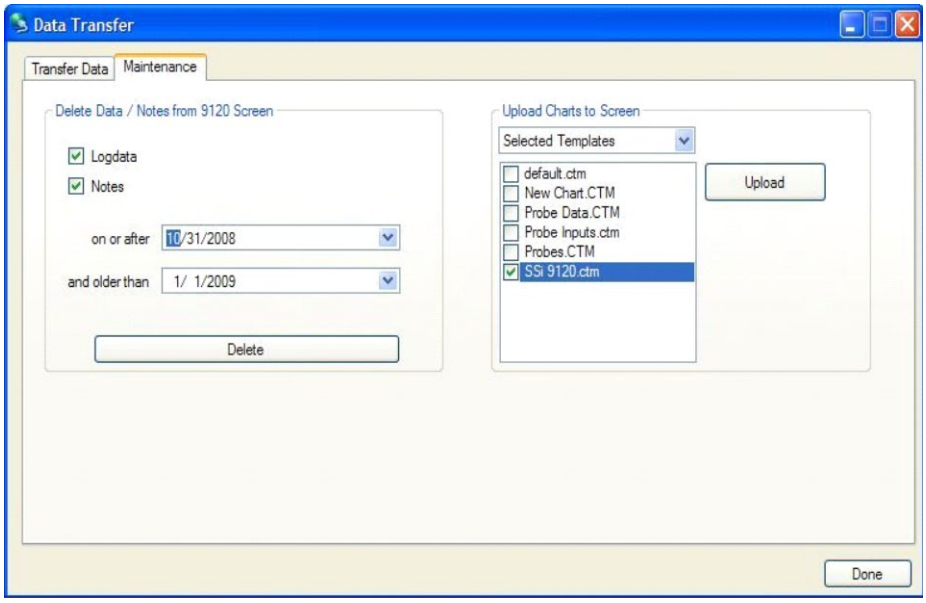
Flash Card Synchronization

When synchronizing from a flash card, the flash card needs to be retrieved from the touch screen. **The screen should be turned off before pulling the flashcard**.



The storage location of the flash card should be selected using the period button .. on the Data Transfer screen's Transfer Data tab. *Note: The main location for the flash drive should be selected.*

The Maintenance tab is used to delete logged data or notes either from the video screen directly or on the flash card. Logged data and notes can be removed to create additional free space on the storage card. All data that is synchronized with TS Manager maintains a backup of the data in the



..TSManager\TSScreens\"Screen Name"\Log, Clog and notes directories.
To delete the log data, select the "Logdata" option, and to delete the notes, select the "Notes" option. One or both options may be selected at the same time. The data will be deleted by a date range, which means the user will have to select a beginning date for the date range and an ending date for the date range. The "on or after" drop-down list is the beginning date for the date range, and the "and older than" drop-down list is the ending date for the date range. Clicking on the **Delete** button will delete the selected files from the screen. The user will have to confirm the delete. The user will also be able to upload chart files to the

instrument. In the "Upload Charts to Screen" section, the drop-down list has the options for "All Templates" or "Selected Templates". Click on the **Upload** button to upload the desired chart files. This feature is useful if the user modifies the chart files on the local computer and wishes to update the chart files on the touch screen without having to enter the modifications again.
The **Done** button will close out the screen.

Slave Instrument Mapping

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

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 slave instruments will be split into three sections: Atmosphere Instruments, Temperature Instruments, and Events Instruments. The layout for each instrument will be the same:

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

Atmosphere Instruments

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
AC20	11	123	1	1	%C Actual
(Modbus Mode)	29	138	1	1	%C Setpoint
	13	125	1	1	Probe Temperature
	10	122	1	1	Probe Millivolts
	20	130	10	10	%C Percent Output
	34	142	1	1	CO Factor or Equivalent
	35	143	1	1	H Factor or Equivalent
	12	124	1	1	Dew Point
	36	144	10	10	O_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 Slave	9	46	1	1	Temperature Controller Actual
(MMI Mode)	3	18	1	1	Temperature Controller Setpoint
	12	53	41	41	Temperature Controller Percent Output

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

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

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

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

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

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

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

Controller	Source Location	Write Register	Read Scale	Write Scale	Description
Eurotherm Loop 1	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

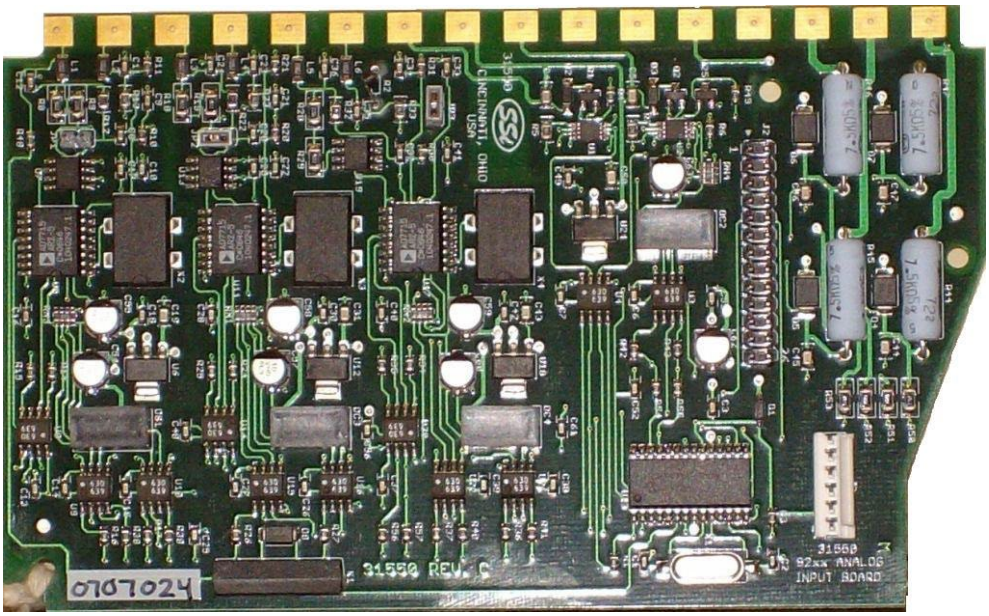
Controller	Source Location	Write Register	Read Scale	Write Scale	Description
MCMModule Modbus	10	110	1	1	Events Actual
RS-232	0	100	1	1	Events Setpoint
	15	115	1	1	Events Input

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

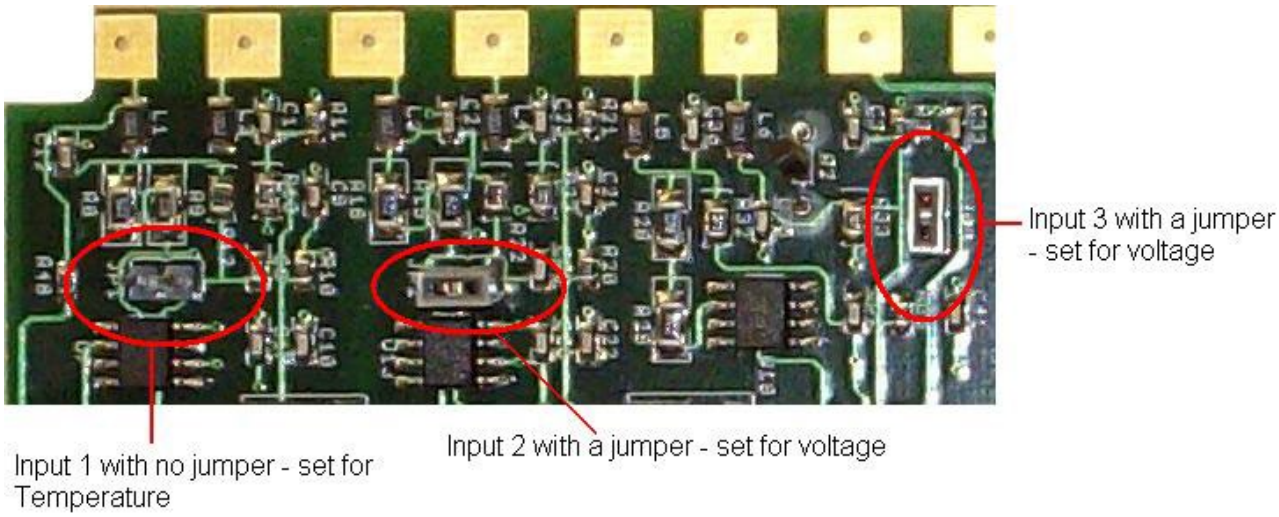
9215 Analog Input Board Jumper Settings

The 9215 analog input boards are initially set up with the following configuration:
Input 1 – Temperature/Thermocouple



In order to change these settings, the following steps must be taken:

1. If necessary, shut down the 9215 screen software by clicking on the *Shutdown* menu option from the *Configuration* menu
2. Shut down power to the screen and any connected instrument
3. Remove the cover of the 9215 instrument. This is done by removing the four (4) screws in the corner of the 9215 instrument box, and then pushing the two (2) tabs on the side of the box outward while pulling on the chassis
4. Remove the analog input board
5. In order for an input to be set up as a voltage input, a jumper must be placed on the two pins of the input



6. To set an input for voltage, place the gray jumper over the two pins on the desired input. To set an input for temperature, remove the gray jumper from the two pins on the desired input.

***** WARNING: A jumper must be placed over the input before voltage inputs can be applied or the analog input board will be damaged *****

7. Re-insert the analog input board
8. Replace the cover on the 9215 instrument
9. Re-attach the power to the screen and any connected device
10. Power up the Advantech Touchscreen
11. From the Analog Input Setup menu screen, select the appropriate input and change the T/C Type to the correct type

Contact Super Systems Inc at 513-772-0060 if there are any questions or problems.

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 atmosphere 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.

NOTE: Only TCs selected in the Load TC Map will be available here. See the Configuration section for more details.

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**.

MEVT_OUT_1
Temperature Setpoint **Event Mask** **Event ON/OFF Bitmap**
This opcode will set multiple output 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 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**. *Note – Even though the events listed are 0 – 15, they correspond to 16 – 31*.

MEVT_OUT_2
Temperature Setpoint **Event Mask** **Event ON/OFF Bitmap**
This opcode will set multiple output events **32** through **47**.
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 32 – 47*.
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**. *Note – Even though the events listed are 0 – 15, they correspond to 32 – 47*.

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.

O2_ALARM
N/A **N/A** **On/Off Option**
If this option is turned on in a recipe, at any point after this Opcode if the $\%O_2$ gets above 1%, an alarm will be present on the screen, and is assignable to a relay output. If the Option is set to On, the alarm is enabled. If the Option is set to Off, the alarm is disabled.

O2_TEST
True Step Number **False Step Number** **Wait Time (Minutes)**
This Opcode tests to see if the $\%O_2$ is below 1%. The wait time (set in **Wait Time**) is the maximum amount of time it can sit in this step trying to see if it is true (below 1%) or false (above 1%). If true, it jumps to the step designated in **True Step Number**. If false, it jumps to the step designated in **False Step Number**.

OG_HOLDT
N/A **Torr** **Level Option**
This opcode will monitor the vacuum level ~~a~~ setpoint to keep the vacuum level under a certain point. When the actual vacuum level is at or above the setpoint, the recipe will be put in a hold. This Opcode can be placed

at any location within the recipe and remains active until (1) another gauge is selected, (2) the Level Option of OFF is selected or (3) the program ends. When the vacuum falls below the setpoint, the hold will be removed.

The gauge can be changed during a cycle or turned off completely but the programmer can only monitor one vacuum gauge at a time.

Torr Level is the vacuum setpoint in Torr.

OGHOLDM

N/A **Micron** **Level Option**

This opcode will monitor the vacuum level ~~a~~ setpoint to keep the vacuum level under a certain point. When the actual vacuum level is at or above the setpoint, the recipe will be put in a hold. This Opcode can be placed at any location within the recipe and remains active until (1) another gauge is selected, (2) the Level Option of OFF is selected or (3) the program ends. When the vacuum falls below the setpoint, the hold will be removed.

The gauge can be changed during a cycle or turned off completely but the programmer can only monitor one vacuum gauge at a time.

Micron Level is the vacuum setpoint in Micron.

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 a recipe when the opcode PIDLOAD 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 slave PLC. Registers to be written to must be described via the Configurator's Recipe Management Group Opcode Control interface. The temperature data is the value to write. The atmosphere data is the Write location. This can be:

Quench SP
Endo SP
Ammonia SP
N2 SP
Methanol SP
Quench Sec
Drain Sec
T.C. Endo SP
T.C. N2 SP

FNC NH3 SP
T.C. Time
PLC Quench SP
Quench Type

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

PO_INQ

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.

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 slave instrument in the Slave Instrument Setup menu and configured in the Furnace Setup menu as *Instrument # 4*. The range is **-301** (disable) – **30000**.

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

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

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

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

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

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

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

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

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

RAMP
Temperature Setpoint **Atmosphere Setpoint** **Time**
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.

RAMP_VALVE
Final Set Point **Ramp Rate** **Valve**
This opcode ramps a valve setpoint.
The Final Set Point is the final setpoint for the ramped valve. The range is **-301** (disable) to **30000**.
The Ramp Rate is which of the four valves to ramp.
Valve is the valve number.
This opcode does not wait for the ramp to complete. The ramp occurs in the background with a new setpoint calculated every 10 seconds. Therefore, all four valves can be ramped independently. The TEST_VRAMP opcode can be used to determine if the ramp completed.

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**.

RLY_INQ
Off step number **On step number** **Option**
The relay inquiry is used to check the relays using the relay setpoint RLY_SP_M or RLY_SP_T opcodes. This Opcode must immediately follow a Relay Setpoint Opcode.

The Off step number determines what the next recipe step will be when this Relay Setpoint is off. The On step number determines what the next recipe step will be when this Relay Setpoint is on.

The Option value will determine which vacuum relay is selected. If the relay is ON, the program moves to the ON step number. If the relay is OFF, the program moves to the OFF step number.

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.

RLY_SP_M
Off setpoint **On setpoint** **Option**
This opcode determines the relay setpoint in microns to be used in conjunction with the RLY_INQ Opcode and must precede the RLY_INQ.

The options are used to select the gauge and setpoint.

RLY _SP_T
Off setpoint **On setpoint** **Option**
This opcode determines the relay setpoint in Torr to be used in conjunction with the RLY_INQ Opcode and must precede the RLY_INQ.

The options are used to select the gauge and setpoint.

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

SET_AUX
Setpoint Value **N/A** **Slave Instrument**
This opcode sends a setpoint down to an auxiliary instrument.
The Setpoint Value is the setpoint to send down. The range is **-301** (disable) – **30000**.
The Slave Instrument is the slave instrument to send the setpoint down to (SSi recipe programmers only).
The options are: **1** – **25**.

SET_COF_TBL
N/A **N/A** **Table Number**
This opcode Sets the table number of the COF adjustment table from 1 to 8. It can also be used to turn off the table usage.
The option value of the opcode is the table number (**1 through 8**) or **0** to disable.
This opcode only changes the COF table setting if the controller is in %C mode.

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 NH_3 +, 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 slave instrument to send the value to. The options are: **1** – **25**.

SET_V_TRACK

Tracking %	Tracking Mode	Valve

This opcode only applies to valve 3 or valve 4. The Valve option must specify which valve.
Tracking % specifies the tracking percentage.
Tracking Mode specifies the setpoint tracking mode. 0 is no tracking, 1 is track total flow, and 2 is track NH_3 flow.
Valve is which of the four valves will be tracked.

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 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)**.

SETPT

Temperature Setpoint	N/A	Option

This opcode is used to set the temperature set point.
The Temperature Setpoint is the setpoint to send for the temperature process variable. The range is **-301** (disable) – **30000**.
The Option will wait for the setpoints to be reached: **Blank** (Don't Wait), **Wait**, **Wait Up**, or **Wait Down**. *Note – The Blank option is an actual blank line, not the word "Blank".*

SL_PV_INQ

Process Variable	Slave	Option

This opcode will check a slave instrument for a specific process variable value, and wait until the PV from the slave instrument matches.
The Process Variable is the PV to check. The range is **-301** (disable) – **32000**.
The Slave is the slave instrument to check. The range is **1** – **12**.
The Option is the wait options for the opcode. The options are: **Wait**, **Wait Up**, or **Wait Down**.

SOAK

N/A	N/A	Soak Time

This opcode is an unconditional soak for the time (in hours and minutes) specified. The programmer will hold for the time specified, and nothing except the operator pausing the recipe will put the program in a hold state.
The Soak time is the total time, in Hours:Minutes format, for the soak to run. The Hours range from **0** – **166**, and the Minutes range from **0** – **59**.

TC_CHK

Source 1	Source 2	Source 3

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

TC_INQ

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.

TEST_VRAMP

Step if not ramping	Step if ramping	Valve to test

This opcode is used to determine is a valve setpoint ramp has completed. The valve setpoint ramp is set using the RAMP_VALVE opcode.
The **Valve to test** option determines which valve to test.
If no ramp is occurring on that valve, then the program continues at the step specified in the **Step if not ramping** option.
If a ramp is occurring on that valve, then the program continues at the step specified in the **Step if ramping** option.

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.

VAC_INQ_M_1-4

N/A	Micron Level	Option

The vacuum inquiry is used to determine the vacuum value of the gauge (1-4) being tested.
The Micron Level is the vacuum level in microns that the actual value will be compared to.
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.

VAC_INQ_T_1-4

N/A	Torr Level	Option

The vacuum inquiry is used to determine the vacuum value of the gauge (1-4) being tested.
The Torr Level is the vacuum level in Torr that the actual value will be compared to.
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.

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:

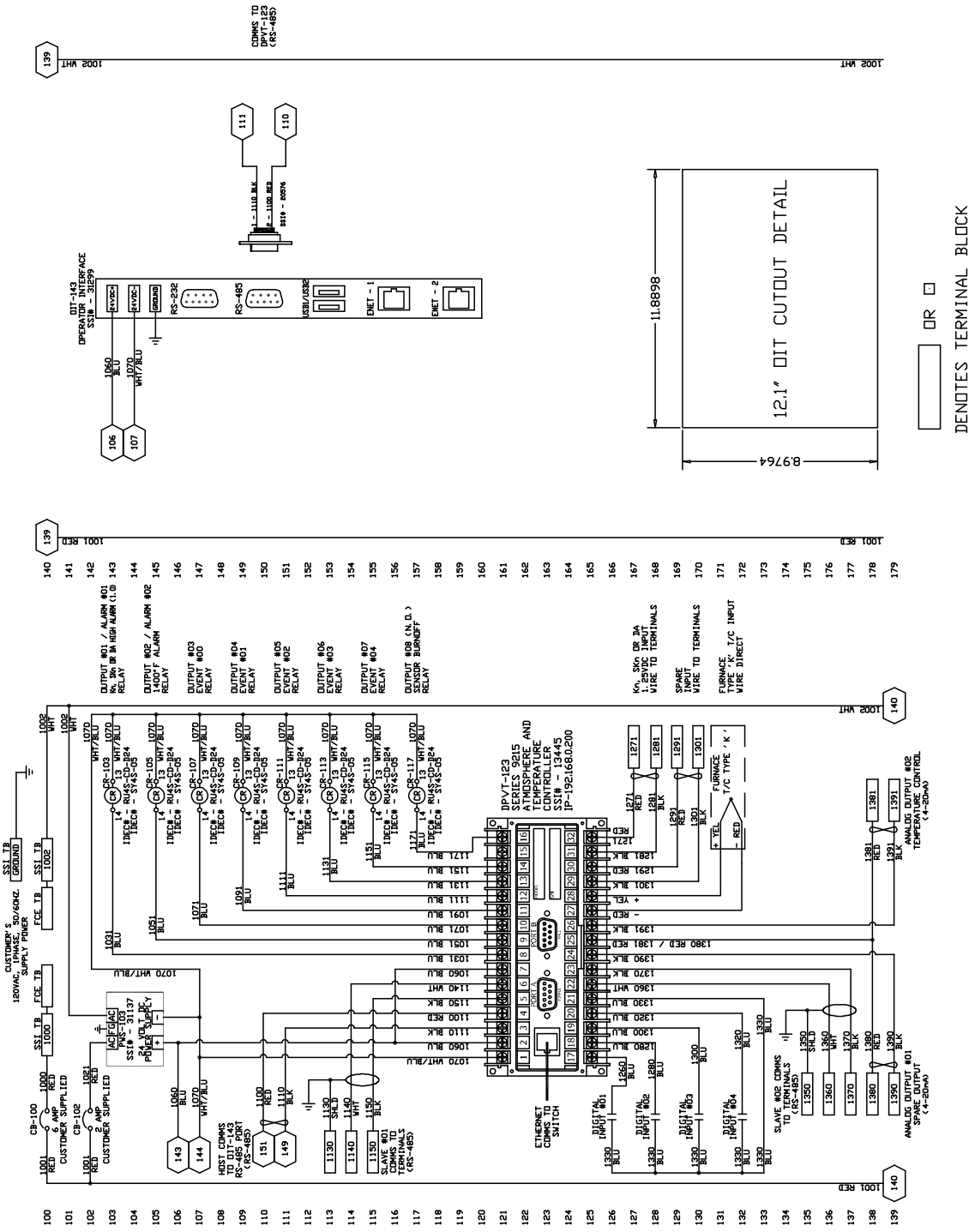
The Limited Warranty applies to new Super Systems Inc. (SSI) products purchased direct from SSI or from an authorized SSI dealer by the original purchaser for normal use. SSI warrants that a covered product is free from defects in materials and workmanship, with the exceptions stated below.

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 – Wiring Diagram of Series 9215



Appendix B – Guide to Building a Recipe

The SSi 9215 is a multi-loop programmable recipe controller. The 9215 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 9215

	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 9215'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.

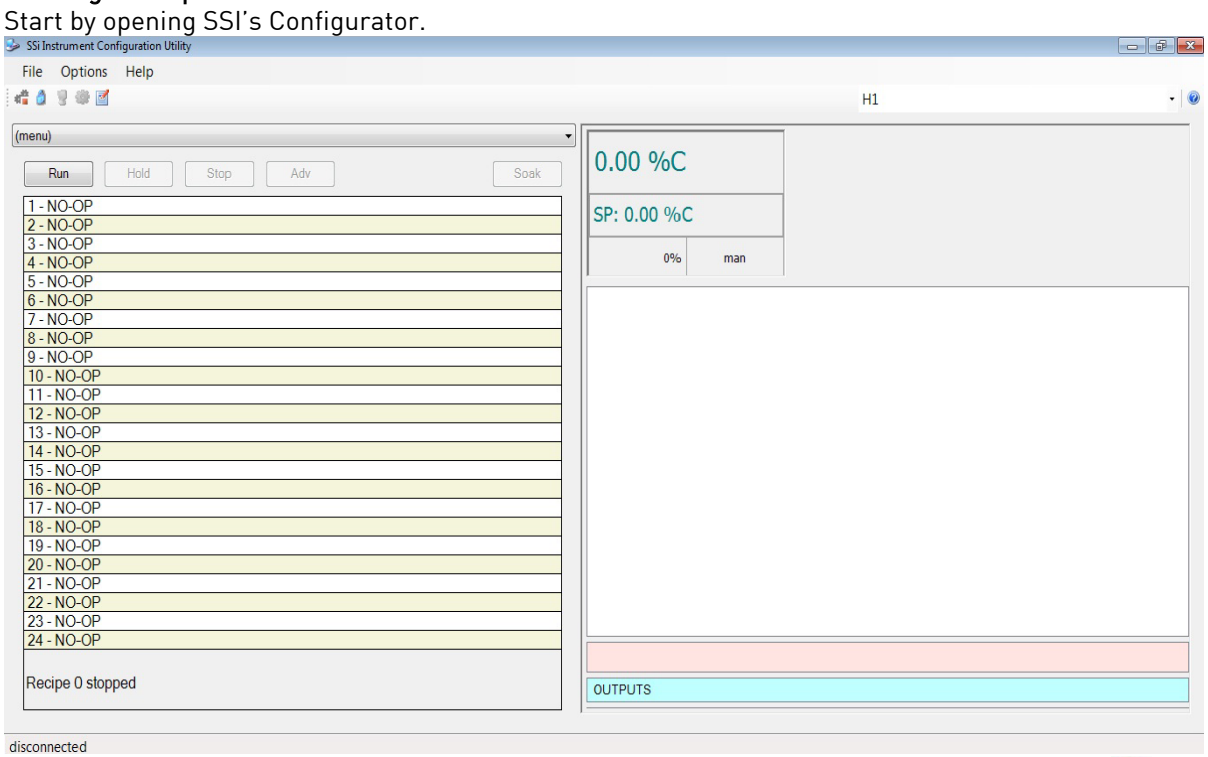
7) The controller is now starting its Soak Timer in Step 7. The work will soak for 30 minutes. Once the Soak Timer has completed, the recipe will continue to Step 8.

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

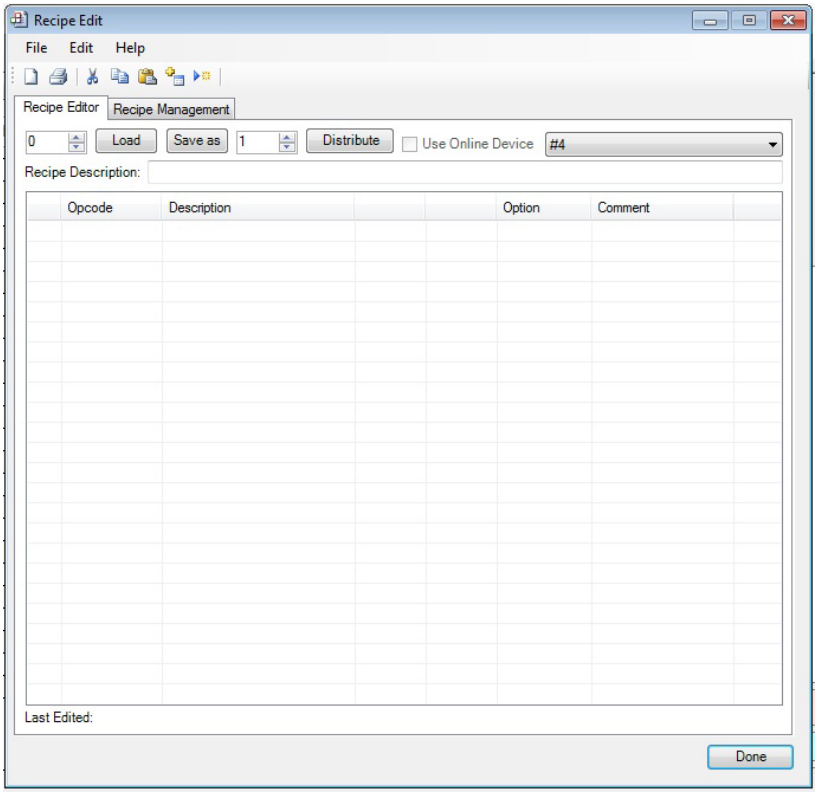
Start by opening SSI's Configurator.



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.

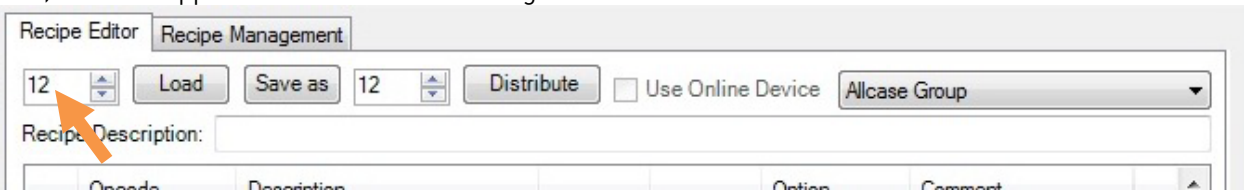
To start to build or modify recipes, click the Recipe Editor icon in the upper left hand corner of the screen.

The Recipe Editor will open.

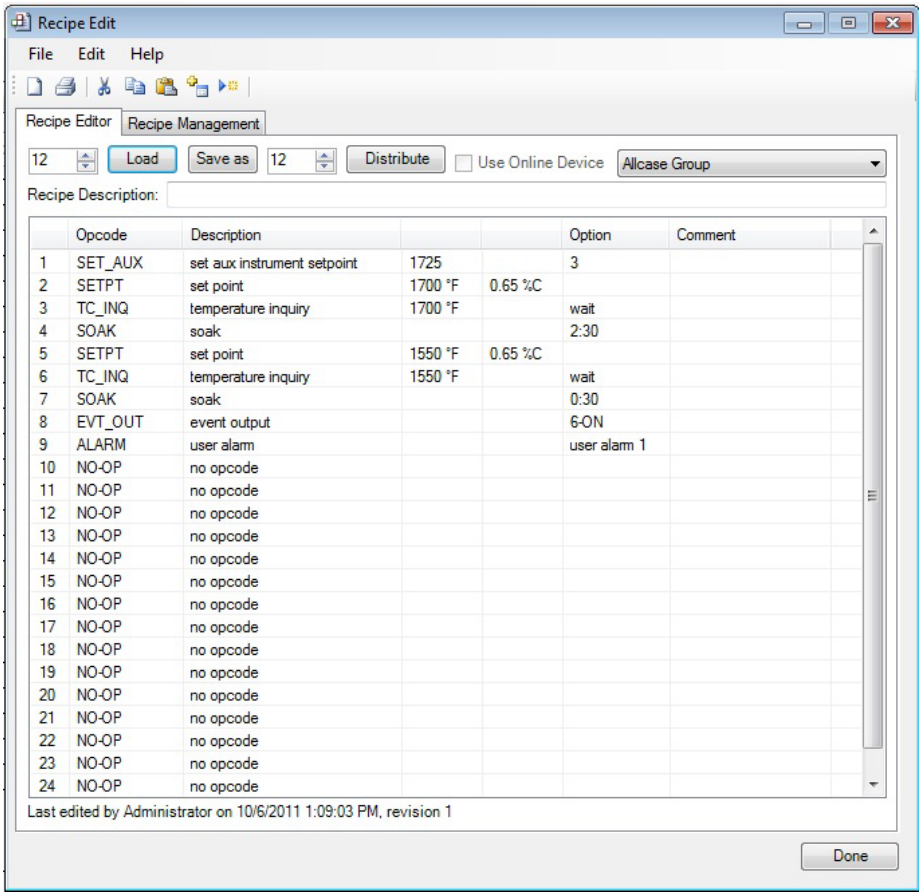


First, start by choosing the correct Recipe Group. To do this, click the drop down box near the upper right hand corner of the screen.

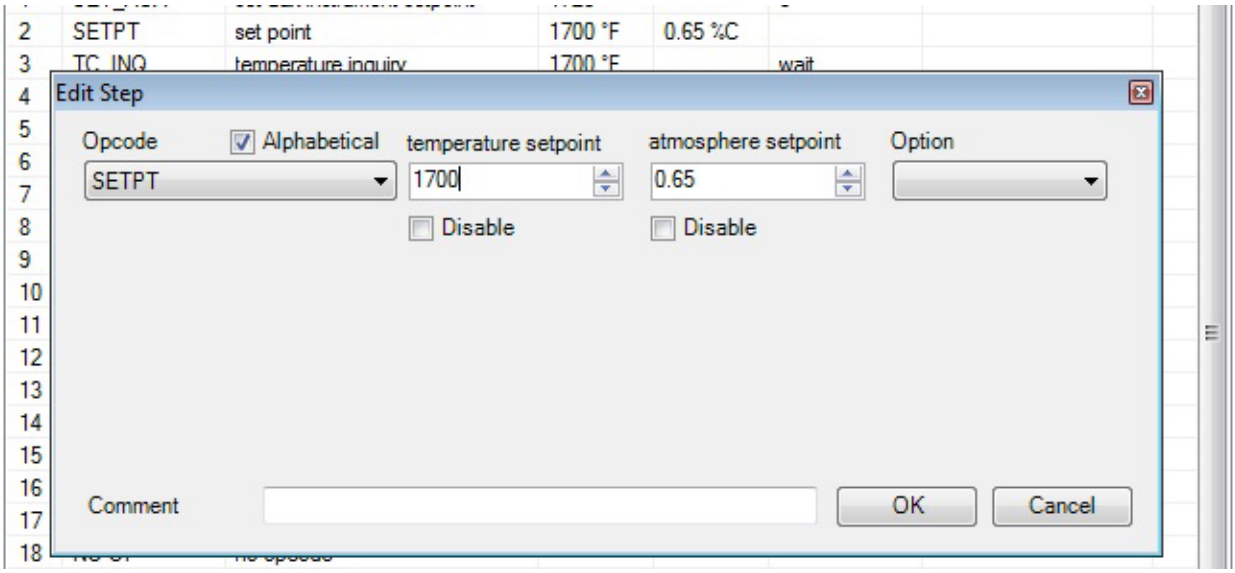
Once the correct recipe group has been selected, type or click the Up or Down arrows in the Load Entry Box, near the upper left hand corner to change the number.



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.

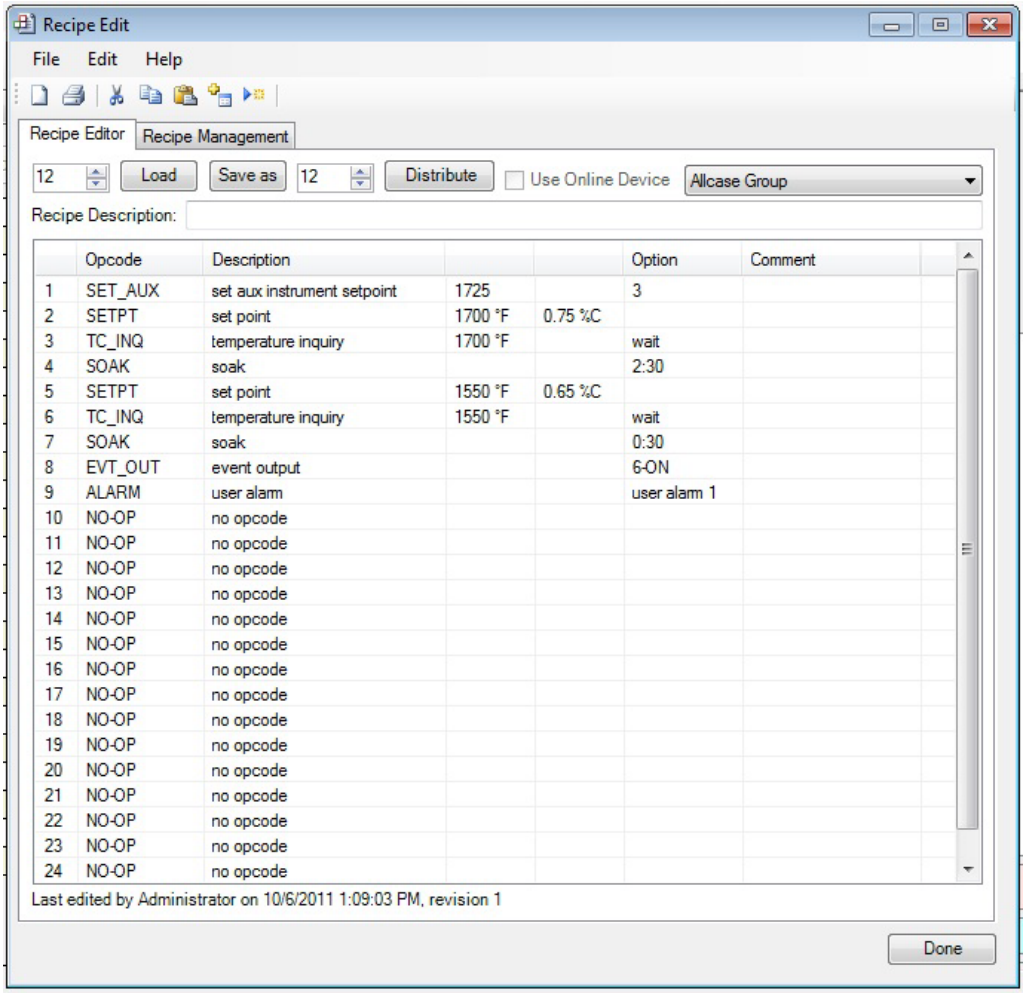


Before adjusting the recipe, the operator must first understand what needs to be modified. For example, if the atmosphere level needs to be adjusted at the beginning of the recipe, double click on the line for SETPT. The SETPT Edit Step box will appear.



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

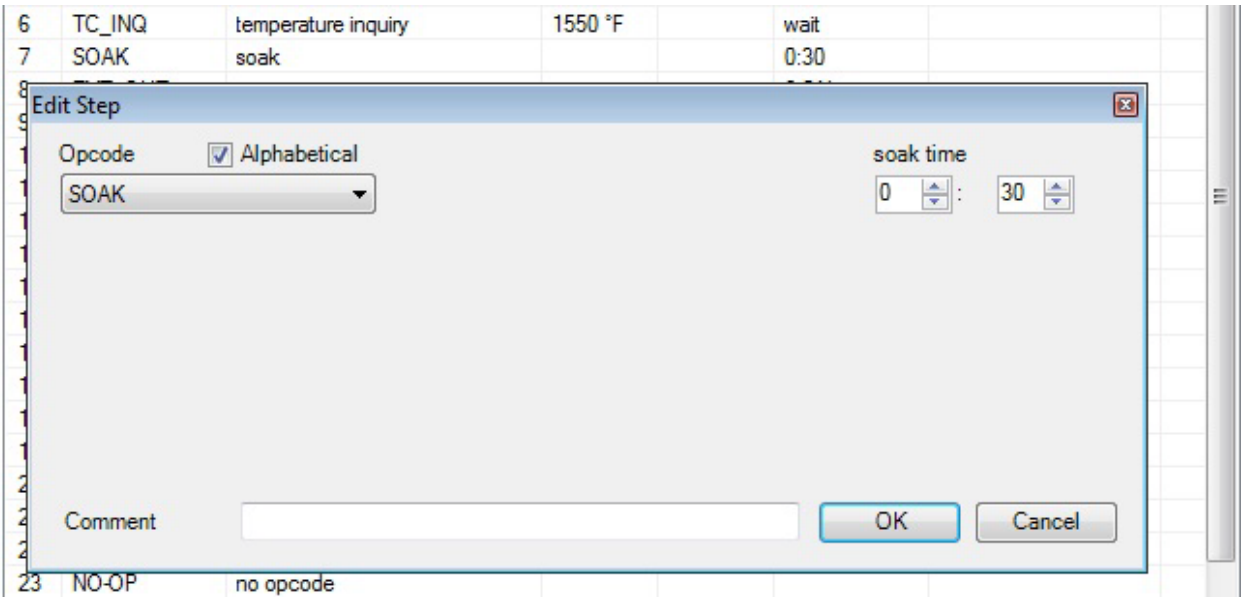
level can be entered into the box from a keyboard. Once the correct setpoint has been entered, press the OK button in the bottom right corner of the Edit Step box.



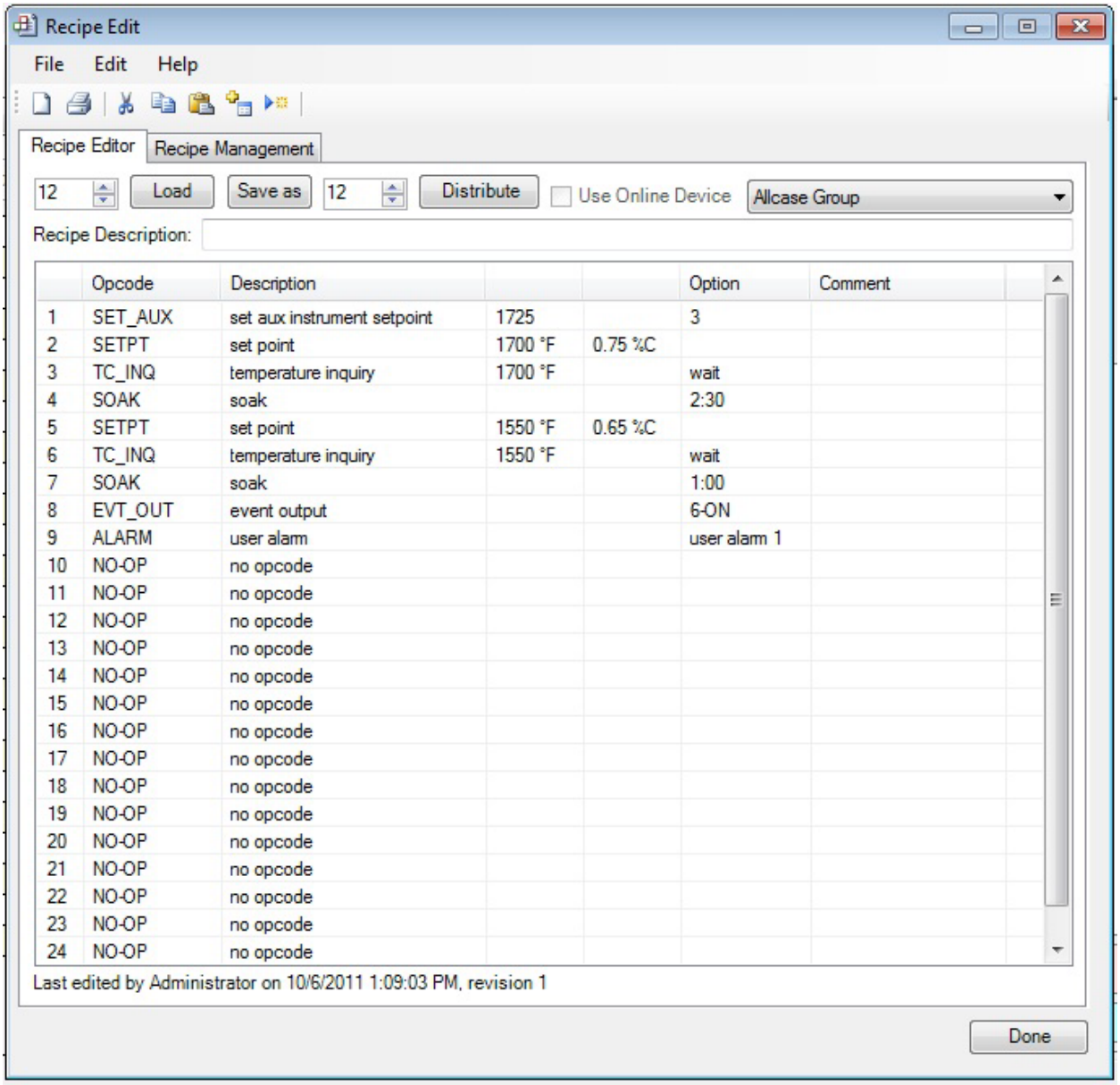
	Opcode	Description			Option	Comment
1	SET_AUX	set aux instrument setpoint	1725		3	
2	SETPT	set point	1700 °F	0.75 %C		
3	TC_INQ	temperature inquiry	1700 °F		wait	
4	SOAK	soak			2:30	
5	SETPT	set point	1550 °F	0.65 %C		
6	TC_INQ	temperature inquiry	1550 °F		wait	
7	SOAK	soak			0:30	
8	EVT_OUT	event output			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				

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.

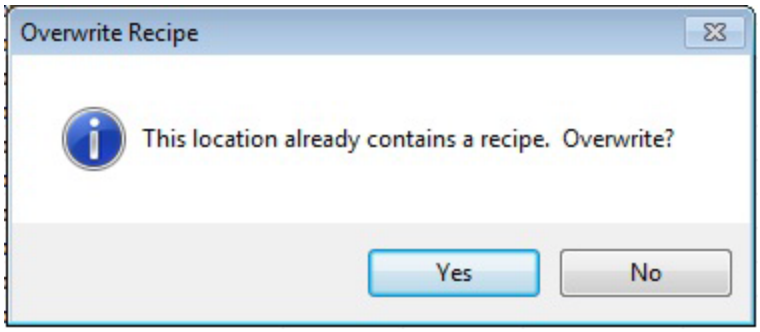


	Opcode	Description			Option	Comment
1	SET_AUX	set aux instrument setpoint	1725		3	
2	SETPT	set point	1700 °F	0.75 %C		
3	TC_INQ	temperature inquiry	1700 °F		wait	
4	SOAK	soak			2:30	
5	SETPT	set point	1550 °F	0.65 %C		
6	TC_INQ	temperature inquiry	1550 °F		wait	
7	SOAK	soak			1:00	
8	EVT_OUT	event output			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				

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.

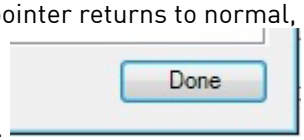
1) To permanently save Recipe #12 with the modifications, click the Save As button. A pop up box will appear.



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.

Appendix C – 9215 Instrument Alarms

This appendix provides a list of alarms programmed into the 9215 controller. The table below provides the alarm name, alarm text (as presented in Configurator), the condition(s) under which the alarm is generated, and information on user-accessible settings that affect the triggering of the alarm.

Alarm Description	Register/Bit Location	Type	Values
Programmer (any) alarm	141/0	Programmer	
Alarm 1	141/1	Main	
Alarm 2	141/2	Main	
Alarm 3	141/3	Main	
Alarm 4	141/4	Main	
Alarm 5	141/5	Main	
Alarm 6	141/6	Main	
Alarm 7	141/7	Main	
TC redundancy alarm	141/8		
End of Quench	141/12		
Programmer 2 (any) alarm	141/14		
Slave coms (any) alarm	141/15		
PLC Alarms (custom)	2980 - 2989	PLC	
user alarm	25024/0	Programmer	
deviation, atmosphere	25024/1	Programmer	
high atmosphere	25024/2	Programmer	
low atmosphere	25024/3	Programmer	
deviation, temperature	25024/4	Programmer	
high temperature	25024/5	Programmer	
low temperature	25024/6	Programmer	
high atm % output	25024/7	Programmer	
low atm % output	25024/8	Programmer	
high temperature % output	25024/9	Programmer	
low temperature % output	25024/10	Programmer	
Gosub	25024/11	Programmer	
Limit	25024/12	Programmer	
internal system error	25024/13	Programmer	
hold alarm	25024/14	Programmer	
slave coms alarm (any)	25024/15	Programmer	
User alarm	25028	Programmer	0 - 99

Alarm Description	Register/Bit Location	Type	Values
deviation, atmosphere		op-code DEV_AL (A.bnd)	101
high atmosphere		op-code DEV_AL (A.+dev)	102
low atmosphere		op-code DEV_AL (A.-dev)	103
deviation, temperature		op-code DEV_AL (T.bnd)	104
high temperature		op-code DEV_AL (T.+dev)	105
low temperature		op-code DEV_AL (T.-dev)	106
high atmosphere % output		op-code High_PO (ATM)	107
low atmosphere % output		op-code Low_PO (ATM)	108
high temperature % output		op-code High_PO (Temp)	109
low temperature % output		op-code Low_PO (Temp)	110
Gosub		op-code gosub	111
Limit		op-code Limit	112
checksum error		Recipe self verification embedded in recipe	113
load TCs out of band		op-code LTC_Set	114
hold alarm (step programmer)		op-codes with wait/wait up/wait down	115
internal system error		Error between processor and analog board	116
hold alarm (segment programmer)		When hold time is exceeded within a segment	117
hold alarm (guarantee)		When using a guarantee and time is exceeded beyond setting	118
bad PID values loaded		op-code PIDLOAD	125
quench transfer time exceeded		op-code Q_TT_AS_SP	140
Slave instrument coms (1-based instrument number + 200).			201 + inst #
Currently not supported			401

Appendix D – Factory Default Settings for the 9215 Controller

Field	Factory Default Value
Revision	
Revision	2.22
PID Loop 1 Setup	
Prop Band (0 for On/Off)	20.0
Reset	0.10
Rate	0.00
Mode	Dual Reverse
Integral Preset	0
Cycle Time	16
Setpoint Change Limit	OFF
Low Limit	-100
High Limit	100
0 set point stops control	yes
IN1 high input shuts down ctrl	no
IN2 high input shuts down ctrl	no
IN3 high input shuts down ctrl	no
PID auto switch	no
Switch Point PID 1->2	9999
Switch Point PID 2->3	9999
Setpoint Lower Limit	-9999
Setpoint Upper Limit	29999
Positive Output Accumulator	0.0
Negative Output Accumulator	0.0
Overshoot Control Logic	no
Ramp Detect Logic	no
Ramp Overshoot Control Level 1	no
Ramp Overshoot Control Level 2	no
PID Loop 2 Setup	
Prop Band (0 for On/Off)	4.0
Reset	0.10
Rate	0.00
Mode	Single Reverse
Integral Preset	0
Cycle Time	60
Setpoint Change Limit	80%
Low Limit	0
High Limit	100
0 set point stops control	no
IN1 high input shuts down ctrl	no
IN2 high input shuts down ctrl	no
IN3 high input shuts down ctrl	no
PID auto switch	no
Switch Point PID 1->2	9999
Switch Point PID 2->3	9999
Setpoint Lower Limit	-9999
Setpoint Upper Limit	29999
Positive Output Accumulator	0.0
Negative Output Accumulator	0.0
Overshoot Control Logic	no

Field	Factory Default Value
Ramp Detect Logic	no
Ramp Overshoot Control Level 1	no
Ramp Overshoot Control Level 2	no
PID Loop 3 Setup	
Prop Band (0 for On/Off)	4.0
Reset	0.10
Rate	0.00
Mode	Single Reverse
Integral Preset	0
Cycle Time	60
Setpoint Change Limit	OFF
Low Limit	0
High Limit	100
0 set point stops control	no
IN1 high input shuts down ctrl	no
IN2 high input shuts down ctrl	no
IN3 high input shuts down ctrl	no
PID auto switch	no
Switch Point PID 1->2	9999
Switch Point PID 2->3	9999
Setpoint Lower Limit	-9999
Setpoint Upper Limit	29999
Positive Output Accumulator	0.0
Negative Output Accumulator	0.0
Overshoot Control Logic	no
Ramp Detect Logic	no
Ramp Overshoot Control Level 1	no
Ramp Overshoot Control Level 2	no
Event Run Program Setup	
Program number to run	0
Load T/C Configuration	
Load TC Enable	off
Control TC	
TC 1	
TC 2	
TC 3	
TC 4	
TC 5	
TC 6	
TC 7	
TC 8	
TC 9	
TC 10	
TC 11	
TC 12	
TC 13	
TC 14	
TC 15	
TC 16	
TC 17	

Field	Factory Default Value
TC 18	
TC 19	
TC 20	
TC 21	
TC 22	
TC 23	
TC 24	
Port Setup	
Host 232 Baud	19200
Host 232 Mode	Modbus/no PLC
Host 485 (3,4) Baud	19200
Host 485 (3,4) Mode	Modbus
Host 485 Address	1
Slave 1 (5,6) Baud	19200
Slave 1 (5,6) Mode	Modbus
Slave 1 (5,6) Bits	8, None, 1
Slave 2 (22,23) Baud	19200
Slave 2 (22,23) Mode	Modbus
Slave 2 (22,23) Bits	8, None, 1
232-2 Port Baud	19200
PLC Type	Micrologix Modbus
Slave Instrument Setup	
Instrument 1	
Instrument 2	
Instrument 3	
Instrument 4	
Instrument 5	
Instrument 6	
Instrument 7	
Instrument 8	
Instrument 9	
Instrument 10	
Instrument 11	
Instrument 12	
Instrument 13	SSi O2 Remote @ 8 on slave 1
Instrument 14	
Instrument 15	
Instrument 16	MGA @ 13 on slave 1
Instrument 17	MGA @ 14 on slave 1
Instrument 18	
Instrument 19	
Instrument 20	
Instrument 21	
Instrument 22	
Instrument 23	
Instrument 24	
Instrument 25	
Instrument 26	error @ -32768 on undef port
Furnace Setup	
Name	PROGRAMMER

Field	Factory Default Value
Date and Time	invalid
PVT Type	% Carbon
Mode	N/A
Send Probe data to MGA	no
Control Mode	control
LP3 control	off
Active SPP ATM Instrument	Loop 1
Active SPP TC Instrument	Loop 2
Active Event Instrument	internal
Active Quench Instrument	Instrument 2
End of quench event	7
Quench speed event	6
Quench run event	0
Quench hold event	none
N2 ctrl by Valve 1	no
NH3 ctrl by Valve 2	yes
D.A. ctrl by Valve 3	yes
H2 ctrl by Valve 4	no
Temperature Mode	°F
Clear events/end of recipe	yes
Use MGA Suggested Factor	no
Event time configuration	Event 1 active to event 2 active
Digital Input 3 is FNC Select	yes
PVT Type When FNC Selected	Nitrider
Carburize Atmosphere Instrument	0
Nitrider calc includes diluents	yes
MGA In Passive	no
MGA Out Passive	no
Probe Source	Internal
Default Hold Time	90
Deviation Alarm Delay	0
Wait Limits	
Temp Wait Limit	0
Atm Wait Limit	0.00
Alarm 1 Setup	
Setpoint	100
Alarm Type	PV1 proc high
Hysteresis	1
Smart Alarm	disabled
ON Delay Time	0
0 SP blocks alarm	no
BO/Impedance inhibits alarm	no
Inhibit source	none
Disable on open input	no
Base Setpoint	N/A
Alarm 2 Setup	
Setpoint	1400
Alarm Type	PV2 proc high
Hysteresis	10
Smart Alarm	disabled

Field	Factory Default Value
ON Delay Time	0
0 SP blocks alarm	no
BO/Impedance inhibits alarm	no
Inhibit source	none
Disable on open input	no
Base Setpoint	N/A
Alarm 3 Setup	
Setpoint	1400
Alarm Type	PV2 proc high
Hysteresis	1
Smart Alarm	disabled
ON Delay Time	0
0 SP blocks alarm	no
BO/Impedance inhibits alarm	no
Inhibit source	none
Disable on open input	no
Base Setpoint	N/A
Alarm 4 Setup	
Setpoint	0
Alarm Type	PV1 proc high
Hysteresis	0
Smart Alarm	disabled
ON Delay Time	0
0 SP blocks alarm	no
BO/Impedance inhibits alarm	no
Inhibit source	none
Disable on open input	no
Base Setpoint	N/A
Alarm 5 Setup	
Setpoint	0
Alarm Type	PV1 proc high
Hysteresis	0
Smart Alarm	disabled
ON Delay Time	0
0 SP blocks alarm	no
BO/Impedance inhibits alarm	no
Inhibit source	none
Disable on open input	no
Base Setpoint	N/A
Alarm 6 Setup	
Setpoint	0
Alarm Type	PV1 proc high
Hysteresis	0
Smart Alarm	disabled
ON Delay Time	0
0 SP blocks alarm	no
BO/Impedance inhibits alarm	no
Inhibit source	none
Disable on open input	no
Base Setpoint	N/A

Field	Factory Default Value
Alarm 7 Setup	
Setpoint	0
Alarm Type	PV1 proc high
Hysteresis	0
Smart Alarm	disabled
ON Delay Time	0
0 SP blocks alarm	no
BO/Impedance inhibits alarm	no
Inhibit source	none
Disable on open input	no
Base Setpoint	N/A
Relay Assignments	
Relay 1	alarm 1
Relay 2	alarm 2
Relay 3	event 0
Relay 4	event 1
Relay 5	event 2
Relay 6	event 3
Relay 7	event 4
Relay 8	burn off
Relay Setpoints	
Relay ON SP for IN1 A	0
Relay OFF SP for IN1 A	0
Relay ON SP for IN1 B	0
Relay OFF SP for IN1 B	0
Relay ON SP for IN1 C	0
Relay OFF SP for IN1 C	0
Relay ON SP for IN2 A	0
Relay OFF SP for IN2 A	0
Relay ON SP for IN2 B	0
Relay OFF SP for IN2 B	0
Relay ON SP for IN2 C	0
Relay OFF SP for IN2 C	0
Relay ON SP for IN3 A	0
Relay OFF SP for IN3 A	0
Relay ON SP for IN3 B	0
Relay OFF SP for IN3 B	0
Relay ON SP for IN3 C	0
Relay OFF SP for IN3 C	0
Input 1 Setup	
Input Type	1.25 volts
Filter Time	2
Initial Scale	0
Full Scale	1000
Decimal Point Location	0
Open Input	up scale
Input Offset	0
Trip Point 1 Setpoint	0
Trip Point 1 Force Value	0
Trip Point 1 Direction	input above setpoint

Field	Factory Default Value
Trip Point 2 Setpoint	0
Trip Point 2 Force Value	0
Trip Point 2 Direction	input above setpoint
High Input Limit Setpoint	0
High Input Limit Hysteresis	0
Custom Curve	none
Input 2 Setup	
Input Type	S
Filter Time	2
Initial Scale	0
Full Scale	10000
Decimal Point Location	0
Open Input	up scale
Input Offset	0
Trip Point 1 Setpoint	0
Trip Point 1 Force Value	0
Trip Point 1 Direction	input above setpoint
Trip Point 2 Setpoint	0
Trip Point 2 Force Value	0
Trip Point 2 Direction	input above setpoint
High Input Limit Setpoint	0
High Input Limit Hysteresis	0
Custom Curve	none
Input 3 Setup	
Input Type	K
Filter Time	2
Initial Scale	0
Full Scale	10000
Decimal Point Location	0
Open Input	up scale
Input Offset	0
Trip Point 1 Setpoint	0
Trip Point 1 Force Value	0
Trip Point 1 Direction	input above setpoint
Trip Point 2 Setpoint	0
Trip Point 2 Force Value	0
Trip Point 2 Direction	input above setpoint
High Input Limit Setpoint	0
High Input Limit Hysteresis	0
Custom Curve	none
Output 1 Setup	
Assignment	loop 3 inc
Offset	0
Range	100
Current Selection	4 - 20 mA
Output 2 Setup	
Assignment	loop 2 inc
Offset	0
Range	100
Current Selection	4 - 20 mA

Field	Factory Default Value
Passcodes	
Level 1 Code	1
Level 2 Code	2
Web Level 1 Code	111
Web Level 2 Code	222
Web Change Enable	1
Programmer Alarm	normally open
Alarm 1	normally open
Alarm 2	normally open
Alarm 3	normally open
O2 Alarm	normally open
IP Address	
IP Address 1	192
IP Address 2	168
IP Address 3	0
IP Address 4	200
IP Address Mask 1	255
IP Address Mask 2	255
IP Address Mask 3	255
IP Address Mask 4	0
IP Address Gateway 1	192
IP Address Gateway 2	168
IP Address Gateway 3	1
IP Address Gateway 4	1
Zone 1 Assignment	
Atm Instrument	Loop 1
Atm Zone Number	0
Default Zone Offset, atm	0.00
Temp Instrument	Loop 1
Temp Zone Number	0
Default Zone Offset, temp	0
Zone 2 Assignment	
Atm Instrument	Loop 1
Atm Zone Number	0
Default Zone Offset, atm	0.00
Temp Instrument	Loop 1
Temp Zone Number	0
Default Zone Offset, temp	0
Zone 3 Assignment	
Atm Instrument	Loop 1
Atm Zone Number	0
Default Zone Offset, atm	0.00
Temp Instrument	Loop 1
Temp Zone Number	0
Default Zone Offset, temp	0
Zone 4 Assignment	
Atm Instrument	Loop 1
Atm Zone Number	0
Default Zone Offset, atm	0.00
Temp Instrument	Loop 1

Field	Factory Default Value
Temp Zone Number	0
Default Zone Offset, temp	0
Zone 5 Assignment	
Atm Instrument	Loop 1
Atm Zone Number	0
Default Zone Offset, atm	0.00
Temp Instrument	Loop 1
Temp Zone Number	0
Default Zone Offset, temp	0
Event Control	
Hold instrument number	0
Hold Minimum PV	2000
Hold Maximum PV	0
Input Event for Program Run	-1
Input Event for Program Reset	-1
Input Event 0	
Input Event 1	
Input Event 2	
Input Event 3	
Input Event 4	
Input Event 5	
Input Event 6	
Input Event 7	
Input Event 8	
Input Event 9	
Input Event 10	
Input Event 11	
Input Event 12	
Input Event 13	
Input Event 14	
Input Event 15	
Menu Security	
Analog Input 1 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 2 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 3 Setup	
Input type 0	B
Input type 1	B
Input type 2	B

Field	Factory Default Value
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 4 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 5 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 6 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 7 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 8 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Generic Instrument Configuration	
Instrument 1 Register Read 1	0
Instrument 1 Count 1	0
Instrument 1 Storage 1	0
Instrument 1 Register Read 2	0
Instrument 1 Count 2	0
Instrument 1 Storage 2	0
Instrument 1 Register Read 3	0
Instrument 1 Count 3	0
Instrument 1 Storage 3	0
Instrument 1 Register Read 4	0
Instrument 1 Count 4	0

Field	Factory Default Value
Instrument 1 Storage 4	0
Instrument 1 PV Memory	0
Instrument 1 PV Register	0
Instrument 1 PV In Scale	0
Instrument 1 PV Out Scale	0
Instrument 1 SP Memory	0
Instrument 1 SP Register	0
Instrument 1 SP In Scale	0
Instrument 1 SP Out Scale	0
Instrument 1 Output Memory	0
Instrument 1 Output Register	0
Instrument 1 Output In Scale	0
Instrument 1 Output Out Scale	0
Instrument 2 Register Read 1	0
Instrument 2 Count 1	0
Instrument 2 Storage 1	0
Instrument 2 Register Read 2	0
Instrument 2 Count 2	0
Instrument 2 Storage 2	0
Instrument 2 Register Read 3	0
Instrument 2 Count 3	0
Instrument 2 Storage 3	0
Instrument 2 Register Read 4	0
Instrument 2 Count 4	0
Instrument 2 Storage 4	0
Instrument 2 PV Memory	0
Instrument 2 PV Register	0
Instrument 2 PV In Scale	0
Instrument 2 PV Out Scale	0
Instrument 2 SP Memory	0
Instrument 2 SP Register	0
Instrument 2 SP In Scale	0
Instrument 2 SP Out Scale	0
Instrument 2 Output Memory	0
Instrument 2 Output Register	0
Instrument 2 Output In Scale	0
Instrument 2 Output Out Scale	0
Instrument 3 Register Read 1	0
Instrument 3 Count 1	0
Instrument 3 Storage 1	0
Instrument 3 Register Read 2	0
Instrument 3 Count 2	0
Instrument 3 Storage 2	0
Instrument 3 Register Read 3	0
Instrument 3 Count 3	0
Instrument 3 Storage 3	0
Instrument 3 Register Read 4	0
Instrument 3 Count 4	0
Instrument 3 Storage 4	0
Instrument 3 PV Memory	0

Field	Factory Default Value
Instrument 3 PV Register	0
Instrument 3 PV In Scale	0
Instrument 3 PV Out Scale	0
Instrument 3 SP Memory	0
Instrument 3 SP Register	0
Instrument 3 SP In Scale	0
Instrument 3 SP Out Scale	0
Instrument 3 Output Memory	0
Instrument 3 Output Register	0
Instrument 3 Output In Scale	0
Instrument 3 Output Out Scale	0
Instrument 4 Register Read 1	0
Instrument 4 Count 1	0
Instrument 4 Storage 1	0
Instrument 4 Register Read 2	0
Instrument 4 Count 2	0
Instrument 4 Storage 2	0
Instrument 4 Register Read 3	0
Instrument 4 Count 3	0
Instrument 4 Storage 3	0
Instrument 4 Register Read 4	0
Instrument 4 Count 4	0
Instrument 4 Storage 4	0
Instrument 4 PV Memory	0
Instrument 4 PV Register	0
Instrument 4 PV In Scale	0
Instrument 4 PV Out Scale	0
Instrument 4 SP Memory	0
Instrument 4 SP Register	0
Instrument 4 SP In Scale	0
Instrument 4 SP Out Scale	0
Instrument 4 Output Memory	0
Instrument 4 Output Register	0
Instrument 4 Output In Scale	0
Instrument 4 Output Out Scale	0
Instrument 5 Register Read 1	0
Instrument 5 Count 1	0
Instrument 5 Storage 1	0
Instrument 5 Register Read 2	0
Instrument 5 Count 2	0
Instrument 5 Storage 2	0
Instrument 5 Register Read 3	0
Instrument 5 Count 3	0
Instrument 5 Storage 3	0
Instrument 5 Register Read 4	0
Instrument 5 Count 4	0
Instrument 5 Storage 4	0
Instrument 5 PV Memory	0
Instrument 5 PV Register	0
Instrument 5 PV In Scale	0

Field	Factory Default Value
Instrument 5 PV Out Scale	0
Instrument 5 SP Memory	0
Instrument 5 SP Register	0
Instrument 5 SP In Scale	0
Instrument 5 SP Out Scale	0
Instrument 5 Output Memory	0
Instrument 5 Output Register	0
Instrument 5 Output In Scale	0
Instrument 5 Output Out Scale	0
Instrument 6 Register Read 1	0
Instrument 6 Count 1	0
Instrument 6 Storage 1	0
Instrument 6 Register Read 2	0
Instrument 6 Count 2	0
Instrument 6 Storage 2	0
Instrument 6 Register Read 3	0
Instrument 6 Count 3	0
Instrument 6 Storage 3	0
Instrument 6 Register Read 4	0
Instrument 6 Count 4	0
Instrument 6 Storage 4	0
Instrument 6 PV Memory	0
Instrument 6 PV Register	0
Instrument 6 PV In Scale	0
Instrument 6 PV Out Scale	0
Instrument 6 SP Memory	0
Instrument 6 SP Register	0
Instrument 6 SP In Scale	0
Instrument 6 SP Out Scale	0
Instrument 6 Output Memory	0
Instrument 6 Output Register	0
Instrument 6 Output In Scale	0
Instrument 6 Output Out Scale	0
Instrument 7 Register Read 1	0
Instrument 7 Count 1	0
Instrument 7 Storage 1	0
Instrument 7 Register Read 2	0
Instrument 7 Count 2	0
Instrument 7 Storage 2	0
Instrument 7 Register Read 3	0
Instrument 7 Count 3	0
Instrument 7 Storage 3	0
Instrument 7 Register Read 4	0
Instrument 7 Count 4	0
Instrument 7 Storage 4	0
Instrument 7 PV Memory	0
Instrument 7 PV Register	0
Instrument 7 PV In Scale	0
Instrument 7 PV Out Scale	0
Instrument 7 SP Memory	0

Field	Factory Default Value
Instrument 7 SP Register	0
Instrument 7 SP In Scale	0
Instrument 7 SP Out Scale	0
Instrument 7 Output Memory	0
Instrument 7 Output Register	0
Instrument 7 Output In Scale	0
Instrument 7 Output Out Scale	0
Instrument 8 Register Read 1	0
Instrument 8 Count 1	0
Instrument 8 Storage 1	0
Instrument 8 Register Read 2	0
Instrument 8 Count 2	0
Instrument 8 Storage 2	0
Instrument 8 Register Read 3	0
Instrument 8 Count 3	0
Instrument 8 Storage 3	0
Instrument 8 Register Read 4	0
Instrument 8 Count 4	0
Instrument 8 Storage 4	0
Instrument 8 PV Memory	0
Instrument 8 PV Register	0
Instrument 8 PV In Scale	0
Instrument 8 PV Out Scale	0
Instrument 8 SP Memory	0
Instrument 8 SP Register	0
Instrument 8 SP In Scale	0
Instrument 8 SP Out Scale	0
Instrument 8 Output Memory	0
Instrument 8 Output Register	0
Instrument 8 Output In Scale	0
Instrument 8 Output Out Scale	0
Instrument 9 Register Read 1	0
Instrument 9 Count 1	0
Instrument 9 Storage 1	0
Instrument 9 Register Read 2	0
Instrument 9 Count 2	0
Instrument 9 Storage 2	0
Instrument 9 Register Read 3	0
Instrument 9 Count 3	0
Instrument 9 Storage 3	0
Instrument 9 Register Read 4	0
Instrument 9 Count 4	0
Instrument 9 Storage 4	0
Instrument 9 PV Memory	0
Instrument 9 PV Register	0
Instrument 9 PV In Scale	0
Instrument 9 PV Out Scale	0
Instrument 9 SP Memory	0
Instrument 9 SP Register	0
Instrument 9 SP In Scale	0

Field	Factory Default Value
Instrument 9 SP Out Scale	0
Instrument 9 Output Memory	0
Instrument 9 Output Register	0
Instrument 9 Output In Scale	0
Instrument 9 Output Out Scale	0
Instrument 10 Register Read 1	0
Instrument 10 Count 1	0
Instrument 10 Storage 1	0
Instrument 10 Register Read 2	0
Instrument 10 Count 2	0
Instrument 10 Storage 2	0
Instrument 10 Register Read 3	0
Instrument 10 Count 3	0
Instrument 10 Storage 3	0
Instrument 10 Register Read 4	0
Instrument 10 Count 4	0
Instrument 10 Storage 4	0
Instrument 10 PV Memory	0
Instrument 10 PV Register	0
Instrument 10 PV In Scale	0
Instrument 10 PV Out Scale	0
Instrument 10 SP Memory	0
Instrument 10 SP Register	0
Instrument 10 SP In Scale	0
Instrument 10 SP Out Scale	0
Instrument 10 Output Memory	0
Instrument 10 Output Register	0
Instrument 10 Output In Scale	0
Instrument 10 Output Out Scale	0
Instrument 11 Register Read 1	0
Instrument 11 Count 1	0
Instrument 11 Storage 1	0
Instrument 11 Register Read 2	0
Instrument 11 Count 2	0
Instrument 11 Storage 2	0
Instrument 11 Register Read 3	0
Instrument 11 Count 3	0
Instrument 11 Storage 3	0
Instrument 11 Register Read 4	0
Instrument 11 Count 4	0
Instrument 11 Storage 4	0
Instrument 11 PV Memory	0
Instrument 11 PV Register	0
Instrument 11 PV In Scale	0
Instrument 11 PV Out Scale	0
Instrument 11 SP Memory	0
Instrument 11 SP Register	0
Instrument 11 SP In Scale	0
Instrument 11 SP Out Scale	0
Instrument 11 Output Memory	0

Field	Factory Default Value
Instrument 11 Output Register	0
Instrument 11 Output In Scale	0
Instrument 11 Output Out Scale	0
Instrument 12 Register Read 1	0
Instrument 12 Count 1	0
Instrument 12 Storage 1	0
Instrument 12 Register Read 2	0
Instrument 12 Count 2	0
Instrument 12 Storage 2	0
Instrument 12 Register Read 3	0
Instrument 12 Count 3	0
Instrument 12 Storage 3	0
Instrument 12 Register Read 4	0
Instrument 12 Count 4	0
Instrument 12 Storage 4	0
Instrument 12 PV Memory	0
Instrument 12 PV Register	0
Instrument 12 PV In Scale	0
Instrument 12 PV Out Scale	0
Instrument 12 SP Memory	0
Instrument 12 SP Register	0
Instrument 12 SP In Scale	0
Instrument 12 SP Out Scale	0
Instrument 12 Output Memory	0
Instrument 12 Output Register	0
Instrument 12 Output In Scale	0
Instrument 12 Output Out Scale	0
Instrument 13 Register Read 1	0
Instrument 13 Count 1	0
Instrument 13 Storage 1	0
Instrument 13 Register Read 2	0
Instrument 13 Count 2	0
Instrument 13 Storage 2	0
Instrument 13 Register Read 3	0
Instrument 13 Count 3	0
Instrument 13 Storage 3	0
Instrument 13 Register Read 4	0
Instrument 13 Count 4	0
Instrument 13 Storage 4	0
Instrument 13 PV Memory	0
Instrument 13 PV Register	0
Instrument 13 PV In Scale	0
Instrument 13 PV Out Scale	0
Instrument 13 SP Memory	0
Instrument 13 SP Register	0
Instrument 13 SP In Scale	0
Instrument 13 SP Out Scale	0
Instrument 13 Output Memory	0
Instrument 13 Output Register	0
Instrument 13 Output In Scale	0

Field	Factory Default Value
Instrument 13 Output Out Scale	0
Instrument 14 Register Read 1	0
Instrument 14 Count 1	0
Instrument 14 Storage 1	0
Instrument 14 Register Read 2	0
Instrument 14 Count 2	0
Instrument 14 Storage 2	0
Instrument 14 Register Read 3	0
Instrument 14 Count 3	0
Instrument 14 Storage 3	0
Instrument 14 Register Read 4	0
Instrument 14 Count 4	0
Instrument 14 Storage 4	0
Instrument 14 PV Memory	0
Instrument 14 PV Register	0
Instrument 14 PV In Scale	0
Instrument 14 PV Out Scale	0
Instrument 14 SP Memory	0
Instrument 14 SP Register	0
Instrument 14 SP In Scale	0
Instrument 14 SP Out Scale	0
Instrument 14 Output Memory	0
Instrument 14 Output Register	0
Instrument 14 Output In Scale	0
Instrument 14 Output Out Scale	0
Instrument 15 Register Read 1	0
Instrument 15 Count 1	0
Instrument 15 Storage 1	0
Instrument 15 Register Read 2	0
Instrument 15 Count 2	0
Instrument 15 Storage 2	0
Instrument 15 Register Read 3	0
Instrument 15 Count 3	0
Instrument 15 Storage 3	0
Instrument 15 Register Read 4	0
Instrument 15 Count 4	0
Instrument 15 Storage 4	0
Instrument 15 PV Memory	0
Instrument 15 PV Register	0
Instrument 15 PV In Scale	0
Instrument 15 PV Out Scale	0
Instrument 15 SP Memory	0
Instrument 15 SP Register	0
Instrument 15 SP In Scale	0
Instrument 15 SP Out Scale	0
Instrument 15 Output Memory	0
Instrument 15 Output Register	0
Instrument 15 Output In Scale	0
Instrument 15 Output Out Scale	0
Instrument 16 Register Read 1	0

Field	Factory Default Value
Instrument 16 Count 1	0
Instrument 16 Storage 1	0
Instrument 16 Register Read 2	0
Instrument 16 Count 2	0
Instrument 16 Storage 2	0
Instrument 16 Register Read 3	0
Instrument 16 Count 3	0
Instrument 16 Storage 3	0
Instrument 16 Register Read 4	0
Instrument 16 Count 4	0
Instrument 16 Storage 4	0
Instrument 16 PV Memory	0
Instrument 16 PV Register	0
Instrument 16 PV In Scale	0
Instrument 16 PV Out Scale	0
Instrument 16 SP Memory	0
Instrument 16 SP Register	0
Instrument 16 SP In Scale	0
Instrument 16 SP Out Scale	0
Instrument 16 Output Memory	0
Instrument 16 Output Register	0
Instrument 16 Output In Scale	0
Instrument 16 Output Out Scale	0
Generic Block Write Table	
Block Write 1 Instrument	0
Block Write 1 Interval	0
Block Write 1 Data Start	0
Block Write 1 Data Target	0
Block Write 1 Count	0
Block Write 2 Instrument	0
Block Write 2 Interval	0
Block Write 2 Data Start	0
Block Write 2 Data Target	0
Block Write 2 Count	0
Block Write 3 Instrument	0
Block Write 3 Interval	0
Block Write 3 Data Start	0
Block Write 3 Data Target	0
Block Write 3 Count	0
Block Write 4 Instrument	0
Block Write 4 Interval	0
Block Write 4 Data Start	0
Block Write 4 Data Target	0
Block Write 4 Count	0
Block Write 5 Instrument	0
Block Write 5 Interval	0
Block Write 5 Data Start	0
Block Write 5 Data Target	0
Block Write 5 Count	0
Block Write 6 Instrument	0

Field	Factory Default Value
Block Write 6 Interval	0
Block Write 6 Data Start	0
Block Write 6 Data Target	0
Block Write 6 Count	0
Block Write 7 Instrument	0
Block Write 7 Interval	0
Block Write 7 Data Start	0
Block Write 7 Data Target	0
Block Write 7 Count	0
Block Write 8 Instrument	0
Block Write 8 Interval	0
Block Write 8 Data Start	0
Block Write 8 Data Target	0
Block Write 8 Count	0
Block Write 9 Instrument	0
Block Write 9 Interval	0
Block Write 9 Data Start	0
Block Write 9 Data Target	0
Block Write 9 Count	0
Block Write 10 Instrument	0
Block Write 10 Interval	0
Block Write 10 Data Start	0
Block Write 10 Data Target	0
Block Write 10 Count	0
Block Write 11 Instrument	0
Block Write 11 Interval	0
Block Write 11 Data Start	0
Block Write 11 Data Target	0
Block Write 11 Count	0
Block Write 12 Instrument	0
Block Write 12 Interval	0
Block Write 12 Data Start	0
Block Write 12 Data Target	0
Block Write 12 Count	0
Block Write 13 Instrument	0
Block Write 13 Interval	0
Block Write 13 Data Start	0
Block Write 13 Data Target	0
Block Write 13 Count	0
Block Write 14 Instrument	0
Block Write 14 Interval	0
Block Write 14 Data Start	0
Block Write 14 Data Target	0
Block Write 14 Count	0
Block Write 15 Instrument	0
Block Write 15 Interval	0
Block Write 15 Data Start	0
Block Write 15 Data Target	0
Block Write 15 Count	0
Block Write 16 Instrument	0

Field	Factory Default Value
Block Write 16 Interval	0
Block Write 16 Data Start	0
Block Write 16 Data Target	0
Block Write 16 Count	0
Generic IP Address Table	
IP Address 1 Octet 1	0
IP Address 1 Octet 2	0
IP Address 1 Octet 3	0
IP Address 1 Octet 4	0
IP Address 1 Port	0
IP Address 2 Octet 1	0
IP Address 2 Octet 2	0
IP Address 2 Octet 3	0
IP Address 2 Octet 4	0
IP Address 2 Port	0
IP Address 3 Octet 1	0
IP Address 3 Octet 2	0
IP Address 3 Octet 3	0
IP Address 3 Octet 4	0
IP Address 3 Port	0
IP Address 4 Octet 1	0
IP Address 4 Octet 2	0
IP Address 4 Octet 3	0
IP Address 4 Octet 4	0
IP Address 4 Port	0
IP Address 5 Octet 1	0
IP Address 5 Octet 2	0
IP Address 5 Octet 3	0
IP Address 5 Octet 4	0
IP Address 5 Port	0
IP Address 6 Octet 1	0
IP Address 6 Octet 2	0
IP Address 6 Octet 3	0
IP Address 6 Octet 4	0
IP Address 6 Port	0
IP Address 7 Octet 1	0
IP Address 7 Octet 2	0
IP Address 7 Octet 3	0
IP Address 7 Octet 4	0
IP Address 7 Port	0
IP Address 8 Octet 1	0
IP Address 8 Octet 2	0
IP Address 8 Octet 3	0
IP Address 8 Octet 4	0
IP Address 8 Port	0
IP Address 9 Octet 1	0
IP Address 9 Octet 2	0
IP Address 9 Octet 3	0
IP Address 9 Octet 4	0
IP Address 9 Port	0

Field	Factory Default Value
IP Address 10 Octet 1	0
IP Address 10 Octet 2	0
IP Address 10 Octet 3	0
IP Address 10 Octet 4	0
IP Address 10 Port	0
IP Address 11 Octet 1	0
IP Address 11 Octet 2	0
IP Address 11 Octet 3	0
IP Address 11 Octet 4	0
IP Address 11 Port	0
IP Address 12 Octet 1	0
IP Address 12 Octet 2	0
IP Address 12 Octet 3	0
IP Address 12 Octet 4	0
IP Address 12 Port	0
IP Address 13 Octet 1	0
IP Address 13 Octet 2	0
IP Address 13 Octet 3	0
IP Address 13 Octet 4	0
IP Address 13 Port	0
IP Address 14 Octet 1	0
IP Address 14 Octet 2	0
IP Address 14 Octet 3	0
IP Address 14 Octet 4	0
IP Address 14 Port	0
IP Address 15 Octet 1	0
IP Address 15 Octet 2	0
IP Address 15 Octet 3	0
IP Address 15 Octet 4	0
IP Address 15 Port	0
IP Address 16 Octet 1	0
IP Address 16 Octet 2	0
IP Address 16 Octet 3	0
IP Address 16 Octet 4	0
IP Address 16 Port	0
DF1 Configuration	
My node	6
PLC node	1
PLC read table	13
PLC write table	12
PLC intermessage delay (ms)	500
Relay Assignments	
Relay 1	alarm 1
Relay 2	alarm 2
Relay 3	event 0
Relay 4	event 1
Relay 5	event 2
Relay 6	event 3
Relay 7	event 4
Relay 8	burn off

Field	Factory Default Value
Valve Setup	
Control Mode	ratio adjust
DA Switch Point	60
Auto Valve Event	no
Valve 1 Input	
Initial Scale	0
Full Scale	0
Trim Enable	no
Setpoint	0
Trim Range	0
Initial SP Scale	0
Full SP Scale	0
Valve Max	750
Deviation setpoint	Off
Deviation alarm delay	0 sec
Gas Type	N2
Decimal Place	0
Flow Signal	RS-485/slave inst 7
Valve 2 Input	
Initial Scale	0
Full Scale	0
Trim Enable	no
Setpoint	0
Trim Range	0
Initial SP Scale	0
Full SP Scale	0
Valve Max	750
Deviation setpoint	Off
Deviation alarm delay	0 sec
Gas Type	NH3
Decimal Place	0
Flow Signal	RS-485/slave inst 8
Valve 3 Input	
Initial Scale	0
Full Scale	0
Trim Enable	no
Setpoint	0
Trim Range	0
Initial SP Scale	0
Full SP Scale	0
Valve Max	750
Deviation setpoint	Off
Deviation alarm delay	0 sec
Gas Type	D.A.
Decimal Place	0
Flow Signal	RS-485/slave inst 9
Tracking Mode	none
Tracking Percent	0.0
Valve 4 Input	
Initial Scale	0

Field	Factory Default Value
Full Scale	0
Trim Enable	no
Setpoint	0
Trim Range	0
Initial SP Scale	0
Full SP Scale	0
Valve Max	750
Deviation setpoint	Off
Deviation alarm delay	0 sec
Gas Type	H2
Decimal Place	0
Flow Signal	RS-485/slave inst 10
Tracking Mode	none
Tracking Percent	0.0
Alternate PID 1 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 2 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 3 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 4 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 5 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 6 Setup	

Field	Factory Default Value
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 7 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 8 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 9 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 10 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 11 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 12 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 13 Setup	
Prop Band (0 for On/Off)	-0.1

Field	Factory Default Value
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 14 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 15 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 16 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	100
Low Limit	-100
Alternate PID 17 Setup	
Prop Band (0 for On/Off)	-0.1
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Alternate PID 18 Setup	
Prop Band (0 for On/Off)	0.0
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Alternate PID 19 Setup	
Prop Band (0 for On/Off)	0.0
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Alternate PID 20 Setup	
Prop Band (0 for On/Off)	0.0
Reset	0.00

Field	Factory Default Value
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Alternate PID 21 Setup	
Prop Band (0 for On/Off)	0.0
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Alternate PID 22 Setup	
Prop Band (0 for On/Off)	0.0
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Alternate PID 23 Setup	
Prop Band (0 for On/Off)	0.0
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Alternate PID 24 Setup	
Prop Band (0 for On/Off)	0.0
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Alternate PID 25 Setup	
Prop Band (0 for On/Off)	0.0
Reset	0.00
Rate	0.00
Integral Preset	0
High Limit	0
Low Limit	0
Analog Input 1 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 2 Setup	
Input type 0	B
Input type 1	B
Input type 2	B

Field	Factory Default Value
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 3 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 4 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 5 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 6 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 7 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Analog Input 8 Setup	
Input type 0	B
Input type 1	B
Input type 2	B
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Relay Setpoints	
Relay ON SP for IN1 A	0
Relay OFF SP for IN1 A	0
Relay ON SP for IN1 B	0
Relay OFF SP for IN1 B	0

Field	Factory Default Value
Relay ON SP for IN1 C	0
Relay OFF SP for IN1 C	0
Relay ON SP for IN2 A	0
Relay OFF SP for IN2 A	0
Relay ON SP for IN2 B	0
Relay OFF SP for IN2 B	0
Relay ON SP for IN2 C	0
Relay OFF SP for IN2 C	0
Relay ON SP for IN3 A	0
Relay OFF SP for IN3 A	0
Relay ON SP for IN3 B	0
Relay OFF SP for IN3 B	0
Relay ON SP for IN3 C	0
Relay OFF SP for IN3 C	0
ADAM Offset	
Enable offsets for SSi AIB	no
Input 1	0.0
Input 2	0.0
Input 3	0.0
Input 4	0.0
Input 5	0.0
Input 6	0.0
Input 7	0.0
Input 8	0.0
Input 9	0.0
Input 10	0.0
Input 11	0.0
Input 12	0.0
Input 13	0.0
Input 14	0.0
Input 15	0.0
Input 16	0.0
Input 17	0.0
Input 18	0.0
Input 19	0.0
Input 20	0.0
Input 21	0.0
Input 22	0.0
Input 23	0.0
Input 24	0.0
Input 25	0.0
Input 26	0.0
Input 27	0.0
Input 28	0.0
Input 29	0.0
Input 30	0.0
Input 31	0.0
Input 32	0.0
Input 33	0.0
Input 34	0.0

Field	Factory Default Value
Input 35	0.0
Input 36	0.0
Input 37	0.0
Input 38	0.0
Input 39	0.0
Input 40	0.0
Input 0 Correction	not used
Input 1 Correction	not used
Input 2 Correction	not used
Input 3 Correction	not used
Input 4 Correction	not used
Input 5 Correction	not used
Input 6 Correction	not used
Input 7 Correction	not used
Input 8 Correction	not used
Input 9 Correction	not used
Input 10 Correction	not used
Input 11 Correction	not used
Input 12 Correction	not used
Input 13 Correction	not used
Input 14 Correction	not used
Input 15 Correction	not used
Input 16 Correction	not used
Input 17 Correction	not used
Input 18 Correction	not used
Input 19 Correction	not used
Input 20 Correction	not used
Input 21 Correction	not used
Input 22 Correction	not used
Input 23 Correction	not used
Input 24 Correction	not used
Input 25 Correction	not used
Input 26 Correction	not used
Input 27 Correction	not used
Input 28 Correction	not used
Input 29 Correction	not used
Input 30 Correction	not used
Input 31 Correction	not used
Input 32 Correction	not used
Input 33 Correction	not used
Input 34 Correction	not used
Input 35 Correction	not used
Input 36 Correction	not used
Input 37 Correction	not used
Input 38 Correction	not used
Input 39 Correction	not used
Auxiliary Setpoint Configuration	
Retrans to Slave 1	Off
Retrans to Slave 2	Off
Retrans to Slave 3	Off

Field	Factory Default Value
Setpoint Offset Sl 1	0
Setpoint Offset Sl 2	0
Setpoint Offset Sl 3	0
Setpoint Delay Sl 1	0
Setpoint Delay Sl 2	0
Setpoint Delay Sl 3	0
Flow Setpoint Configuration	
Carburize Minimum Endo Flow	0
Carburize preset, N2 valve	0
Carburize preset, NH3 valve	0
Carburize preset, D.A. valve	0
Carburize preset, H2 valve	0
FNC preset, N2 valve	0
FNC preset, NH3 valve	0
FNC preset, D.A. valve	0
FNC preset, H2 valve	0
Redundant TC Setup	
Active	no
Band	20
Delay Time (min)	1
TC Selection	TC 1 (Input 2)
Select Mode	highest

Revision History

Rev.	Description	Date	MCO #
-	First Release	12/18/2015	2161
A	Added clarification to Valve Setup section. Added explanation of T/C curve interpolation. Added clarification of PID switchpoints. Corrected cold junction calibration information, added note about pid autoswtich and pidload opcode.	10/21/2016	2193
B	Added reference to TS Manager manual for changing IP address, mask, and gateway of touchscreen.	5-26-2017	2215
C	Corrected description of GHSOAK opcode	8/18/2017	2222
D	Added operating range and COF description	7/28/2018	2235
E	Corrected 4-20mA resistor info	10/11/2018	2241
F	Added screenshots and functionality for naming analog inputs, analog outputs, and aux analog inputs	11/27/2018	2243
G	Added TS mounting information	12/3/2018	2245
H	Clarified Trip Point section	4/6/2022	2321
I	Added Load TC Map and Chart Settings	6/8/2022	2324
J	Clarified Wait/Wait Up/Wait Down	9/9/2022	2327
K	Removed screen saver information	11/7/2022	2330
L	Added alarm information to Appendix C	5/2/2023	2336
M	Corrected description of DEV_AL Opcode	10/19/2026	2385