SSi's Nitriding Control System

USER'S MANUAL

Table of Contents

Safety

- *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, which 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 sensor input or other low level inputs and outputs. Only use copper conductors for connections (except thermocouple inputs) and ensure that the wiring of installations comply with all local wiring regulations. For example in the 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 264VAC:

    - line or neutral to any other connection
    - relay or triac output to logic, DC or sensor connections
    - any connection to ground

The power supply/controller should not be wired to a three phase supply with an unearthed star connection. Under fault conditions such a supply could rise above 264Vac with respect to ground and the product would not be safe.

Voltage transients across the power supply connections, and between the power supply and ground, must not exceed 2.5kV. Where occasional voltage transients 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 volt age 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 setpoint 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.

- *Grounding of the temperature sensor shield* - In some installations it is common practice to replace the temperature sensor while the controller is still powered up. Under these conditions, as additional protection against electric shock, we recommend that the shield of the temperature sensor be grounded. Do not rely on grounding through the framework of the machine.

- *Installation requirements for EMC* - To ensure compliance with the European EMC directive certain installation precautions are necessary. 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 t he 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 and particularly the sensor input 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.

About This Manual

This instrument is designed for Nitriding control and configured per individual customer requirements. This manual covers the operation of the Model 9210 Nitriding Controller, the Nitriding Control System and the Gas Flow Panel.

Controller Description

The Model 9210-Nitriding instrument is a multi-loop Proportional Integral Derivative (PID) controller that can be custom configured to control up to three Nitriding process loops. General features of this product include:

The Model 9210 is powered by 24 VDC, ***NOT* LINE** Voltage. Please be careful when connecting power to this controller. Connecting anything other then 24 VDC will cause serious damage.

Approximate Box Dimensions	2.75" x 4" x 4.5"
Power Requirements	24VDC, 4 Watts
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 control enclosure is powered by 120 VAC, Single Phase, 60 Hz (Line Power). Line voltage for the isolation relays comes from the same source.

Model 9210 Terminals Connections

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 (+)

Note: See electrical drawings for terminal block assignments.

Additional Features

The Operator Interface (touch screen) contains a removable compact flash card that can be used to transfer data from the Model 9210 to a computer. This flash card acts like a removable hard drive, however it is very small and contains no moving parts to make it very portable. It is located on the back of the display (see *Flash Card Installation* on page #8).

Also included is a "Utility Software CD" that includes SSi's Super Data (SD) Recorder. SD Recorder is a utility program that can be loaded onto any Windows® based computer (operating Windows 98® or higher). This software will allow the computer to read the data from the Model 9210, and allow it to be charted in a manner that is similar to a strip chart recorder.

The Operator Interface is normally accessed via the touch-screen, however connections also exist that will allow the operator to use a traditional mouse and keyboard to enter information.

Ethernet Connections

The Ethernet connection has two distinct uses. The first is, should the Operator Interface fail, it allows a laptop to be connected to the Series 9210 DIN rail mounted unit. 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 98® or higher with Internet Explorer. The default IP address is **192.168.0.200.** If you are experiencing problems please call **800-666-4330** and talk with our computer communications personnel. The second use for the Ethernet port would be for communications to a SCADA software package. Call us at **800-666-4330** if you are interested in this option.

Mechanical Installation

The Model 9210 operator interface is generally flush-mounted, either in an existing enclosure, on a "plate" that will be retrofitted to an existing enclosure, or on a new enclosure specifically designed for it's particular application. Installation begins by securing the new enclosure to the floor or wall, securing the retrofit plate to the door of the existing enclosure, or flush-mounting the operator interface in a cut-out of the existing enclosure. When tightening the retaining clips on the Operator Interface, it is important to make them snug but not to over-tighten them. Over-tightening can warp the bezel and cause irreparable damage to the Operator Interface. The DIN rail mount portion of the controller (the Model 9210 and the 24 VDC power supply) needs to be located in close proximity to the existing wires that were connected to the older control unit being replaced. These units should be secured prior to making any electrical connections.

Electrical Installation

The Model 9210 requires 24VDC, 4 Watt, 60 Hz, single-phase power. A 24 VDC power supply is required and is generally included as part of the Model 9210 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 for each site, the customer is responsible for providing adequate power and making it available to the Model 9210 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….** MOV's must be connected across the HOT and NEUTRAL wires when the solenoid is wired to them. **IT IS AN ABSOLUTE MUST to have the MOV's at BOTH LOCATIONS.**

Instrument Start-up

On power-up, the Operator Interface will display a logo screen for thirty seconds and then switch to the default status screen. The logo display can be terminated early by touching the 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, and select *Shutdown*. At the prompt, press **Yes** to shut down the operator interface. This will bring you to a conventional Microsoft Windows screen. Sliding the black switch (located directly over the green power connector) to the operator interface to the OFF position will turn off the power.

Once the Operator Interface is turned off, remove the compact flash card cover at the top of the display unit, exposing the card. Press the release button 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 it's up position, and replace the flash card cover to it's proper position. To restore power to the unit, move the black switch to the right or ON position.

Operator Interface Screen Saver

The operator interface has a default screen saver. It automatically blanks the screen after ten (10) minutes of non-activity. To disengage the screen saver, simply touch the screen and it will re-appear.

A typical Nitriding Control system consists of two panels, a Control Enclosure and a Flow Panel.
The variety of input and output combinations available with this system allows SSi to configure the Model 9210-Nitrider to control **Nitriding** (temperature, % dissociation, and back-pressure) or just to monitor % Dissociation.

The Control Enclosure contains a 24 VDC power supply, SSi's Model 9210 Controller, flush-mounted operator interface (Advantech touch-screen), an Allen Bradley Micrologix 1200 PLC, a ring-back alarm system with enunciator, terminal blocks, isolation relays, a hi-limit temperature controller and a UPS unit. The Model 9210 has several control outputs, allowing the customer to choose what variables to control, and how to control them. The 9210 is also used as a recipe programmer to control the furnace cycle from startup to cool down. The operator interface allows the operator to interface with the Model 9210 to view/modify Process Loops, Program status and to modify operating parameters as necessary. The operator interface also contains a Flash card that is used as to datalog Furnace parameters and provides the capability to transfer historical data from the Flash card to any PC that has the SDRecorder Utility

software installed. The Micrologix 1200 is used in conjunction with the 9210 for alarm and event handling purposes. The Hi-Limit controller provides furnace over-temperature protection. The UPS Unit provides Battery backup and surge protection for the 120Vac that is used to power the 9210's 24Vdc power supply and the Micrologix PLC .

The UPS will provide up to 15 minutes of power in case of power loss. To properly shutdown the Nitriding panel …SHUTDOWN the ADVANTECH screen (see instructions), then open panel door and turn OFF UPS. The panel is now safe for electrical work.

There are **NO implied safety devices** included with this control system.

The safety system (atmosphere flow and pressure) is the responsibility of the customer.

Stand-alone Flow Panel includes the atmosphere flow sample enclosure, the flow switches, back-pressure control (if part of the system), the flow control devices, and the pressure switches. The Flow panel is interconnected with the Control panel to allow the Nitriding Control system to provide control of Gas flows, the furnace's back-pressure and monitoring of supply and exhaust pressures for alarming. The flow panel is designed to supply up to four different gases to the furnaces. Typical gases used are Nitrogen, Ammonia, Dissociated Ammonia and Hydrogen.

Nitriding Control System: Mode of Operation -

A typical 9210 Nitriding Control system allows the user to automatically run the Nitriding cycle without requiring operator intervention. The system will set temperature, % Dissociation/Kn, Back Pressure and Gas Flows as part of it's recipe. To control the % Dissociation/Kn, the 9210 has the ability to adjust the Gas flows at any step of the process. Typically, the Ammonia flow rate is adjusted to achieve the desired % Dissociation/Kn. This adjustment uses the Trim Enable and Trim Range variables. These variables can be set by the recipe or manually from the Detail screen. Trim Enable determines whether the Gas flow can be adjusted. Trim Range is a +/- band from setpoint that the Gas Flow setpoint can be adjusted to. For example, Ammonia Flow Setpoint = 50,Ammonia Trim Enable = Yes and Trim Range = 20. With these settings the Ammonia Flow setpoint can be adjusted from 30 up to 70. The amount of adjustment is determined by the % Dissociation/Kn control loop. If the % Dissociation/Kn requires more ammonia the setpoint is increased, if less ammonia is required, the ammonia flow setpoint is decreased.

Chapter 1 - INSTALLATION

Mounting

Stand-alone Flow Panel

The flow panel needs to be mounted in a manner that allows the panel to function as designed. The flow panel should be physically mounted close to the nitriding furnace. The gas inlets and outlets must be situated so that all of the connections can be made. Power comes from the control enclosure. The shortest sample line will allow for easy maintenance should there be a problem.

The gas sample from the nitriding furnace needs to be connected to the exhaust line of the flow panel. This allows for control of the furnace's backpressure as well as providing gas flow for the Sample Box. The connection point is at the "T" fitting located on the bottom of the flow panel. All connection with the flow panel need to be tight, remember that there is ammonia gas in the sample line.

NOTE: *All exhaust gases should be disposed of according to local regulations*.
NOTE: *DO NOT USE ANY OF THE FOLLOWING TYPE OF PIPING OR CONNECTORS WITH THE FLOW PANEL:*

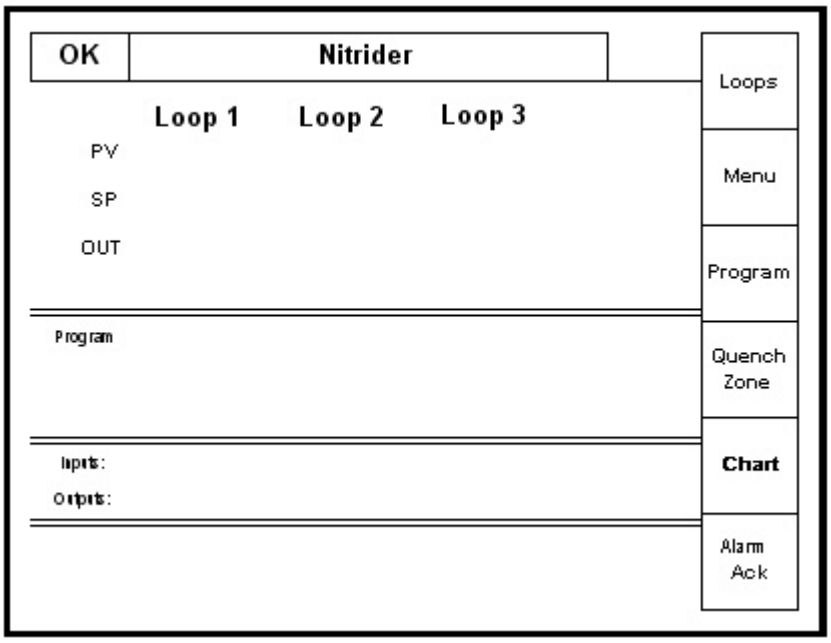
1. *Copper*
2. *Brass*
3. *Galvanized Steel*
4. *Aluminum*

SOME METALS REACT WITH AMMONIA AND CAN PRODUCE LEAKS OVER TIME!!!
USE SCHEDULE 80 PIPING AND FITTINGS ON ANY LINE THAT WILL HAVE AMMONIA OR DISSOCIATED AMMONIA FLOWING THROUGH IT.

The Control Enclosure

This unit needs to be mounted less than 50 feet from the flow panel. Communications between the **Flow Panel's Sample Unit** and the **Control Enclosure** use RS232, which has a 50-foot maximum distance requirement.

Chapter 2 – Touch-screen Interface



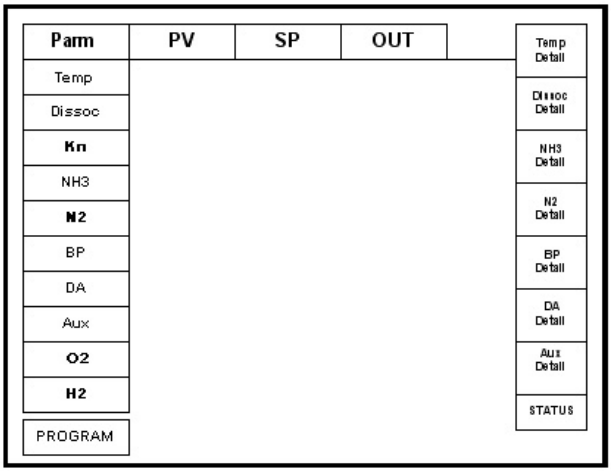
Default status screen

Display

The *Status* display shows the controller information. This information includes data for Loop 1, Loop2 and Loop 3, as well as data for up to four (4) gas flowmeters. The Status display also shows the current Program status, Input/Output Events status and alarm indication. There are six active buttons on the left side of the status display screen: **Loops, Menu, Program, Quench Zone, Chart** and **Alarm Ack.**

- The "Loops" button will switch the display to the parameters for the active control loops, up to nine parameters. The buttons on the right side of the operator interface allows the operator to look at the "detail" for the loop designated.
- The "Menu" button will switch to the operator menu. The "blue" UP and DOWN arrow keys move you from one selection to another.
- The "Program" button will switch to the program display. This is a companion display to the status screen and is described below.
- The "Quench Zone" button (generally NOT used with the Nitriding Process) will switch to the Quench and Zone display. This is a companion display to the status screen and is described below.
- The "Chart" button will switch the display to the video recorder display. Use of the "Chart" display is explained below.
- The "Alarm Ack" button will switch to the Active Alarms screen. All Active alarms are displayed on this screen. To acknowledge an alarm, press the UP or DOWN arrow keys to highlight the alarm and press the "Ack" button, located in the lower left side of the screen, to acknowledge the alarm. To acknowledge multiple alarms, repeat the process just described. Return to the Status screen by pressing the "Esc" button.

Loops Display

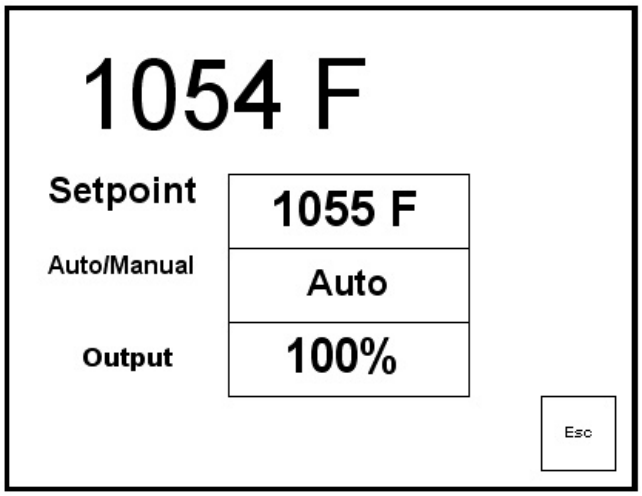


The current process variable for the active loops is displayed on the left. The setpoint for each parameter is to the right of the process variable, with the % control output to the right of the setpoint column.

The "loops" screen also allows you to move back to the default "Status" screen. By pressing the "status" button on the bottom right-hand side of the operator interface. Pressing the Program button will open the "Program" screen.

Temp Detail

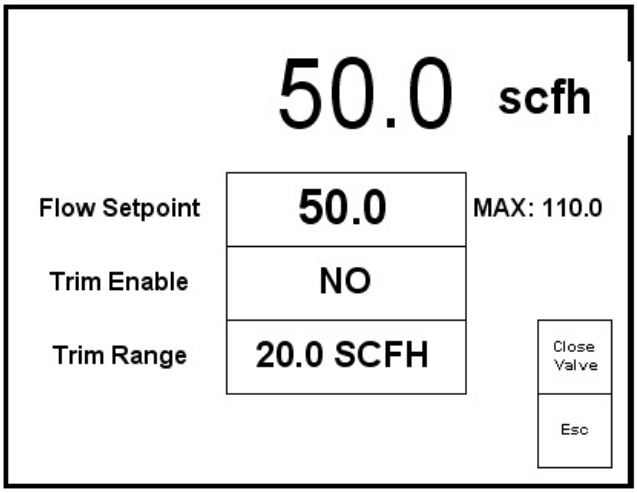
This screen is activated by pressing the **Temp Detail** button on the Loops Display screen.



The operator can change the temperature setpoint by touching the temperature setpoint on the screen next to the words "Setpoint". When pressing the setpoint box, a numeric keypad is displayed, showing the current value and allowing you to enter a new setpoint by simply pressing on the appropriate numeric keys. Once the correct setpoint has been entered, press the **Enter** key to make the change. When the **Enter** key is pressed, the display returns to the "Temperature Detail" screen. The other active buttons - **Auto/Manual** and **Output** - are used in the same way. Pressing the **Auto/Manual** button will cycle the controller mode between auto and manual. Depending on the current Login, the screen may prompt for the Supervisor or Administrator password before the mode can be changed. Pressing the **Output** button displays an alphanumeric keypad that allows the operator to change the % Output (as long as the controller mode as been changed to manual. Entering the % output (while in manual mode) changes the % control output. This is especially useful when setting the linkage on motors, or testing the range of motion of an electric actuator.

The Temp, % Dissociation and Back Pressure detail screens are used in the manner discussed above.

Flow Detail



This screen is displayed by pressing the **NH3 Detail** button.

The operator can change the gas flow setpoint by touching the setpoint on the screen next to the words "Flow Setpoint". When pressing the setpoint box, a numeric keypad is displayed, showing the current value and allowing you to enter a new setpoint by simply pressing on the appropriate numeric keys. Once the correct setpoint has been entered, press the **Enter** key to make the change. When the **Enter** key is pressed, the display returns to the "NH3 detail" screen. The other active buttons - **Trim Enable** and **Trim Range** - are used in the same way. Pressing the **Trim Enable** button allows the user to enable or disable trim adjustment of the gas flow. Depending on the current Login, the screen may prompt for the Supervisor or Administrator password before the Trim mode can be changed. Pressing the **Trim Range** button displays an alphanumeric keypad that allows the operator to change the trim range.

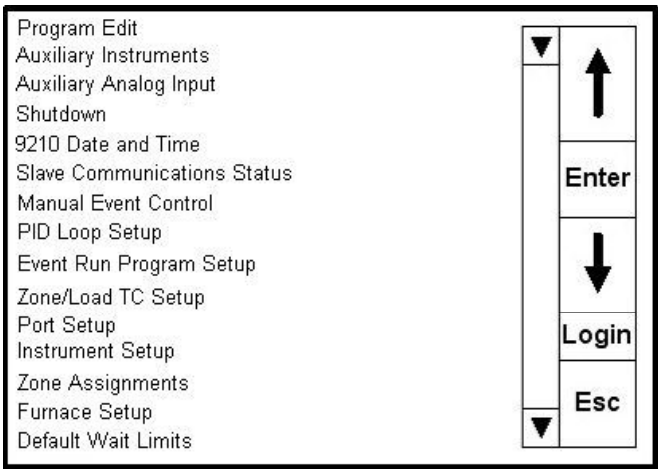
The flow detail screen has a **Close Valve** button that allows you to manually close the flow valve. Pressing the Close Valve button sets the Flow setpoint to zero (0) and causes the valve to drive close for two minutes.

The NH3, N2, DA, and AUX detail screens are used in the manner discussed above.

Menu Display

The items listed under Menu display are:

- Program Edit
- Auxiliary Instruments
- Auxiliary Analog Input
- Shutdown
- 9210 Date and Time
- Slave Communications Status
- Manual Event Control
- PID Loop Setup
- Event Run Program Setup
- Zone/Load TC Setup
- Port Setup
- Instrument Setup
- Zone Assignments
- Furnace Setup
- Default Wait Limits
- Furnace Name
- Alarm Setup
- Relay Assignments
- Relay Setpoints
- Analog Input Setup
- Analog Output Setup
- Passcode and Alarm
- IP Address



- Event Control
- Valve Configuration
- Valve Setup
- User Calibration
- Full Calibration
- Set Menu Security
- Read/Write Raw Data
- Curve Entry
- Alternate PID Setup
- Analog Input Board Setup
- PLC Calibration
- ADAM Correction
- AUX SP Configuration

Menus

There are four levels of menus in the Series 9210.

- 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 to be used by a supervisor. This level requires entry of the level 1 or level 2 pass code.
- The third level is the Administrator level. This requires the level 2 pass code ONLY.
- The fourth level is the SSi level. This requires a special passcode that can only by obtained by calling SSi at 800-666-4330. These menus are used for configuration setups prior to the instrument being shipped.

As shipped, the level 1 and level 2 codes are set as **1** and **2** respectively. The pass codes can be changed under the *Passcode and Alarm* menu option.
The Menu screen has five operating buttons located on the right side of the screen. The Up arrow moves the cursor from bottom to top. The **Enter** button activates the highlighted selection that the operator has chosen, the Down arrow key moves the cursor from top to bottom, the **Login** key activates another screen that allows access to the user to enter a passcode to set the user level, and the **Esc** key takes you back to the previous screen without any action being taken.

The selections on the menu that are generally used by the furnace operator are:

- Program Run
- Slave Communications Status.
- Manual Event Control.
- Zone/Load TC Setup.
- Shutdown

The Program Run screen allows the operator to start/stop/hold/continue recipes, as well as adjust soak time values.

The Slave Communications Status allows the operator to view the communications status with slave instruments.

The Manual Event Control page allows the operator to turn on Output events in place of running a recipe to turn the Event on.

The Zone/Load TC Setup page allows the operator to select the thermocouples to use in the recipe for guaranteeing the Furnace temperature.

The Shutdown selection allows for the Advantech display to be turned off. The "Do you want to Shutdown the Model 9210 " screen pops up when you press the "shutdown" key. Two responses are possible "Yes" or "No". When you shut-down the ADVANTECH interface, the SERIES 9210 controller is still functioning. You can monitor it by connecting the ETHERNET connection to a laptop computer, using Internet Explorer, and assigning a legitimate IP address.

NOTE: *Shutting down the ADVANTECH (Operator Interface) does not "turn-off" the Series 9210. The "shut-down" procedure must be done to remove the "flashcard".*

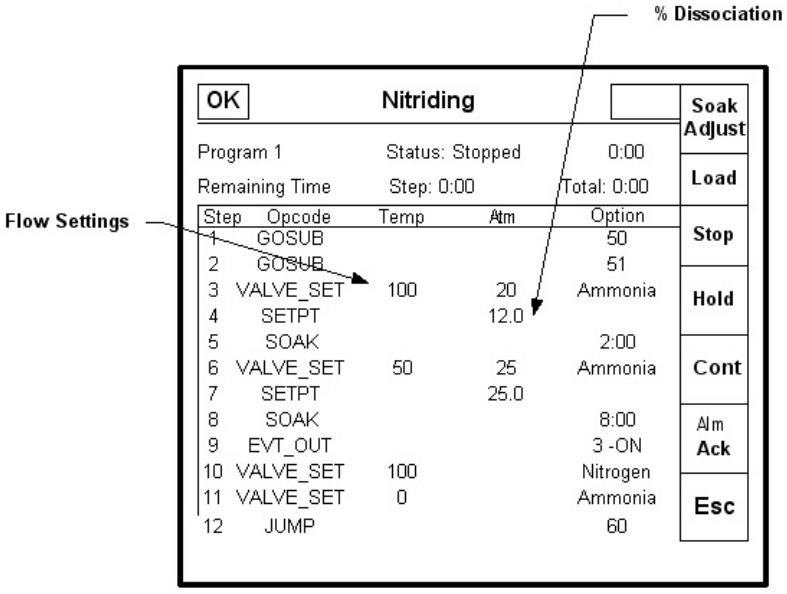
"Yes" shows you a typical computer screen with the "start" button in the bottom left-hand corner. You can now turn the power off to the operator interface without upsetting any of the settings. The "No" response returns you to the initial status screen.

Program Display

Pressing the **Program** key displays the default program status page.

This screen displays the following information:

- Program No. – the last program number loaded into the program run buffer.
- Status – Displays if the program is running, in hold or stopped.
- Remaining Time Step – Time remaining in the current step
- Total – Total run time of the current program



- Program listing – displays all 24 steps for the program. If the program is running the active step number is highlighted.

NOTE: *See "Sample Recipes" at the back of this manual for Recipes "50", "51" and "60".*

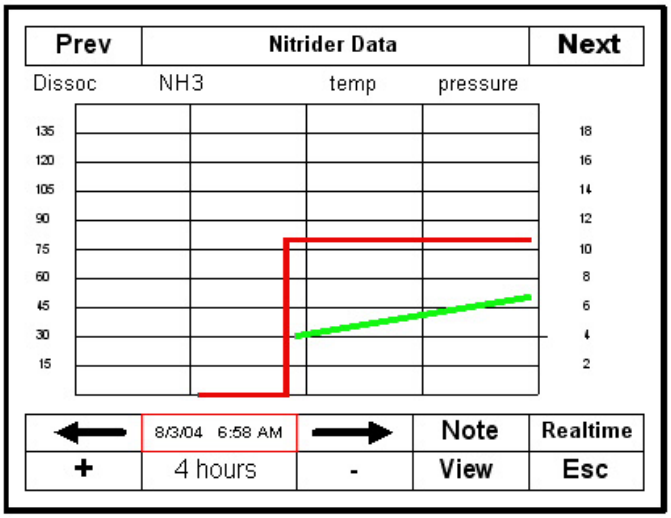
The Program display has six active buttons located on the right-side of the display. These are activated by touching the inside of the blocks. The active buttons are: **Soak Adjust, Load, Stop, Hold, Cont, Alm Ack (Alarm Acknowledge)** and **Esc.**

- The **Soak Adjust** button allows you to enter a new value for the time remaining in the current soak cycle. A soak cycle must be running for a change in soak time to be adjusted.
- 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. You can start the program in any step simply by moving the highlight down to the step that that the program needs to be started in, and then pressing the **Run** button.

  While reviewing the program that is about to be run, certain parameters within those steps can be modified. You can change the set points, the time and the options. You CANNOT delete a step, or modify its Op Code.
- 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 **Hold** below. To re-start the program if it has been stopped, you must use the **Load** button, enter the recipe number, and then enter the segment number of the recipe that you want to start with.
- 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 **Cont** button.
- The **Cont** button re-starts the displayed (active) recipe only after it has been placed in **Hold.**

- The **Alm Ack** acknowledges any active alarm, in most cases it will be acknowledging *End of Cycle*. The alarm must be acknowledged to allow the program to go to the next step, turning EVENT 1 (End of Soak) Off, and stopping the program.
- The **Esc** button returns you to the default display screen.

Chart



The Chart display shows between 15 minutes and 7 days of process variable data on the screen, and can be scrolled back to view all of the data stored on the hard drive (72 hours at a time). The vertical timelines change as the time changes on the screen. A chart is available for the "LP1 and LP2" only and a chart is available for the "LP1 and LP2 plus their setpoints". You can toggle between the two charts by pressing the **Prev** and **Next** keys. Note that LP1 relates to %Dissocation/Kn and LP2 relates to the Furnace Temperature.

The **Prev** and **Next** buttons change the display from one chart to another (i.e. from just process variables to process variables and setpoints.)

The blue Right and Left arrow buttons move the displayed chart along the horizontal axis, going back and forward in time and then returning to real time.

The **+** and **–** buttons change the time window displayed on the screen.

The **Note** key 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 9200 instrumentation. The interface must be the Advantech 5.7 inch with the flash card.

Pressing the **Note** button displays an alpha/numeric keypad. Pressing the **Edit** button will allow the operator to enter the ID/initials. Pressing the **<- Enter** button will set the entered text. Pressing the next **Edit** button will allow the operator to enter the note. The operator can also determine where the note will be written. The default choice is the current time and date. You can change the parameters and place the note at whatever time and date is required. Pressing the **Save** button takes you back to the real time chart page.

The **View** key allows you to look at the notes that have been stored with the chart.

The **Realtime** button will place the chart in realtime mode. Pressing the left or right arrows will take the chart out of realtime.

The **Esc** button will return the operator to the main display screen.

Alarm Ack

The **Alarm Ack** button opens the Active Alarms screen and allows the operator to acknowledge any alarms that have been configured, or that have been made part of the recipes that run on the Series 9210. If a recipe has an alarm as a step, the alarm must be acknowledged before the recipe will continue from that particular step.

Data Logging using Flash Card

The Advantech TPC-642S/642-SE touch screen operator interface utilizing a Compact Flash card allows the unit to data log the parameters setup 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 that which is over-written first. The following is a description on how this data log system works:

1. When the Advantech 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 9210 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.

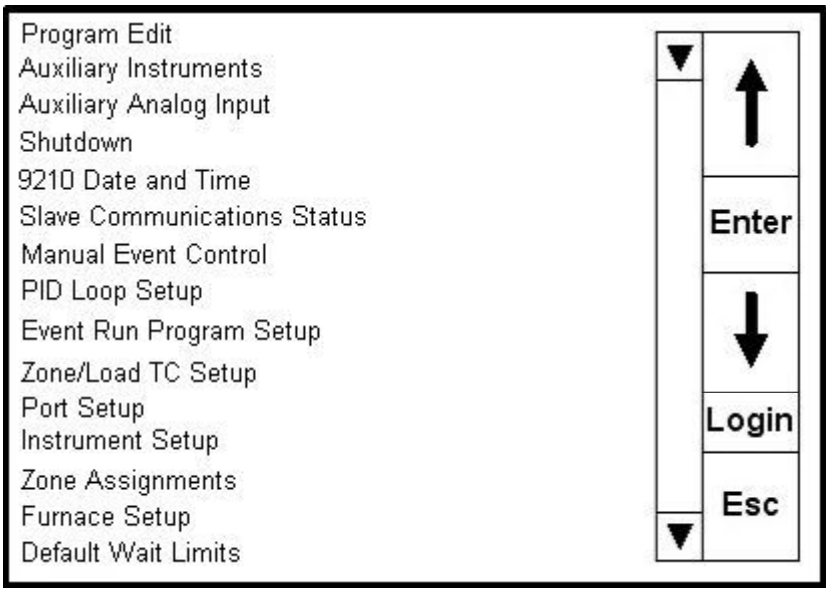
2. If the user does not copy the log data from the disk, it will eventually fall to 2% disk space. At this point, the touch screen will select the oldest compressed file and delete it. It then checks to see if 3% remains. It repeats this procedure until 3% disk space remains. At this point the alarm 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 continues to display)
3. The data log data alarm is the lowest priority. The alarm priorities are touch-screen communications, then 9210 controller/programmer, then disk space.

Warning: Make sure that the 9210 application has been shut down before removing the flash card

Chapter 3 - CONFIGURATION

Configuration Menu



The Configuration Menu is entered through the **Menu** button that is part of the 6-buttons running down the right side of the default status display screen. Pressing the **Login** button that is below the blue Up and Down arrow buttons displays a numeric keypad. Enter the correct passcode for the configuration level and press the **Enter** key. This displays the configuration menu.

Program Edit

Selecting *Program Edit* displays another screen, which asks the operator to enter a program number to be edited. Enter **0** to edit a blank program. To erase/delete an existing recipe/program you need to save it as Program Zero (0). Program 0 is a "NO-OP" program. Depending on the 9210's security setup and current Login status, the user may be first prompted to enter a pass code before being allowed to enter a program number to edit.

When you enter a number for a stored program and push the **Enter** key the program steps are displayed. Using the up and down arrow keys allow the user select the step in the existing program to edit. Move the cursor to that step and press the **Enter** key. The next screen to pop up will show the step's parameter and its value.

NOTE: A list of Op-Codes appears in Chapter 5 of this manual.

Example:

Parameter	**Value**
Opcode	SOAK
Time (hh:mm)	3:45

Highlighting the Opcode line and pressing the **Enter** button brings up a screen that shows all of the possible Opcodes. Use the Up or Down arrow keys to select the Opcode that you want to use for the program step that you are editing and press the **Enter** key. To change the Time option, highlight the line and press the **Enter** key. The next screen is the "Time Edit" screen. If you wish to change the hour, press the **Hour** button in the upper right-hand corner. If you want to change the minutes press the **Min** button. The next screen that pops up in both cases is a numeric keypad. Enter the number of hours or minutes that you wish to permanently change the recipe to and press the **Enter** button. If you DO NOT wish to make any changes press the **Esc** button.
Press the **Set** button to save the changes in the program. Notice that the time has been changed on the program segment that you were editing. If you wish to save this change, press the **Save** button. You will notice that a numeric keypad pops up and asks you to enter the number of the program that you wish to save. It defaults to the program number that you were editing. If this is the program that you wish to save the change, press the **Enter** key. If you wish to save this as a new program, press the **Clr** button on the numeric keypad, enter the number of the recipe that you want to save it as and press the **Enter** button. At this point, Program Editing is done and the display returns back to the Menu screen.

NOTE: See Chapter 6 of this manual for some sample programs.

Auxiliary Instruments

The Auxiliary Instruments screen shows the instruments slaved to the Series 9210 and their process variables. This screen is read-only.

Auxiliary Analog Input

The Auxiliary Analog Input screen shows the information from all three of the 9210's inputs and any attached analog input modules such as load T/C's, flows from electronic flow meters, etc. This screen is read-only.

Shutdown (Display)

The Shutdown selection pops up another screen asking whether or not the user wishes to shutdown the interface with the Series 9210. The two responses possible are either **Yes** or **No**.
Yes will shut down the 9210 interface program and display a common Windows desktop. You can now turn the power off to the operator interface without upsetting any of the settings. **No** returns the user to the initial status screen. Remember that shutting down the operator interface does not shut down the Series 9210 Controller.

9210 Date and Time

Highlighting the date and pressing **Enter** displays the Date Edit screen. The current date will be displayed at the top. The date is displayed in a box with scroll bars on the left in long version – Day of the week as well as month, day, and year (Friday January 4, 2008). Any portion of the date can be individually selected. To change any part of the date, select it and use the scroll bars to change the value. For example, to change the month, select the current month and press the up or down scroll bar to change the month to the specific month desired. When all of the changes have been made, press the **Set** button to save the changes, or press the **Cancel** button to cancel any changes.
Highlighting the time and pressing **Enter** displays the Time Edit screen. The current time will be displayed at the top. The new time can be entered through the use of the **Hour** and **Min** buttons. Pressing the **Hour** button will allow the user to change the hour, and pressing the **Min** button will allow the user to change the minutes. Pressing either of these buttons will display a numeric keypad that will allow the user to enter the new time. The new time will be displayed on the screen as well. When all of the changes have been made, press the **Set** button to save the changes, or press the **Cancel** button to cancel any changes.

Slave Communications Status

The Slave Communications Status screen displays the auxiliary instruments and their status, if any.
For a typical Nitrider application, the following slave instruments are used and should show a communications status ("Status") of **OK**:

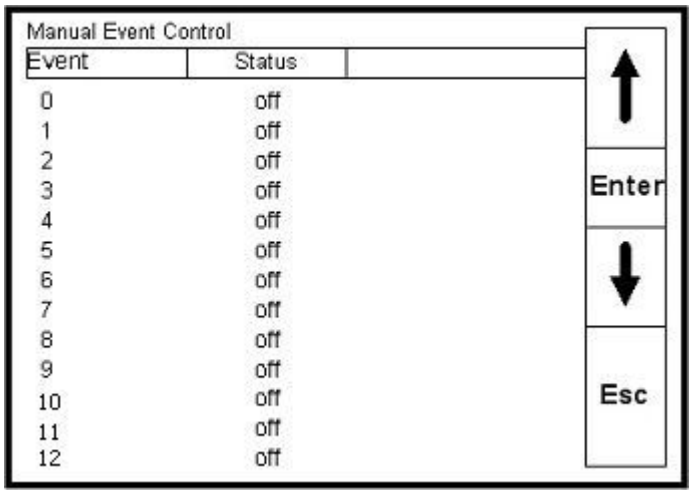
- Instrument 7 – Nitrogen Flow Controller Board
- Instrument 8 – Ammonia Flow Controller Board
- Instrument 9 – Dissociate Ammonia Flow Controller Board
- Instrument 11 – Micrologix 1200 PLC

All other instruments will display N/A for communication status.
The possible communications messages that can be displayed are:

- 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

This screen is read-only.

Manual Event Control



The Manual Event Control screen will allow the user to manually control the events for the 9210 instrument.
Highlighting a specific event and pressing the **Enter** button will allow the user to turn the event **On** or **Off**. This will activate or de-activate whatever digital contact is connected to that particular event.

The following is a list of Events typically used with the Control system:

- Event 0 – Nitrogen Addition
- Event 1 – Ammonia Addition
- Event 2 – Dissociated Ammonia Addition
- Event 3 – Spare
- Event 4 – Spare
- Event 5 – Spare
- Event 6 – Spare
- Event 7 – Sample Cell Enable
- Event 8 – Spare
- Event 9 – Spare
- Event 10 – Spare
- Event 11 – Spare
- Event 12 – Spare
- Event 13 – Spare
- Event 14 – Spare
- Event 15 – Spare

Pressing the **Esc** button returns you to the original Menu screen. Be sure to turn OFF all events turned on manually prior to starting a recipe cycle. This will ensure that the process will run as designed.

PID Loop Setup

The PID Loop Setup screen displays Loop 1 and its control parameter - i.e. % Dissociation/Kn, Loop 2 and its parameter – Temperature, and Loop 3 and its parameter – Backpressure.
The top two blue arrows move you from one loop to the other. Below each of the loops is shown the PID parameters as they exist in the Series 9210 at that particular moment.
Using the lower up and down arrow keys allows the operator/supervisor to highlight the parameters shown in the lower portion of the screen. These parameters include proportional band, reset, rate, probe millivolts, process variable, setpoint, percent output, mode, integral preset, cycle time, setpoint change limit, control mode, low limit, high limit, and 0 setpoint stops control. Some of the parameters are read-only, such as probe millivolts, process variable, and Pct Out (percent control output). Pressing the **Enter** key when the parameter is highlighted can change all of the other parameters. This will display a numeric keypad or a menu of choices that will allow you to change the specific parameter. Highlight/enter your choice and press the **Enter** button to make the appropriate selection.

Change setpoint overshoot protection
When the "Change Setpoint" is set to any value other than OFF, the PID control operates normally until there is a setpoint change. When a setpoint change occurs, the PID algorithm uses PB only (i.e. it ignores

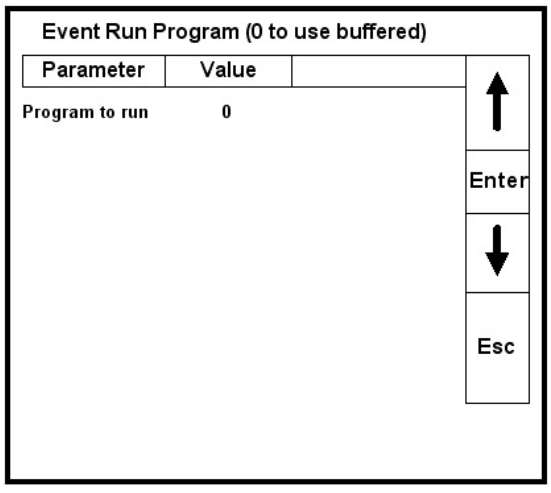
the Reset (I) and Rate (D)) until the % output from the specified loop falls below the value specified. Then it will begin calculating reset and rate and return to normal operation.
Example: Change setpoint is set at 80%; Current setpoint is 1500
New setpoint is 1700 - % output rapidly goes to 100%, PID ignores Reset and Rate.
Temperature gets within PB, % Output starts to drop.
When % Output drops below 80%, PID operation returns to normal with Reset and Rate applied.
Normally overshoot is caused by a buildup of the Reset error term. By ignoring this term until the temperature is with PB, the Reset term is minimized, thus reducing the overshoot error. You should be cautious not to set the Change Setpoint value too low - e.g. if the furnace controls 1700 in a steady state at 50% output and you set the Change Setpoint value to 40% and the PB value is low, you could find yourself in a situation where you never see 40% output and remain in a **PB only** control mode.

Default PID Parameters for Loop 1 - %Dissociation/Kn, Loop 2 – Temperature, and Loop 3 - Backpressure

Loop 1 Default PID Parameters	Loop 2 Default PID Parameters	Loop 3 Default PID Parameters
Proportional Band: 1.3	Proportional Band: 20.0	Proportional Band: 4.0
Reset: 0.01	Reset: 0.10	Reset: 0.10
Rate: 0.00	Rate: 0.0	Rate: 0.0
Mode: Auto	Mode: Auto	Mode: Auto
Integral Preset: 0	Integral Preset: 0	Integral Preset: 0
Cycle time: 24	Cycle time: 60	Cycle time: 60
Setpoint Change Limit: OFF	Setpoint Chazge Limit: 80%	Setpoint Change Limit: OFF
Control Mode: Dual Direct	Control Mode: Single Reverse	Control Mode: Single Reverse
Low Limit: -100	Low Limit: 0	Low Limit: 0
Hight Limit: 100	Hight Limit: 100	Hight Limit: 100
0 set point stops control: no	0 set point stops control: no	0 set point stops control: no

The **Esc** key on some of the screens returns you to the previous screen without any changes taking affect. From the PID Setup screen, the **Esc** key takes you back to the Menu screen.

Event Run Program Setup



This screen is used to start a program stored in the 9210 by contact closure between terminals 21 (Digital In Com) and 17 (Digital In 1). The value entered at program to run will start with contact closure.

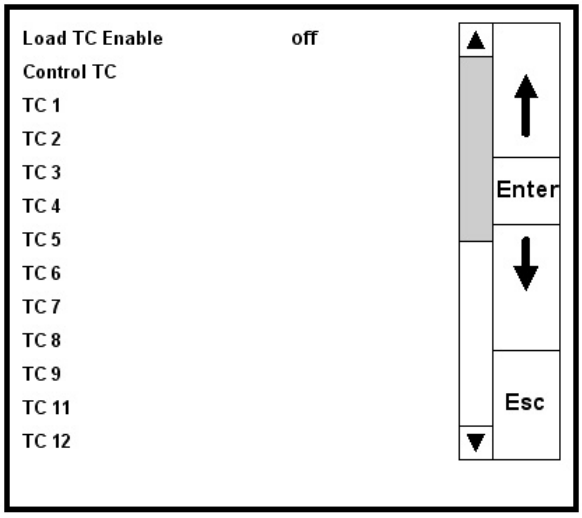
Pressing **Enter** pops up the Current Value Screen, showing the current value in the Series 9210. To make an adjustment, enter the program number, using the numeric keypad and press the **Enter** key. This returns you to the original Event Run Program Screen that now shows the new program number that you have entered. If you do not wish to make the change simply press the **Esc** key which takes you back to the Event Run Program Screen with NO change being made to the Event Run Program.

Zone / Load TC Setup

This screen is used for Nitrider applications that utilize a Load Thermocouple in addition to the Furnace Control Thermocouple for Soak statements. The operator must manually select the Thermocouples for the

9210 to use in determining when to start/hold/stop Soak timers in a recipe. For Nitrider applications that do not use a Load Thermocouple, this menu can be ignored.

Use the up and down arrow keys to highlight a specific thermocouple. The Load TC Enable can be either: **Off**, **On**, or **On + Alarm**. Pressing the **Enter** button while the item is highlighted changes the current status of that particular selection to either **Active** or **Inactive (blank)**.



Port Setup

Highlighting this menu selection and pressing the **Enter** button moves you to the Port Setup screen.

Warning: Changes to this screen should not be made without consulting SSi at 800-666-4330.

Parameter	Value
Host 232 Baud	TPC-642S/SE
Host 232 Mode	Modbus
Host 485 (3,4) Baud	19200
Host 485 (3,4) Mode	Modbus
Host 485 (3,4) Address	1
Slave 1 (5,6) Baud	19200
Slave 1 (5,6) Mode	Modbus
Slave 2 (22,23) Baud	19200
Slave 2 (22,23) Mode	Modbus
232/H2 Port Baud	9600

These values can be changed by using the up and down arrow keys to highlight the selection. Press the **Enter** button to select the item. A selection of communication protocols is displayed. Make the desired selection and press the **Enter** button. The **Cancel** button takes you back to the previous screen without changes being made.

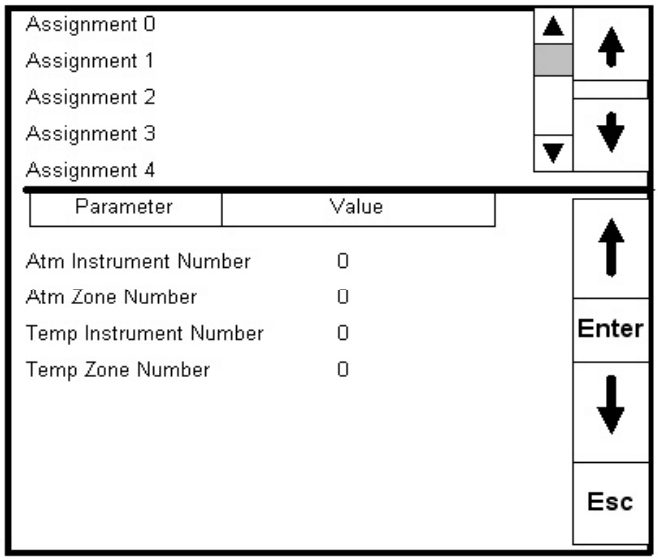
Instrument Setup

WARNING: The 9210 Instrument Setup is pre-configured and tested prior to shipment. This screen should not be changed without consulting SSi at 800-666-4330.

The Instrument Setup screen will allow the user to set up the slave instruments. The first level allows you to select the instrument to setup. To highlight the desired instrument use the first set of blue up and down arrow keys and then press the **Enter** button. This will display a list of controllers: **Atmosphere Controllers**, then **Temperature Controllers**, and then **Miscellaneous Controllers**. The Port, Address, and Atmosphere, Temperature, Events, and Quench Assignments can also be modified from the lower portion of the screen.
Pressing the **Esc** button will return you to the Menu screen.

Zone Assignments

WARNING: This screen should not be changed without consulting SSi at 800-666-4330.



The zone assignment feature allows the SERIES 9210 program to change set points on all instruments of a multi-zone furnace. The SERIES 9210 has up to five (5) temperature and atmosphere zone assignments available. The SERIES 9210 programmer looks for appropriate zone assignments whenever a set point is to be sent to the atmosphere or temperature controller. The temperature set point is sent to every instrument number in the temperature zone assignment.

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.

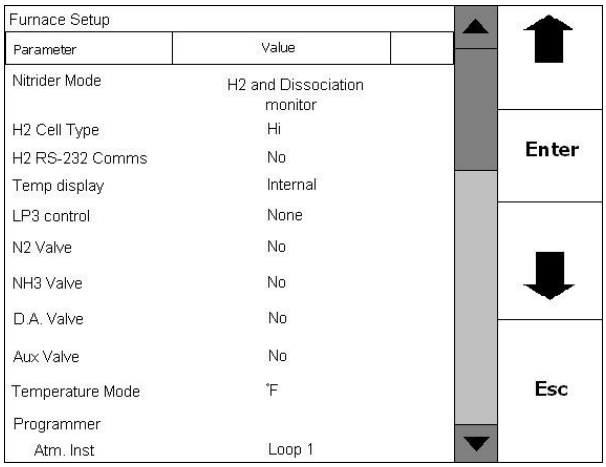
If the first three steps of a program are as shown below, then the bottom zone set point is 1725, the middle zones are 1750, and the top zone is 1800.

Step	**opcode**	**Temperature**	**Atmosphere**	**Option**
1	*ZONE_OFF*	50		1
2	*ZONE_OFF*	25		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 1725 when step 3 is executed. Likewise step 2 sets the offset for zone 4 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 atmosphere and temperature controller assigned as instruments 1 and 2 should be in zones that will not be offset.

Furnace Setup



The "Nitrider Mode" selection will allow the user to select the specific Nitriding mode:
H2 and Dissociation
NH3 and Dissociation
H2, NH3 and Dissociation
H2, NH3 and Nit. Potential
H2 and Nit. Potential
NH3 and Nit. Potential
H2 and H2 Control
NH3 and NH3 Control

The "H2 Cell Type" selection will allow the user to set the H2 cell type. It can be either **Hi** or **H2**.
The "H2 RS-232 Comms" selection will allow the user to know if there are RS-232 communications. It can be either **Yes** or **No**.
The "Temp display" selection will allow the user to set the temperature display source. It can be either **Internal** or **SPP Instrument**.
The "LP3 Control" selection allows the user to set the loop 3 control factor:
None
BP (Back Pressure)
N/A
Temp

The "N2 Valve" selection will allow the user to set the N2 valve. It can be either **Yes** or **No**.
The "NH3 Valve" selection will allow the user to set the NH3 valve. It can be either **Yes** or **No**.
The "D.A. Valve" selection will allow the user to set the Dissociated Ammonia valve. It can be either **Yes** or **No**.
The "Aux Valve" selection will allow the user to set the auxiliary valve. It can be either **Yes** or **No**.
The "Temperature Mode" selection will allow the user to set the temperature mode. It can be either **°F** (Fahrenheit) or **°C** (Celsius).
The programmer section will allow the user to set up the different instruments for the programmer.

The "Atm. Inst" selection will allow the user to set the atmosphere instrument:
Internal Loop 1
Internal Loop 2
Internal Loop 3
Instrument 1 – Instrument 25
The "Temp. Inst" selection will allow the user to set the temperature instrument:
Internal Loop 1

Internal Loop 2
Internal Loop 3
Instrument 1 – Instrument 25
The "Event Inst" selection will allow the user to set the events instrument:
Internal
Instrument 1 – Instrument 25
The "Quench Inst" selection will allow the user to set the quench instrument:
Internal Loop 1
Internal Loop 2
Internal Loop 3
Instrument 1 – Instrument 25
The "End of Quench Event" will allow the user to set the end of quench event. It can be **event 0** through **event 14**.
The "Quench Speed Event" will allow the user to set the quench speed event. It can be **event 0** through **event 14**.
The "Quench Run Event" will allow the user to set the quench run event. It can be **event 0** through **event 14**.

The "Nitrider Bias" selection can be used to adjust the % Dissociation/Kn reading to match Pipette or Metallurgical readings. Setting this value to **5.0** will increase the reading from 20 to 25, whereas setting the value to **–5.0** will decrease the reading from 20 to 15. This can range from **–10.0** to **10.0**
The "SSI Flow Signal" selection will allow the user to set the flow signal. It can be either **Analog** or **Digital/485**.
The "End Recipe Events Clear" selection will allow the user to clear out the events at the end of a recipe. It can be either **Yes** or **No**.

Default Wait Limits

Parameter	Value
Temperature Wait Limit	15 °
Atmosphere Wait Limit	10

The wait limits are used in the recipe programming. A wait limit allows the program to move to the next step once the process variable (or the actual furnace) has gotten to within the default wait limits that are indicated on this screen.
Highlighting your choice to be changed and pressing the **Enter** key moves you to a numeric keypad that allows you to enter a new value by touching the appropriate keys. The Temperature Wait Limit can range from **0** to **50** degrees. The Atmosphere Wait Limit can range from **0.00** to **0.49**. Pressing the **Esc** key takes you back to the Menu screen.

Furnace Name

Parameter	Value
Furnace Name	Nitrider
PV1 Name	Dissociation
PV2 Name	Temperature
PV3 Name	Back Pressure

Select the parameter to edit and press the **Enter** key to display an alphanumeric keyboard. Enter the name that you wish to be displayed.

Alarm Setup

The Alarm Setup menu is a two-level screen. The first level allows you to select the alarm – **Alarm1** – **Alarm 3**. The Second level scrolls through the alarm parameters.

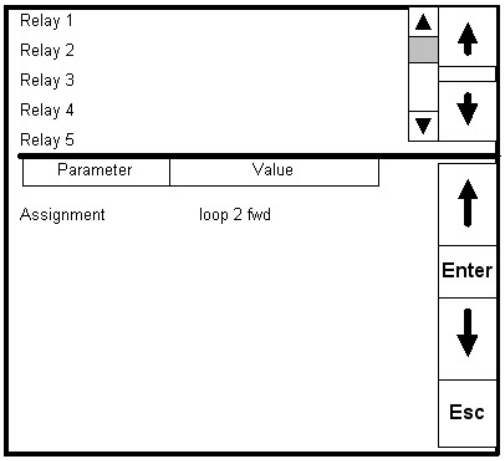
Parameter	Value
Setpoint	2500
Alarm Type	PV2 proc high
Hysteresis	1

Using the lower blue up and down arrow keys, select the parameter to modify, and then press the **Enter** button. The "Setpoint" selection will allow the user to enter the setpoint for the alarm. This will display a numeric keypad. This can range from **–9999** to **9999**. The "Alarm Type" selection will allow the user to set the type of alarm. This will display a two-level screen. The top level has the following options:
Process High
Process Low
Band, Normally Open
Band, Normally Closed
Deviation, Normally Open
Deviation, Normally Closed
The bottom level has the following options:
PV 1 Value
PV 2 Value
PV 3 Value
Input 1 Value
Input 2 Value
Input 3 Value
PO1 Value
PO2 Value
PO3 Value
The "Hysteresis" selection will allow the user to set the hysteresis. This will display a numeric keypad. This can range from **0** to **9999**.
If you are configuring more than one alarm, follow the above instructions for each alarm that you are configuring.

Relay Assignment

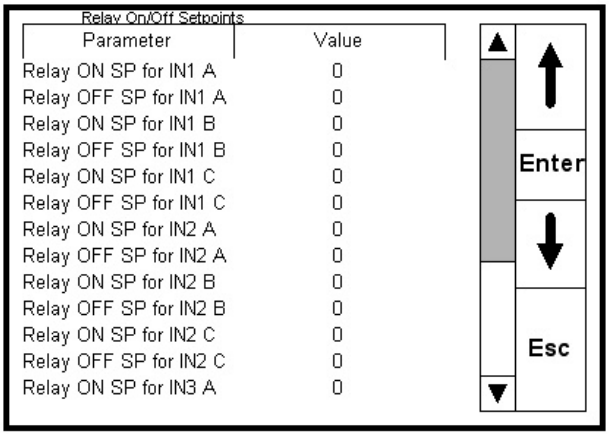
This menu selection allows the user to assign the action to the selected Relay Output.
All eight of the 9210's relay outputs are assigned in this screen. To select a Relay Output to modify, use the up or down arrow keys to highlight the event.
Highlighting the "Assignment" selection that you wish to assign and pressing the **Enter** button takes you to a screen that has the following choices

- Loop 1 fwd
- Loop 1 rev
- Loop 2 fwd
- Loop 2 rev
- Loop 3 fwd
- Loop 3 rev



- Programmer alarm
- Alarm 1
- Alarm 2
- Alarm 3
- Event 0 through Event 15
- Burn off
- IN 1 Relay SP A
- IN 1 Relay SP B
- IN 1 Relay SP C
- IN 2 Relay SP A
- IN 2 Relay SP B
- IN 2 Relay SP C
- IN 3 Relay SP A
- IN 3 Relay SP B
- IN 3 Relay SP C
- Alarm Combination (can be any combination below)
  - Programmer Alarm
  - Alarm 1
  - Alarm 2
  - Alarm 3

Relay Set Points



This menu screen is not used and should be ignored. Contact Super Systems Inc at 800-666-4330 before making any changes to this screen. This screen will allow the user to set the ON/OFF setpoints for Input 1, 2, and 3 A, B, and C relays. Selecting a setpoint to modify and pressing the **Enter** button will display a numeric keypad. This can range from **–9999** to **9999**.

Analog Input Setup

This menu option displays a two-level screen with the top level showing the three inputs. Use the blue up and down arrow keys to select one of the inputs.
Pressing the "Enter" key takes you to a menu of parameters that can be assigned to any of the three inputs. Included are thermocouples, voltage, and current inputs.
The lower zone of the "Analog Input Setup" screen contains a table:

Parameter	Value
TC Type	S
Filter Time	0
Initial Scale	0
Full Scale	3000
Decimal Point Location	0
Open TC	Up scale
Input offset	0

Use curve	0

Select the "TC Type" option and press the **Enter** button. This will display a screen with the different input types available. *Note: See the Input type selections for the Series 9210 below for the different input types available*. The "Filter Time" selection will display a numeric keypad from which the user can enter the new filter time. This can range from **0** to **9999**. The "Initial Scale" selection will display a numeric keypad from which the user can enter the new initial scale. This can range from **-9999** to **9999**. The "Full Scale" selection will display a numeric keypad from which the user can enter the new full scale. This can range from **–999-** to **9999**. The "Decimal Point Location" selection will display a numeric keypad from which the user can enter the new decimal point location. This can range from **0** to **4**. The "Open TC" selection will display a screen from which the user can enter the new filter time. This can be either **Up Scale** or **Down Scale**. The "Input Offset" selection will display a numeric keypad from which the user can enter the new input offset. This can range from **-10** to **10**. The "Use Curve" selection will display a numeric keypad from which the user can enter the new curve to use. This can range from **0** to **5**. **0** means no curve is used. Continue until all values associated/required by the input type have been entered. Pressing the **Esc** key takes you back to the configuration menu.

Input type selections for the Series 9210:

Input Type Options	T/C's B, C, E, J, K, N, NNM, R, S, T
	2.5 Volts
	1.25 Volts
	78.125 Millivolts
	19.53125 Millivolts
	4 – 20 mA (124 Ohm precision shunt required)
	25 Volts (Requires internal jumper)
	12.5 Volts (Requires internal jumper)
	781.25 Millivolts (Requires internal jumper)
	195.3125 Millivolts (Requires internal jumper)

Analog Output Setup

This menu screen is similar in function to the *Analog Input Setup* screen, with the exception that these are analog outputs, not inputs. There are two analog output available. The top blue up and down arrow keys highlight either Output 1 or Output 2. The lower blue up and down arrow keys will allow the user to set up the analog output settings.

Parameter	Value
Assignment	PV 2 retrans
Offset	0
Range	100

The "Assignment" selection will display a screen from which the user can select the new assignment. For example you can re-transmit PV1 (Process Variable 1 - %C) to a chart recorder or an analog input board in a PLC. In most Nitrider applications Output 1 is used to control the backpressure and Output 2 is used for Temperature control. The list of options is:

PV 1 retrans
Loop 1 Inc
Loop 1 Dec
Loop 1 Combo
PV 2 retrans
Loop 2 Inc

Loop 2 Dec
Loop 2 Combo
PV 3 retrans
Loop 3 Inc
Loop 3 Dec
Loop 3 Combo
Input 1 retrans
Input 2 retrans
Input 3 retrans
Input 4 retrans
The "Offset" selection will allow the user to set the offset. This will display a numeric keypad. This will range from **–9999** to **9999**.
The "Range" selection will allow the user to set the range of the output. This will display a numeric keypad. This will range from **–9999** to **9999**.
Pressing the **Esc** key returns you to the configuration menu.

Passcode and Alarm

Parameter	Value
Level 1 Code	1
Level 2 Code	2
Web Level 1 Code	111
Web Level 2 Code	222
Web Change Enable	1
No Alarm	Contact is Open
Alarm Text Setup	
Alarm 0 – Alarm 99	User Alarm xx

The values shown in the above table are the default values. The parameter "No Alarm" means that if there is NO CONTROLLER ALARM, the controller alarm relay is NO. The "Level 1 Code" and the "Level 2 Code" selections will allow the user to set the Supervisor and Administration passcodes, respectively. Either of these options will display a numeric keypad that will range from **0** to **9999**. The "Web Level 1 Code" and the "Web Level 2 Code" selections will allow the user to set the Supervisor and Administration passcodes, respectively, for the 9210's web page. Either of these options will display a numeric keypad that will range from **0** to **9999**. The "Web Change Enable" selection will allow the user determine if changes can be made to the instrument through the web page. This will display a numeric keypad that can be either **1** (Change OK) or **0** (No Change Allowed). The "No Alarm" selection will allow the user to set what the no alarm state is. This will display a numeric keypad that can be either **0** (Contact is Open) or **1** (Contact is Closed). This allows the operator to assign the controller alarm as a NC contact such as a 1400°F alarm. The "Alarm Text Setup" section will allow the user to set the alarm text for up to ninety-nine user alarms. Any of these options will display an alphanumeric keypad.
Press the **Esc** key to return to the configuration menu.

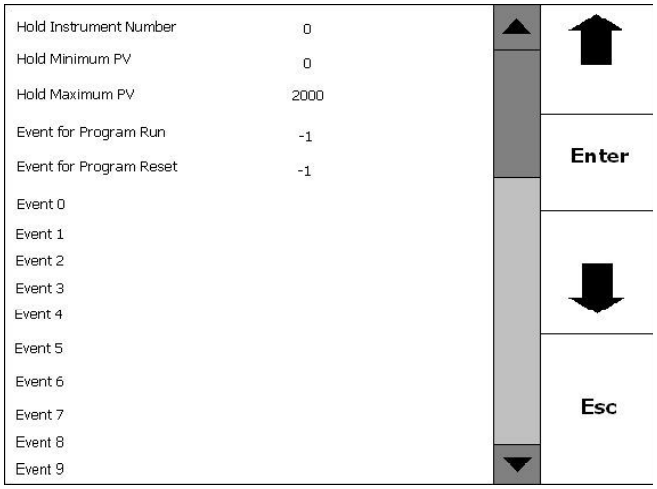
IP Address

Parameter	Value
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

Highlighting the parameter that needs to be entered and pressing the **Enter** button displays a numeric keypad that can be used to enter the required value. This will range from **0** to **256**.
The default IP address is: 192.168.0.200
The default IP Address Gateway is: 192.168.1.1
Pressing the **Esc** key returns you to the configuration menu.

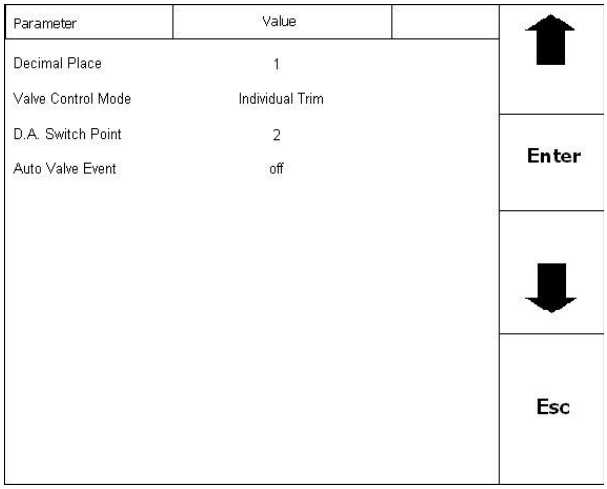
Event Control



This menu option will allow the user to set up the event control for the 9210. The "Hold Instrument Number" selection will display a numeric keypad that can range from **0** to **11**. The "Hold Minimum PV" selection will display a numeric keypad that will range from **0** to **4000**. The "Hold Maximum PV" selection will display a numeric keypad that will range from **0** to **4000**. The "Event for Program Run" selection will display a numeric keypad that will range from **–1** to **15**. A value of **–1** means there is no event. The "Event for Program Reset" selection will display a numeric keypad that will range from **–1** to **15**. A value of **–1** means there is no event. The "Event 0" through "Event 15" selection will allow the user to assign the specific events. The list of options for this selection is:

- **Event Inactive**
- **Event Active, Open Triggers Hold**
- **Event Active, Closed Triggers Hold**

Valve Configuration



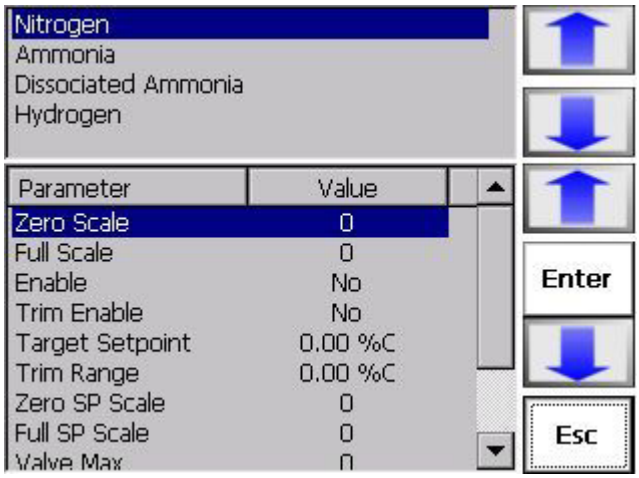
This screen provides setup information for the 9210 on the flow controller boards.
The "Decimal Place" selection determines how the 9210 will display gas flows. This will display a numeric keypad that can range from **0** to **4**.
The "Valve Control Mode" selection determines how the 9210 will adjust 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

The "D.A. Switch Point" selection determines the control switch point for switching the atmosphere display from %Dissociation to Kn. This will display a

numeric keypad that can range from **0** to **100**. The "Auto Valve Event" selection will allow the user to either 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

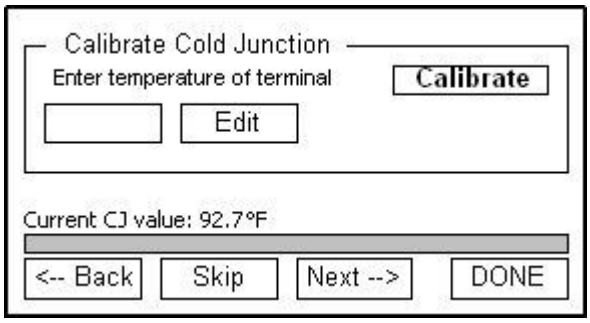


This screen is used to setup the 9210 based on how the flow meter boards are setup. This allows the 9210 to know how display each individual gas flow. There are four gases to select: **Nitrogen**, **Ammonia**, **Dissociated Ammonia**, and **Hydrogen**. Once a gas flow has been selected, the values for that flow will be displayed in the lower level. The "Zero Scale" selection will allow the user to set the zero scale for the flow. This will display a numeric keypad that can range from **0** to **30,000**. The "Full Scale" selection will allow the user to set the full scale for the flow. This will display a numeric keypad that can range from **0** to **30,000**. Selecting the "Enable" selection will allow the user to enable the flow. This will cycle between **Yes** and **No**. Selecting the "Trim Enable" selection will allow the user to enable the trim flow. This will cycle between **Yes** and **No**. The "Target Setpoint" selection will allow the user to set the target setpoint for the flow. This will display a numeric keypad that can range from **0** to **2000**. The "Trim Range" selection will allow the user to set the trim range for the flow. This will display a numeric keypad that can range from **0** to **2000**. The "Zero SP Scale" selection will allow the user to set the zero scale for the setpoint for the flow. This will display a numeric keypad that can range from **0** to **30,000**. The "Full SP Scale" selection will allow the user to set the full scale for the setpoint for the flow. This will display a numeric keypad that can range from **0** to **30,000**. The "Valve Max" selection will allow the user to set the valve maximum for the flow. This will display a numeric keypad that can range from **0** to **30,000**. The "Flow deviation setpoint" selection will allow the user to set the setpoint for the flow deviation alarm. This will display a numeric keypad that will range from **0** to **30,000**. A setpoint of 0 will disable the deviation alarm for the valve. The "Dev. Alarm delay (sec)" selection will allow the user to set the number of seconds before the deviation alarm will sound. This will display a numeric keypad that will range from **0** to **30,000**. *Note: The deviation alarm delay is entered in 1/10 minutes (6 seconds), so a **2** entered will be displayed as 12 seconds*.

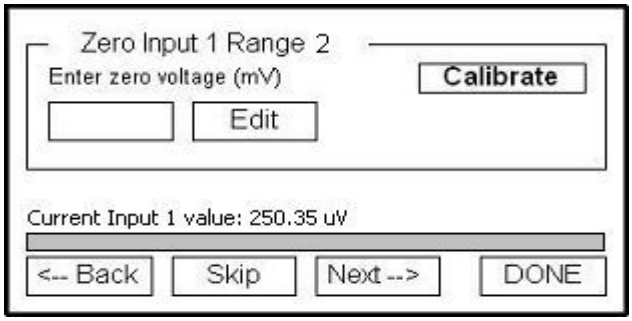
User Calibration

The user will need a thermocouple calibrator capable of outputting a thermocouple signal to calibrate the zero, span or cold junction value of the 9210 instrument. The user will need to connect the calibrator to one of the inputs on the instrument that will be calibrated. It is recommended to let everything (calibrator and instrument) sit for approximately thirty minutes to allow the temperature to achieve equilibrium. Set up the calibrator for the specific thermocouple type of the thermocouples in the 9210 instrument, 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.
*Note: The buttons on the screen always have the same functionality. The **←Back** button will display the previous screen, if any. The **Skip** button will skip the current screen and display the next screen, if any. The **Next** → button will display the next screen, if any. The **Done** button will close out the* User

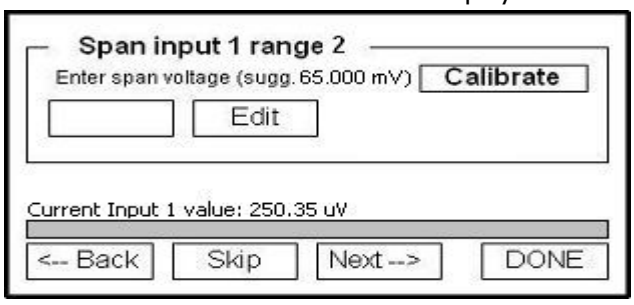
Calibration *menu. The **Edit** button will display a numeric keypad from which the user can enter a new value for the calibration process. The **Calibrate** button will begin the calibration process for the selected screen.*



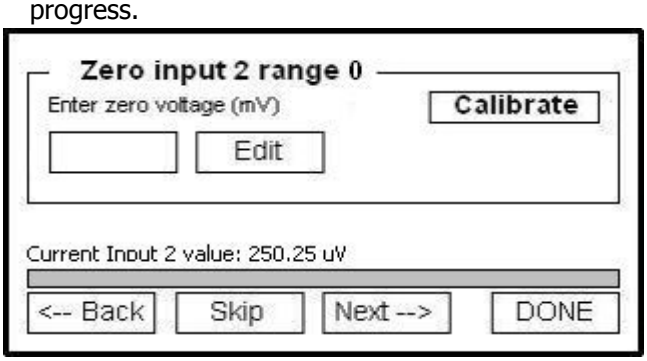
The first screen in the *User Calibration* menu is the Calibrate Cold Junction screen. This will allow the user to enter an offset for the cold junction value. The current value is displayed directly above the progress bar and bottom row of buttons as "Current CJ value: XX.X ° F". Press the Calibrate button to set the cold junction offset. The progress bar at the bottom of the screen will display the calibration progress.



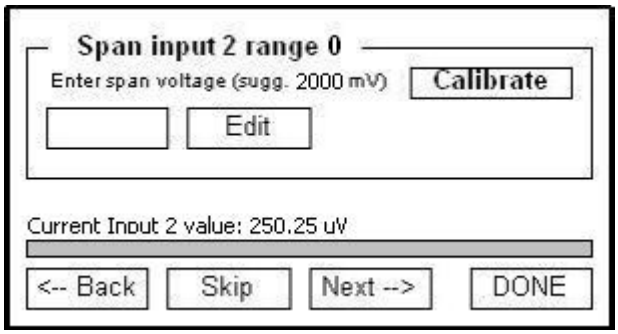
The next screen is the Zero Input 1 Range 2 screen. This screen will allow the user to set the zero scale for Input 1 Range 2. A value of 0 millivolts will need to be sourced to the inputs. For a zero calibration, enter a 0 as the value of the terminal to correctly calibrate the inputs. The current Input 1 value will be displayed near the bottom of the screen as "Current Input 1 value: xxxx.xx uV". The progress bar at the bottom of the screen will display the calibration progress.



The next screen is the Span Input 1 Range 2 screen. This screen will allow the user to set the span value for Input 1 Range 2. A suggested value will be displayed next to the **Calibrate** button ("sugg. 65.000 mV"). The current Input 1 value will be displayed near the bottom of the screen as "Current Input 1 value: xxxx.xx uV". The progress bar at the bottom of the screen will display the calibration progress.

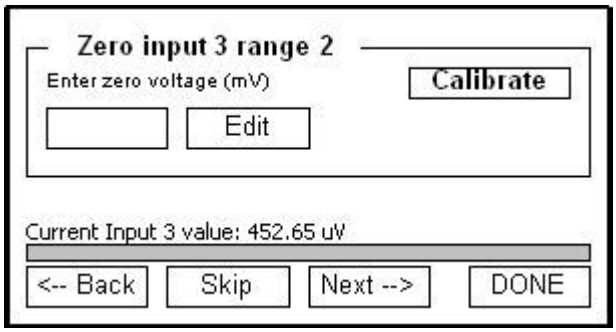


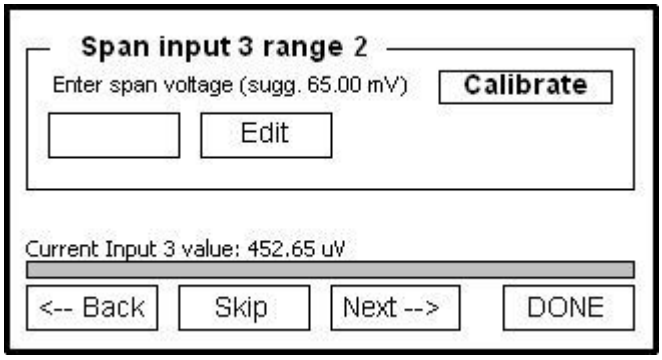
The next screen is the Zero Input 2 Range 0 screen. This screen will allow the user to set the zero scale for Input 2 Range 0. A value of 0 millivolts will need to be sourced to the inputs. For a zero calibration, enter a 0 as the value of the terminal to correctly calibrate the inputs. The current Input 2 value will be displayed near the bottom of the screen as "Current Input 2 value: xxxx.xx uV". The progress bar at the bottom of the screen will display the calibration progress.



The next screen is the Span Input 2 Range 0 screen. This screen will allow the user to set the span value for Input 2 Range 0. A suggested value will be displayed next to the **Calibrate** button ("sugg. 2000 mV"). The current Input 2 value will be displayed near the bottom of the screen as "Current Input 2 value: xxxx.xx uV". The progress bar at the bottom of the screen will display the calibration progress.

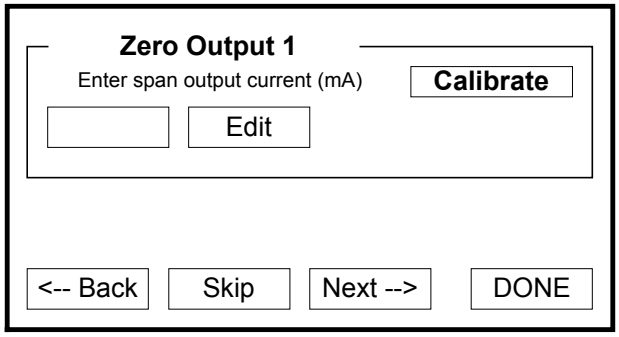
The next screen is the Zero Input 3 Range 2 screen. This screen will allow the user to set the zero scale for Input 3 Range 2. A value of 0 millivolts will need to be sourced to the inputs. For a zero calibration, enter a 0 as the value of the terminal to correctly calibrate the inputs. The current Input 3 value will be displayed near the bottom of the screen as "Current Input 3 value: xxxx.xx uV". The progress bar at the bottom of the screen will display the calibration progress.

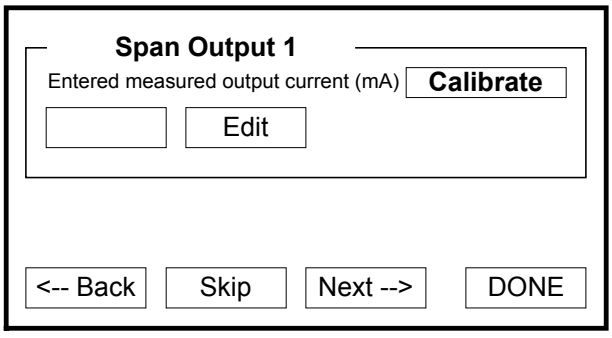




The next screen is the Span Input 3 Range 2 screen. This screen will allow the user to set the span value for Input 3 Range 2. A suggested value will be displayed next to the **Calibrate** button ("sugg. 65.000 mV"). The current Input 3 value will be displayed near the bottom of the screen as "Current Input 3 value: xxxx.xx uV". The progress bar at the bottom of the screen will display the calibration progress.

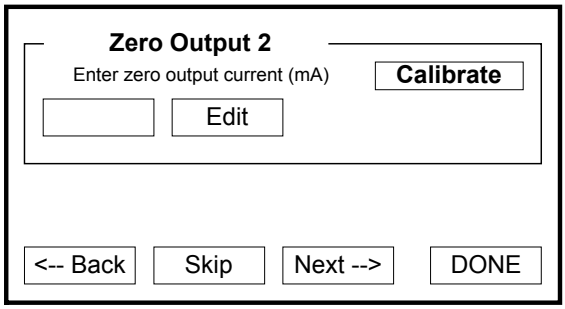
The next screen is the Zero Output 1 screen. This screen will allow the user to set the zero value for Output 1. Measured at terminals 24(-) and 25(+) for this step. The progress bar at the bottom of the screen will display the calibration progress.

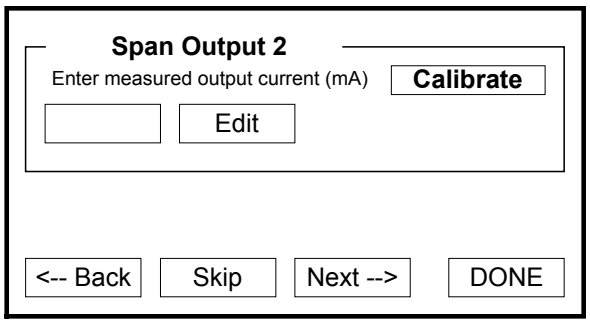




The next screen is the Span Output 1 screen. This screen will allow the user to set the span value for Output 1. Measured at terminals 24(-) and 25(+) for this step. The progress bar at the bottom of the screen will display the calibration progress.

The next screen is the Zero Output 2 screen. This screen will allow the user to set the zero value for Output 2. Measured at terminals 26(-) and 25(+) for this step. The progress bar at the bottom of the screen will display the calibration progress.





The next screen is the Span Output 2 screen. This screen will allow the user to set the span value for Output 2. Measured at terminals 26(-) and 25(+) for this step. The progress bar at the bottom of the screen will display the calibration progress.

The next screen indicates that the calibration process is complete.

Full Calibration

This screen is used by SSi personnel, and it is a longer version of the *User Calibration* menu**.**

Set Menu Security

This menu allows the user to set the security level for all of the menu screens to one of three levels:

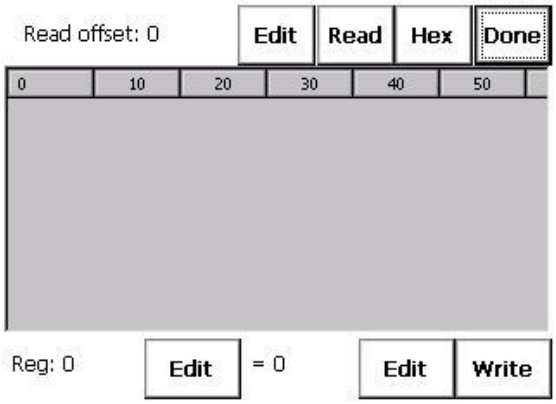
1. Operator – Lowest Level, No Pass code Required
2. Supervisor – Middle Level, Level 1 Pass code Required
3. Administrator – Highest Level, Level 2 Pass code Required.

The menu items with security levels are:

Menu Item	**Security Level**
Program Edit	Supervisor
Auxiliary Instruments	Operator
Auxiliary Analog Input	Operator
Shutdown	Operator
9210 Date and Time	Supervisor
Slave Communications Status	Supervisor
Manual Event Control	Supervisor
PID Loop Setup	Administrator
Event Run Program Setup	Administrator
Zone/Load TC Setup	Administrator
Port Setup	Administrator
Instrument Setup	Administrator
Zone Assignments	Administrator
Furnace Setup	Administrator
Default Wait Limits	Administrator
Furnace Name	Administrator
Alarm Setup	Administrator
Relay Assignments	Administrator
Relay Setpoints	Administrator
Analog Input Setup	Administrator
Analog Output Setup	Administrator
Passcode and Alarm	Administrator
IP Address	Administrator
Event Control	Administrator
Valve Configuration	Administrator
Valve Setup	Administrator
User Calibration	Administrator

Full Calibration	Administrator
Set Menu Security	Administrator
Read/Write Raw Data	Administrator
Curve Entry	Administrator
Alternate PID Setup	Administrator
Analog Input Board Setup	Administrator
AI Board Calibration	Administrator
Program Run	Administrator
PLC Calibration	Administrator
ADAM Correction	Administrator
Aux SP Configuration	Administrator

Read/Write Raw Data

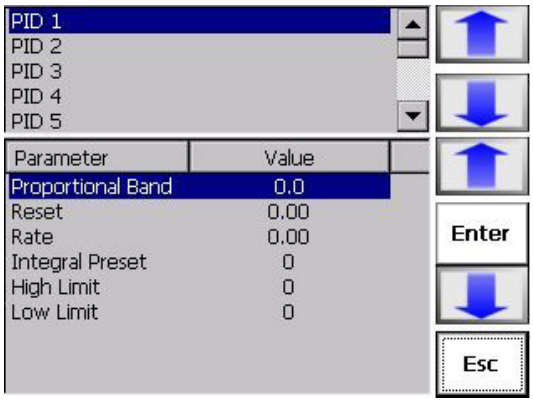


This menu is used to view raw data as stored in the 9210. This is only for use by qualified personnel under direction of SSI. Contact Super Systems Inc at 800-666-4330 before modifying any of these values. The "Read Offset:" at the top of the screen will indicate where in the 9210's registers the application will begin reading. Press the **Edit** button to edit the read offset. Press the **Read** button to read the values from the 9210. The application will read 60 registers at a time. Press the **Hex** button to convert the values to their hexadecimal counterparts. The **Hex** button will now read **Dec**. Pressing the **Dec** button will convert the values to their decimal counterparts. The **Dec** button will now read **Hex**. Pressing the **Done** button will close out the menu option. The "Reg:" at the bottom of the screen will indicate where in the 9210's registers the application will begin writing. Press the left **Edit** button to edit the write offset. Press the right **Edit** button (next to the **Write** button) to edit the value to write to the register. Press the **Write** button to write the value. *Note: This screen does not continuously update, so the **Read** button will have to be pressed to ensure that any changes were made*.

Curve Entry

This menu is not used with the Nitrider Control system and should be ignored.

Alternate PID Setup



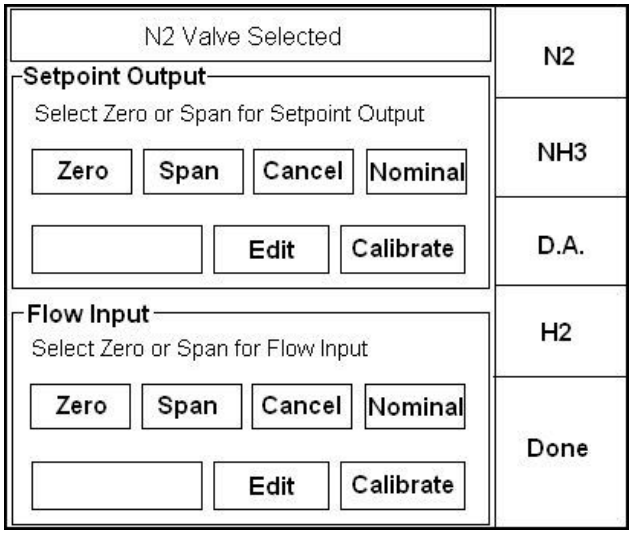
This menu is used to allow for up to sixteen different PID Loops that can be used by the control system. These PID loops can be used in place of the PID parameters for Loop 1, 2 or 3. To use an alternate PID for a control Loop, it must be done via the 9210 Recipe. Contact SSI at 800-666-4330 for assistance with this feature. Use the top blue up and down arrows to select the separate PID loops. Use the bottom up and down arrows to select the parameters for the selected loop. All of the parameters will display a numeric keypad. The "Proportional Band" can range from **0** to **999**. The "Reset" can range from **0.00** to **10.00**. The "Rate" can range from **0.00** to **10.00**. The "Integral Preset" can range from **–100** to **100**. The "High Limit" can range from **–100** to **100**. The "Low Limit" can range from **–100** to **100**.

Analog Input Board Setup

This menu is not used with the Nitrider Control system and should be ignored.

PLC Calibration

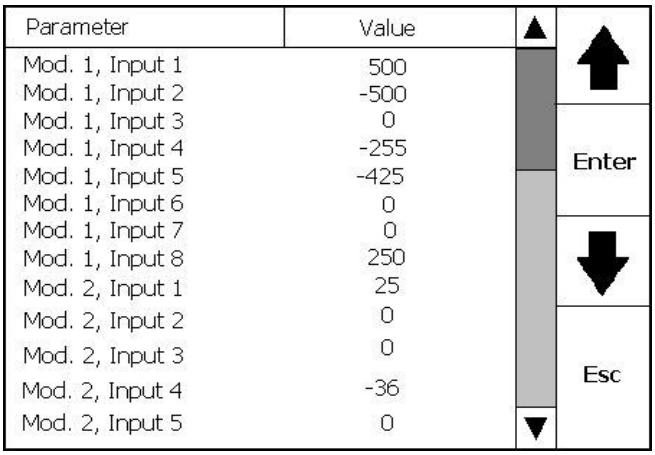
This menu is only used with the Nitrider Control system when the PLC is handling the gas flow readings and control. Contact SSI at 800-666-4330 for assistance with this feature. Press the appropriate button to select that gas valve – i.e., press **H2** for the H2 valve. The selected valve will be displayed at the top of the screen.



The first section is for the Setpoint Output. All of the buttons in both sections function identically. Press the **Zero** button to set the zero value. The text above the buttons will read "Enter measured Zero value (mA) and press calibrate". Press the **Span** button to set the span value. The text above the buttons will read "Enter measured Span value (mA) and press calibrate". Press the **Cancel** button to cancel the zero or span process. Press the **Nominal** button to set nominal values for the Setpoint Output. This will display a message box: "Set nominal zero values. Are you sure?" Press the **Yes** button to set the nominal values, or press the **No** button to cancel the nominal value set. Press the Edit button to display a numeric keypad that will allow the user to edit the zero or span value. This can range from **0.00** to **32767.00**. Press the **Calibrate** button to begin the calibration process. This will display a message: "Begin Calibration. Are you sure?" Press the **Yes** button to begin the calibration process, or press the **No** button to cancel the calibration process.

The second section is for the Flow Input. Press the **Zero** button to set the zero value. The text above the buttons will read "Enter observed Zero flow value and press calibrate". Press the **Span** button to set the span value. The text above the buttons will read "Enter observed Span flow value and press calibrate". Press the **Cancel** button to cancel the zero or span process. Press the **Nominal** button to set nominal values for the Setpoint Output. This will display a message box: "Set nominal zero values. Are you sure?" Press the **Yes** button to set the nominal values, or press the **No** button to cancel the nominal value set. Press the Edit button to display a numeric keypad that will allow the user to edit the zero or span value. This can range from **0.00** to **32767.00**. Press the **Calibrate** button to begin the calibration process. This will display a message: "Begin Calibration. Are you sure?" Press the **Yes** button to begin the calibration process, or press the **No** button to cancel the calibration process.

Press the Done button to return to the *Configuration* menu.



Adam Correction

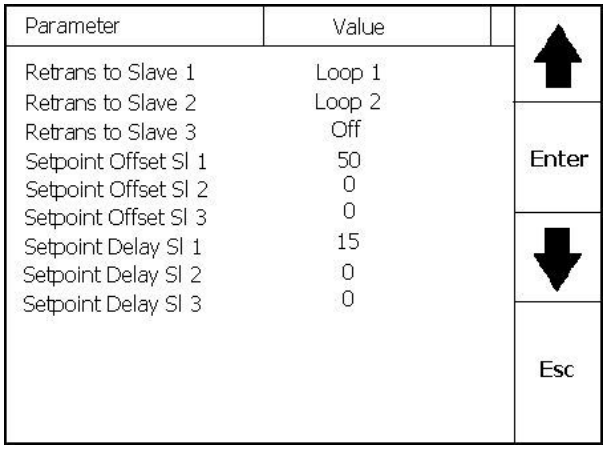
This menu is only used with the Nitrider Control system that utilizes an ADAM module for Load Thermocouples. Contact SSI at 800-666-4330 for assistance with this feature. The ADAM module offset correction menu option gives the

user the ability to offset any input on any ADAM module for up to five ADAM modules. There are eight inputs per module. The offset can be in degrees + or -, and it is typically used to compensate for incorrect T/C wires. The offsets are entered and displayed on the screen without decimal points. For example, an offset of **255** would actually be an offset of **25.5** degrees **+**, and an offset of **–85** would be an offset of **8.5** degrees **-**. The range of the offsets is **–50.0** (**-500**) to **50.0** (**500**).

AUX SP Configuration

This menu is used to setup and assign a setpoint to be transmitted to a slave instrument. The Offset and Delay Time parameters are used to modify the setpoint and when it is sent to the slave instrument. This feature is limited to Slave Instruments 1, 2, and 3. This menu option is typically used to retransmit an alarm setpoint value to an overtemp controller.

The "Retrans to Slave 1", "Retrans to Slave 2", and "Retrans to Slave 3" menu options each have four options to select: **Off**, **Loop 1**, **Loop 2**, or **Loop 3**. These options will allow the user to select which, if any, values to retransmit to the selected slave instrument.



The "Setpoint Offset Sl 1", "Setpoint Offset Sl 2", and "Setpoint Offset Sl 3" menu options can be a number between **–32768** and **32767**. These options will allow the user to set the destination offset for the selected slave instrument.

The "Setpoint Delay Sl 1", "Setpoint Delay Sl 2", and "Setpoint Delay Sl 3" menu options can be a number between **–32768** and **32767**. These options will allow the user to set the delay, in seconds, before the setpoint is retransmitted to the selected slave instrument.

Chapter 4 - PROGRAMS

Overview

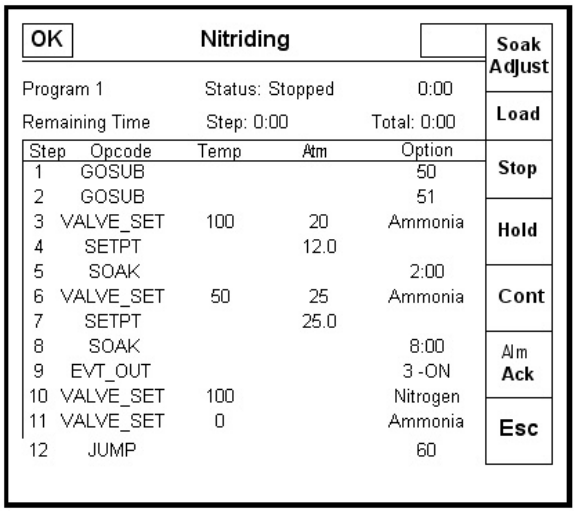
The program format used in the SERIES 9210 provides a simple but powerful recipe language for controlling the heat-treat process. The SERIES 9210 can store up to 300 programs of twenty-four steps each. Each step consists of an opcode that defines what is done at this step. The step can also contain atmosphere, temperature, and option data.

This enhanced step approach provides for shorter programs. For example, a complete boost /diffuse program can be done in twenty-four steps.

The programmer also has alarm capability that can be turned on during a program to monitor deviations and high and low limits while the program is running.

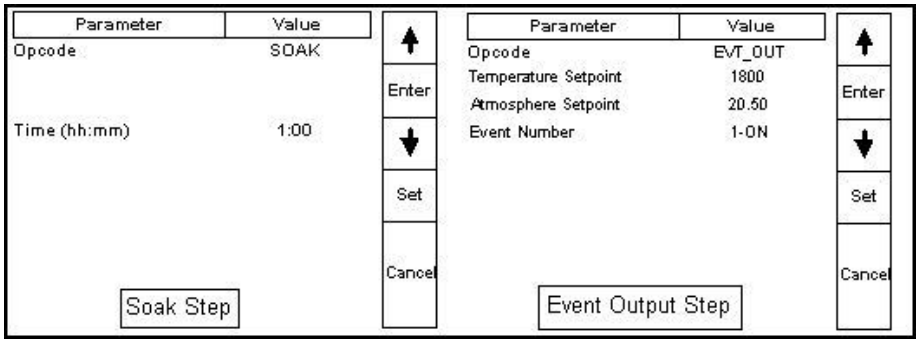
Program Editing

The program edit display is accessed through the **Menu** key on the default display screen. Pressing the **Menu** key displays a screen that contains the configuration items that the operator is allowed to perform. On that screen, running down the right side are five buttons. Below the blue down arrow key is the **Login** key. Pressing this key displays a numeric keypad that allows you to enter the passcode to get to the configuration level (default as shipped from SSi is the number **1**). Pressing the number **1** and then pressing the **Enter** button displays the many configuration menu options, the first option is *Program Edit*. Highlighting this parameter and pressing the **Enter** key displays a numeric keypad that asks you to enter the number of the program that you wish to edit. Pressing that recipe number and then pressing **Enter** displays that particular recipe. You may have to clear the recipe number that is shown in the display box if the number of the recipe to be edited was not the last recipe run on the system. Press the **Clr** button on the numeric keypad and then enter the number for the recipe that you wish to edit.



Step	Opcode	Temp	Atm	Option
1	GOSUB			50
2	GOSUB			51
3	VALVE_SET	100	20	Ammonia
4	SETPT		12.0	
5	SOAK			2:00
6	VALVE_SET	50	25	Ammonia
7	SETPT		25.0	
8	SOAK			8:00
9	EVT_OUT			3 -ON
10	VALVE_SET	100		Nitrogen
11	VALVE_SET	0		Ammonia
12	JUMP			60

To edit a step in the recipe, use the up and down arrow keys to highlight the step that you wish to edit and press the **Enter** key. This will display the Step Edit screen. Highlighting the parameter that you wish to edit and pressing the **Enter** key takes you to the appropriate menu - either that of the Opcode choices, or a numeric keypad to allow you to change the value. *Note: See* Chapter 5 – SERIES 9210 Opcodes *for a list of the opcodes*.



After making the change, press the **Set** button to keep the change, or press the **Cancel** button to cancel the change. This returns you to the *Program Edit* menu screen. The **Insert** button will allow the user to insert a step into the recipe. The **Delete** button will delete a step from the recipe. The **Save** button will display a numeric keypad that will allow the user to save the recipe, either with the original recipe number, or with a new recipe number. This is a quick way to make new recipes using an already existing recipe and changing only those steps that need to be changed. The Esc button will return the user to the *Configuration* menu.

Chapter 5 - SERIES 9210 Opcodes

Programmer Description

The SERIES 9210 series Atmosphere/Temperature 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 consists of an opcode, an optional temperature value, an optional atmosphere value, and an option value. The opcode determines how and if each of the three values are used.

Opcodes

NO-OP This no operation code does nothing and is used as a place hold on programs that are less than 24 steps.

ALARM This alarm function is used to notify the operator that an operation is complete or that a manual action is required. The program waits until the alarm is acknowledged to proceed. The option is the alarm number to display.

ATM_INQ The atmosphere inquiry is used to wait for the actual atmosphere to reach the specified atmosphere setpoint.
The options are:

- wait, reach within band;
- wait up, reach or exceed the setpoint;
- wait down, reach or be less than the setpoint.

The default band can be set under the *Configuration* menu and is typically 10 (i.e. 0.10 percent dissociation).

- 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.

BRANCH The *BRANCH* opcode can change program flow based upon an inquiry opcode. The temperature data is interpreted as the program step if the inquiry is true and the atmosphere data as the program step if the inquiry is false.

CC_SP_L The *Cascade Setpoint Limit* opcode will allow the user 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 This opcode is used when a short delay is needed. The option value is the delay time in seconds.

DEV_AL This deviation alarm opcode is used to turn the temperature or atmosphere deviation alarms ON or OFF.

The option values are:

- OFF, turns OFF both the temperature and atmosphere alarms
- TEMPERATURE, turns ON the temperature alarm and turns OFF the atmosphere alarm

- ATMOSPHERE, turns ON the atmosphere alarm and turns OFF the temperature alarm
- BOTH, turns ON both the temperature and the atmosphere alarms.

The band limit can be changed by the *SET_WAIT* opcode.

DOW_INQ 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 option data is the day of the week, i.e. SUN, MON, TUE, WED, THU, FRI, and SAT.

EVT_IN This opcode waits for an input event to be turned ON or OFF depending on the option value. The option value is the event number followed by either ON or OFF.

If temperature data and or atmosphere data are specified, they are considered setpoints and will be sent to the appropriate controller.

EVT_OUT The *Event Output* opcode turns an output ON or OFF event based upon the option value. The option value is the event number followed by either ON or OFF.

If temperature data and or atmosphere data are specified, they are considered setpoints and will be sent to the appropriate controller.

G_SOAK This is a guaranteed soak opcode. The temperature process value must be within the deviation band to allow the soak timer to run. The option value is the soak time in hours and minutes. The band limit can be changed by the *SET_WAIT* opcode. If Load TC Enable is set to ON, this opcode will wait for all temperature inputs selected to be within the deviation band before starting the soak timer.

GHSOAK This is a guaranteed High soak opcode. The temperature process value must be within the setpoint and the high deviation band range to allow the soak timer to run. The option value is the soak time in hours and minutes. The band limit can be changed by the *SET_WAIT* opcode. If Load TC Enable is set to ON, this opcode will wait for all temperature inputs selected to be within the acceptable band before starting the soak timer.

GHZSOAK This is a *Guaranteed Soak High* opcode for a zone. The temperature process value must be above the deviation band to allow the soak timer to run. The option value is the soak time in hours and minutes. The band limit can be changed by the *SET_WAIT* opcode.

GLSOAK This is a guaranteed Low soak opcode. The temperature process value must be within the setpoint and the low deviation band range to allow the soak timer to run. The option value is the soak time in hours and minutes. The band limit can be changed by the *SET_WAIT* opcode. If Load TC Enable is set to ON, this opcode will wait for all temperature inputs selected to be within the acceptable band before starting the soak timer.

GLZSOAK This is a *Guaranteed Soak Low* opcode for a zone. The temperature process value must be below the deviation band to allow the soak timer to run. The option value is the soak time in hours and minutes. The band limit can be changed by the *SET_WAIT* opcode.

GOSUB The go to subroutine (recipe) opcode is used to call a program 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 levels. The option data is the program number.

GRAMP This opcode changes the temperature setpoint and/or the atmosphere setpoint linearly over time. The option data is the total ramp time in hours and minutes. The temperature data specifies the final setpoint for the temperature setpoint. The atmosphere data specifies the final value for the atmosphere setpoint. This opcode will cause the setpoint change to wait until all temperature

values are within the deviation limit band. If the temperature falls outside of the band, the ramp will wait until the temperature is within the band.

GZRAMP 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. The temperature data is the temperature set point, the atmosphere data is the atmosphere setpoint, and the option data is the ramp time in hours and minutes. The band limit can be changed by the *SET_WAIT* opcode.

GZ_SOAK 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. The option value is the soak time in hours and minutes. The band limit can be changed by the *SET_WAIT* opcode.

HIGH_AL This opcode is used to enable a high limit alarm on the temperature process and/or the atmosphere process. The temperature data is the high limit point for the temperature process. The atmosphere data is the high limit point for the atmosphere process. This alarm remains active until the program ends.

HIGH_PO This opcode is used to enable a high limit alarm on the temperature percent output and/or the atmosphere percent output. The temperature data is the high limit point for the temperature percent output. The atmosphere data is the high limit point for the atmosphere percent output. This alarm remains active until the program ends.

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

ID_INC This opcode increments the ID number by one. No data is required.

ID_INQ This opcode is used to compare the ID value to the value in the temperature data. The option data is equal, high, or low. 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.

IN_inq The *Input Inquiry* opcode will allow the user to check one of the inputs for a specific value. The temperature data is the value to check for. The atmosphere data is the input to check. The options are wait, wait up, or wait down.
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.

JUMP The *JUMP* opcode is used to go to another program when no return is needed. The option data is the program number to execute next. This differs from the *GOSUB* opcode in that the *JUMP* will not return to the calling recipe when the next recipe has finished.

LIMIT This option is used to place a time limit on a wait or inquiry step. The option data is the time limit to wait in hours and minutes. Should the time run out before the wait or inquiry is satisfied an alarm occurs.

LOW_AL This opcode is used to enable a low limit alarm on the temperature process and/or the atmosphere process. The temperature data is the low limit point for the temperature process. The atmosphere data is the low limit point for the atmosphere process. This alarm remains active until the program ends.

LOW_PO This opcode is used to enable a low limit alarm on the temperature percent output and/or the atmosphere percent output. The temperature data is the low limit point for the temperature percent output. The atmosphere data is the low limit point for the atmosphere percent output. This alarm remains active until the program ends.

MV_INQ The millivolt inquiry is used to wait for the probe millivolts to reach the value specified in the atmosphere data.

The options are:
- wait, reach within band;
- wait up, reach or exceed the value;
- or wait down, reach or be less than the value.

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.

PID_SEL This opcode is used to assign a different set of PID parameters to Loop 1, Loop 2 or Loop 3. The temperature data is the Alternate PID set to be used for Loop 2. The atmosphere data is the Alternate PID set to be used for Loop 1. The option data is the Alternate PID set to be used for Loop 3. The PID parameters selected remain active until the recipe selects a different set of PID parameters to use. Setting a value of –1 for each loop will cause the 9210 to use the PID Setup parameters listed under the PID Setup Menu.

PO_INQ The percent output inquiry is used to test the actual percent output of the temperature and/or atmosphere controller.

The options are:
- wait, reach within band;
- wait up, reach or exceed the specified value;
- or wait down, reach or be less than the specified value.

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.

QTCSET This is the *Quench Instrument Setpoint* opcode. This will allow the user to set the setpoint for a quench cycle. The temperature data is the temperature setpoint.

QUENCH The *QUENCH* opcode is used to start a quench cycle. The quench cycle is independent of any program that is running. The temperature data is the quench temperature controller set point. The atmosphere data is the quench time in minutes. The option data can be used to control the agitator speed, high or low, by event #6. Event #6 OFF equals low speed, and Event #6 ON equals high speed. The quench temperature controller must be *Aux Instrument # 4*. The quench cycle starts when the opcode is executed. The setpoint is sent to the quench temperature controller, the timer is started, and the high-speed event is turned on if it is selected. When the quench timer times out, the end of quench cycle (event #7) is turned on for one second and the high speed event is turned off.
NOTE: Not used with Nitrider Application

RAMP This opcode changes the temperature setpoint and/or the atmosphere setpoint linearly over time. The option data is the total ramp time in hours and minutes. The temperature data specifies the final setpoint for the temperature setpoint. The atmosphere data specifies the final value for the atmosphere setpoint.

RAMPR This opcode changes the temperature setpoint at the rate specified in deg/min. The option data is the ramp rate in degrees/minute. The temperature data specifies the final setpoint for the temperature setpoint.

RESET This opcode is used to clear all stacks and timers and starts a program. The temperature data is interpreted as a program number and the atmosphere data as a program step. The option data is not used. The RESET is useful in a weekend shut down program to restart the normal operating program.

SET_AUX The *Set Auxiliary Instrument Setpoint* opcode is used with other instruments in the process such as flow control or belt speed. The temperature data is the setpoint and the option data is the instrument number.

SET_BP This opcode is used to set the backpressure set point. The atmosphere data is the atmosphere setpoint. The options are None, Wait up & Wait down

SET_FCM This opcode sets the gas flow control mode. There are four options: Individual trim, Flow control adjusts two valves, Ratio control – Maintains constant ratio between NH3 +, Auto switch – Switches between Options 1 & 2 based on the DA switch point.

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

SET_FACT This opcode is used to set the CO factor or the H2 factor of the atmosphere controller. If the atmosphere type for the loop is set to dew point then the H2 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 option data is wait, wait up, or wait down. This allows the control loop to recover from the change before continuing the program.

SET_WAIT This opcode sets the band limits for the wait option or inquiry opcodes. The temperature data specifies the temperature band (i.e. +/- the value) and the atmosphere data specifies the atmosphere band.

SETPT This opcode is used to set the temperature and/or atmosphere setpoints. Either or both of the setpoints can be specified. The options are None, Wait up or Wait down. If both setpoints are specified the Wait applies to both.

SOAK This opcode is an unconditional soak for the time (in hours and minutes) specified in the option data.

TC_INQ The temperature inquiry is used to wait for the actual control temperature to reach the specified temperature setpoint.
The options are:
- wait, reach within band;
- wait up, reach or exceed the setpoint;
- or wait down, reach or be less than the setpoint.

The default band can be set under the configuration menu and is typically 15degrees. 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.

TOD_INQ This opcode is a time of day inquiry which would be used to start a process or subroutine at a specific hour and minute. The option data is entered in the 24 hour format (i.e. 2:30pm is 14:30).

TZ_INQ The zone temperature inquiry is used to wait for the actual control zone temperature to reach the value specified in the Temperature data.
The options are:

- wait, reach within band
- wait up, reach or exceed the set point
- wait down, reach or be less than the set point

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.

VALVE SETPOINT This opcode is used to set the flow rate of gas for each valve. The temperature data is the Setpoint Value. The atmosphere data is the Trim Range. The option data is the valve.

ZONE_OFF The *Zone Offset* opcode is used to set an offset to be added to the set point sent to a specific zone. Either temperature, atmosphere, or both can be offset. 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 data = 50 and zone = 1, then a temperature set point value in the following steps of 1700 would be sent to the middle and bottom as 1700 and the top as 1750.

Z_SETPT This opcode is used to set the temperature and/or atmosphere set points for a zone. Either or both of the set points can be specified. The options are None, Wait, Wait Up, or Wait Down. If both set points are specified, the Wait applies to both.

Chapter 6 - APPLICATIONS INFORMATION

Standard Event Assignments

To simplify operation and maintain consistency, SSI has adopted the following event assignments.

Event 0	Nitrogen Addition
Event 1	Ammonia Addition
Event 2	Disassociated Ammonia Addition
Event 3	Hydrogen Addition
Event 4	Spare
Event 5	Spare
Event 6	Spare
Event 7	Sample Cell Enable
Event 8	Spare
Event 9	Spare
Event 10	Spare
Event 11	Spare
Event 12	Spare
Event 13	Spare
Event 14	Spare
Event 15	Spare

Typical Nitriding Instrument Designations

Instrument 7 – Nitrogen
Instrument 8 – Ammonia
Instrument 9 – Disassociated Ammonia

Nitriding Recipes/Programs

Nitriding Recipes can be broken down into three stages, Startup, Nitriding and Shutdown
In the Startup phase of the recipe, the furnace starts to heat up and is purged with Nitrogen. As a general rule to assure safe operation of the furnace, the furnace should be purged with Nitrogen long enough to allow for 5 to 7 volume changes. This ensures that it will be safe to add Ammonia and/or Dissociated Ammonia when required. This purge time is determined by calculating the furnaces volume and dividing by the Nitrogen Flow. The startup phase can also start adding ammonia once the desired purge time and temperature has been achieved.

In the Nitriding process stage of the recipe, the temperature and %Dissociation/Kn setpoints are set and the Soak times are set as well. This phase will also enable the Trim enable feature for ammonia to allow for control of the furnace atmosphere to setpoint.

After the Nitriding process stage, the shutdown routine will run. This typically involves, shutting off the Ammonia and Dissociated Ammonia, turning on Nitrogen and lowering the temperature setpoint to allow the furnace to cool. This stage will also sound an alarm indicating the process is complete.

SAMPLE RECIPES

Recipe 1

Step	OpCode	Temp	ATM	Options
S1	Go-Sub			50

S2	Go-Sub			51
S3	Valve_Set	1000	20.0	Ammonia
S4	Set-Pt		12.0	
S5	Soak			2.00
S6	Valve_Set	500	25.0	Ammonia
S7	Set-Pt		25.0	
S8	Soak			8.0
S9	Evt-Out			3 - On
S10	Valve_Set		100	Nitrogen
S11	Valve_Set	0		Ammonia
S12	JUMP			60

Recipe 2

Step	Opcode	Temp	ATM	Options
S1	Go-Sub			50
S2	Go-Sub			51
S3	Valve_Set	1000	20.0	Ammonia
S4	Set-Pt		12.0	
S5	Soak			3.00
S6	Valve_Set	600	25.0	Ammonia
S7	Set-Pt		27.0	
S8	Soak			9.0
S9	Evt-Out			3 - On
S10	Valve_Set	1000	100	Nitrogen
S11	Valve_Set	0		Ammonia
S12	JUMP			60

Recipe 3

Step	Opcode	Temp	ATM	Options
S1	Go-Sub			50
S2	Go-Sub			51
S3	Valve_Set	900	30.0	Ammonia
S4	Set-Pt		12.0	
S5	Soak			4.00
S6	Valve_Set	600	25.0	Ammonia
S7	Set-Pt		22.0	
S8	Soak			18.0
S9	Evt-Out			3 – On
S10	Valve_Set		100	Nitrogen
S11	Valve_Set	0		Ammonia
S12	JUMP			60

Recipe 4

Step	Opcode	Temp	ATM	Options
S1	Go-Sub			50
S2	Go-Sub			51
S3	Valve_Set	900	30.0	Ammonia
S4	Set-Pt		12.0	
S5	Soak			4.00
S6	Valve_Set	600	25.0	Ammonia

S7	Set-Pt		22.0	
S8	Soak			28.0
S9	Evt-Out			3 – On
S10	Valve_Set	1000		Nitrogen
S11	Valve_Set	0		Ammonia
S12	JUMP			60

Recipe 50

Step	**Opcode**	**Temp**	**ATM**	**Options**
S1	EVT-OUT	150	0	1 - ON
S2	EVT-OUT			2 - ON
S3	EVT-OUT			5 - ON
S4	SETPT	600		
S5	G-SOAK			2.00
S6	EVT-OUT			3 - ON
S7	Valve_Set	80		Nitrogen
S8	SOAK			1.0
S9	EVT-OUT			2 - OFF
S10	EVT-OUT	975		4 - ON
S11	Valve_Set	100		Ammonia
S12	Valve_Set	0		Nitrogen

Recipe 51

Step	**OpCode**	**Temp**	**ATM**	**Options**
S1	SOAK			0.05
S2	EVT-OUT			3 – OFF
S3	SOAK			1.00
S4	EVT-IN			1 – ON
S5	NO OPT			
S6	NO OPT			
S7	NO OPT			
S8	NO OPT			
S9	NO OPT			
S10	NO OPT			
S11	NO OPT			
S12	NO OPT			

Recipe 60

Step	Opcode	Temp	ATM	Options
S1	EVT-OUT			17 – OFF
S2	EVT-OUT	150	0.0	2 – ON
S3	SOAK			0.05
S4	EVT-OUT			4 – OFF
S5	TC-INQ	200		Wait Down
S6	Valve_Set	0		Nitrogen
S7	SOAK			0.05
S8	Jump			61
S9	NO OPT			
S10	NO OPT			
S11	NO OPT			
S12	NO OPT			

Recipe 61

Step	Opcode	Temp	ATM	Options
S1	EVT OUT			1 – OFF
S2	EVT OUT			2- OFF
S3	EVT OUT			3 – OFF
S4	EVT OUT			4 – OFF
S5	EVT OUT			5 – ON
S6	ALARM			1
S7	NO OPT			
S8	NO OPT			
S9	NO OPT			
S10	NO OPT			
S11	NO OPT			
S12	NO OPT			

Flow Section
Nitriding Gas Supply

The Nitriding gas supplies enter the flow section from the top. Each gas has a manual shut off valve as well as a regulator (regulators optional). The regulators are to protect against fluctuations in incoming supply pressures. The location for each incoming gas inlet is as follows from left to right: Nitrogen, Ammonia, and Disassociated Ammonia. Pressure regulation should be set between 12 and 20".

High and Low Pressure Switches

Each gas has a High and Low pressure switch. The location of these switches are just below the manual valves for the incoming gas. The High Pressure Switch is on top and the Low Pressure Switch is on the bottom. The switches have green LED indicators to indicate the pressure condition. Example, If the LED indicator is OFF on the High Pressure switch then the incoming pressure from the supply gas is to high and the condition generates an audible alarm. Each pressure switch has a dial setting on the front to make adjustments to the switch. The pressure switches are set by SSi at the time of panel checkout. SSi presets the regulators for 15" water. The High and Low Pressure switches are set based on this value. Any questions on the settings please call SSi technical support at 800-666-4330.

Vessel Pressure Switches

Vessel Pressure is the accumulated pressure of all gases flowing through the furnace. The switches for Vessel Pressure are located to the immediate right of the gas pressure switches. These pressure switches have LED's to indicate high and low pressure.

Sample Ports

Each gas has a sampling port below the pressure switches. To take a flow pressure reading using a manometer, just connect the manometer to the sampling port and turn the manual valve until it is open. Make sure the incoming supply valve for the gas being checked is also opened.

Emergency Nitrogen

Emergency Nitrogen can be added to the system in the event of an emergency. The operator can initiate Emergency Nitrogen purge by turning the Emergency Nitrogen switch on the front of the control panel to

ON. The Emergency Nitrogen solenoid is a normally open solenoid and will be open on power failure to the control panel.

Flow Head Unit

The process gas flow system is located below the sampling The flow head unit is divided into the following parts; flow control boards, valves, High and Low limits.

Flow Control Boards - Each gas has an individual flow control board associated with the gas. The board is located in the flow head unit and communicates to the 9210 controller. The flow control board has a comm port on it that can be switched between RS-485 and RS-232. The board must be in the RS-485 mode to communicate with the 9210. The RS-232 mode allows for communication directly to a PC running the configuration software. The RS-232 mode allows for downloading of flow curves and troubleshooting. On the front of the flow head unit the LED display shows flow of each gas in SCFH. The LED's on the front of the unit display the following: Auto/Manual, Alarm, V1, V2.

Auto/Manual - When the Auto/Manual LED is ON the board is in the Auto Mode being controlled by the 9210. The switch on the front of the control panel for each gas allows for the board to be put in Auto, Hand (Manual) or OFF. The LED will be OFF when the switch is in Hand position. The operator can turn the valve wheel by hand in this condition.

ALM – This indicator shows when the board is in an Alarm condition. Alams include max range or high limit switch made.

V1 – V1 indicates the direction the valve is moving. The LED is OFF when the valve is closing and ON when the valve is opening.

V2 – V2 indicates the board is given a Run/Stop command. The LED is OFF when the valve is receiving a Stop signal. The LED is ON when the valve is being given a Run signal.

Valves - Each gas has a needle valve attached to a motor. The motor drives the needle valve via a worm gear. The needle valve shaft has a wheel attached with a set screw that allows the valve to be turned by hand. If adjusting the wheel by hand unplug the connector from the drive so the 9210 is not trying to open or close the valve during hand adjustment.

Limit Switches - Each valve has a limit switch that will not allow the valve to open past a preset limit. ***These upper limits need to be set in the field for each gas.*** Before setting the upper limit, the maximum SCFH needs to be known for each flow meter. Instructions for setting the upper limits are as follows:

1. Loosen the set screw on the wheel.
2. Send a setpoint to the valve to obtain the maximum flow desired.
3. Allow the valve to settle at the desired flow.
4. Pull the wheel up till the limit switch is activated.
5. Tighten set screw.
6. Repeat for each valve.
7. Drive each valve closed and then open past the max range to test the limit switch. Be sure to have the event for that specific flow meter turned on under manual events.

Mass Flow Meters

The Mass Flow Meters are located below the Flow Head Unit. The flow meters send a 4-20ma signal to the flow boards to indicate actual flow. If there is no flow it will trigger a Lo FL alarm. If the flow meter has reached its maximum, all LED's will be ON and the last one will be flashing. Each Mass Flow meter is calibrated for a specific range of flow depending on the gas associated with the meter.

Gas Solenoids

Each gas has an associated solenoid, which turns on to allow flow. The gas solenoids are located below and behind the Mass Flow Meters. The gas solenoids can be activated manually by turning the switch on the control panel to HAND for the appropriate gas. The solenoids are also controlled by the 9210 through the events in the recipe and on the manual events menu screen.

Back Pressure Valve

The Back Pressure valve is located behind and to the right of the Flow Head Unit. The Back Pressure valve is attached to the exhaust of the furnace. The valve provides the necessary back pressure to allow flow through the Sample Cell. The valve also provides the ability to restrict the outside oxygen from entering the furnace through the exhaust. During a power outage the Back Pressure valve opens fully to vent all gases and nitrogen purge out of the furnace.

Differential Pressure Transmitter

The Differential Pressure Transmitter is located to the right and below the Gas Solenoids. The transmitter sends a signal to the 9210 which controls the amount of back pressure to be applied to the system. It is critical that no restrictions in the line other than the back pressure valve create the actual pressure. IF the back pressure valve indicates pressure higher than setpoint and the valve is open this is an indication of a restriction or water down stream.

Drip Legs

There are three drip legs associated with the flow section. The drip leg valves need to be opened under the following conditions;

1. Whenever heating up the furnace under air. Heating the furnace under air causes condensation to build up in the exhaust. The buildup of water in the exhaust lines affects the back pressure reading. The error in back pressure will affect the reading of the sample and directly affect dissociation readings.
2. Prior to the addition of ammonia into the furnace. After the heat up of the furnace, when the furnace is at temperature, the drip legs should be opened briefly to allow any water buildup to escape.
3. Any time during blowout of lines during cool down cycles and Nitrogen flow.

DO NOT OPEN DRIP LEGS DURING AMMONIA FLOW OR DISASSOCIATED AMMONIA FLOW. GASES ARE TOXIC AND VERY HAZARDOUS.

The location of the drip legs are as follows:

1. At the bottom of the exhaust line
2. Below the differential pressure transmitter.
3. bottom of the Sample Cell.

Sample Cell Solenoid

The Sample Cell solenoid is energized by event 7 through the program or manual event control. The solenoid should only be energized when the furnace is up to temperature and the event is turned ON. Gas is allowed to flow to the sample cell when the solenoid is energized.

Sample Cell Filter

The filter on the inlet side of the Sample Cell Box can become clogged. The part number for a replacement filter is 37051.

DO NOT CHANGE THE FILTER WHILE AMMONIA OR DISASSOCIATED AMMONIA IS FLOWING. THE GASES ARE TOXIC AND VERY HAZARDOUS.

The steps for replacing the filter are as follows;

1. Close all incoming gas valves.
2. Unscrew the clear bowl from the filter housing.
3. Unscrew the filter holder. The holder is the black plastic knob in the center of the filter.
4. Pull off old filter and replace with new.
5. Screw the filter holder back into the top of the filter housing.
6. Screw the clear bowl back on the housing.
7. Open incoming gas lines

Flow to the sample cell should be a minimum of .5 scfh and a maximum of 2.0. This flow is critical to the nitriding process. If flow is low replace the filter. **If you are unable to maintain flow contact Super Systems Inc at 1-800-666-4330 immediately**.

Super Systems Nitriding Sample Cell

1.0 Introduction

1.1 Applications

This Card is designed to be a Nitriding Sample Cell for Super Systems.
The unit is calibrated for either
(1) 0 to 100% Hydrogen in a background of Methane and Carbon monoxide.
(2) 0 to 75% Hydrogen in dissociated Ammonia (calibrated on 100% H2)

1.2 System Description

The system comprises an electronic unit Consisting of two PCBs mechanically connected via pillars. The lower card provides power and process control options The secondary card with the Nitriding Sample Cell mounted on it offers the signal conditioning and communications port.

1.3 System Highlights

The Unit is provided:

- PCB mounted Nitriding Sample cell
- RS232/485 Communications

.
.逸Voltage free contacts (optional)
.a. High alarm 1:-option
.b. High alarm 2:- option
. 逸Isolated analog output (0…5V) Optional
. 逸24V power supply.

1.4 Unpacking and Visual checking

Take all normal precautions when opening the packages. In particular, avoid the use of long bladed cutters. Check that all pipe connections have compression nuts and olives intact. Search packing if any are missing. Check for any sign of damage. Carefully remove any internal packing material.

2.0 SPECIFICATION

2.1 Enclosure - NA

2.2 Dimensions

Electronics unit: H. 180mm W.85mm D.60mm See figure 1.

2.3 Ambient Temperature

Sensor unit: -10…50°C Max

2.4 Display - NA

2.4 Analog outputs – isolated (Optional)

4…20mAV proportional to 0..100% Hydrogen (minimum load 500 ohm.) Optional

2.5 Alarm indicators (Optional)

Voltage free contacts SPDT Relay 1A /120Vac or 2A /240Vac

- High alarm 1 relay (Set to 0.6% Hydrogen)
- High alarm 2 relay (Set to 1.0% Hydrogen)

2.6 Communications RS232

Set up: 9600 Baud, 1 start bit, 8 data bits, 1 stop bit, no parity, hardware (CTS/RTS) handshaking.
See Appendix 1 for proposed communication protocol.

DTE male 9w	
PIN	NAME
3	TX(out)
2	RX (in)
7	RTS (out)
8	CTS (in)
5	GND

RS485
Optional

2.8 Speed of Response

Typical T90 for combustion gas application is 30 seconds.

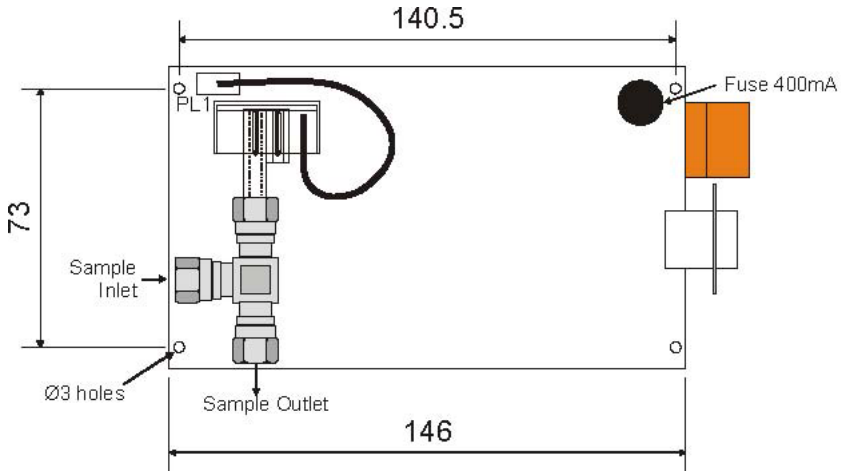
2.9 Power Requirements

Voltage: 24Vdc +/- 5%

Power: 10W

2.10 Gas Connection

The standard connections are captive seal compression fittings suitable for 0.25" (or 6mm) diameter tube on the sample inlet and sample outlet. The tubing must be sturdy enough to withstand the slight compression applied by the tightened coupling. Metal, nylon or other rigid plastics are suitable. Rubber, PVC etc. are only suitable if a supporting insert is used. See figure 1 for inlet / outlet



78

DTE Male 9w	
PIN	NAME
3	TX (out)
2	RX (in)
7	RTS (out)
8	CTS (in)
5	GND

Figure 2: Sensor

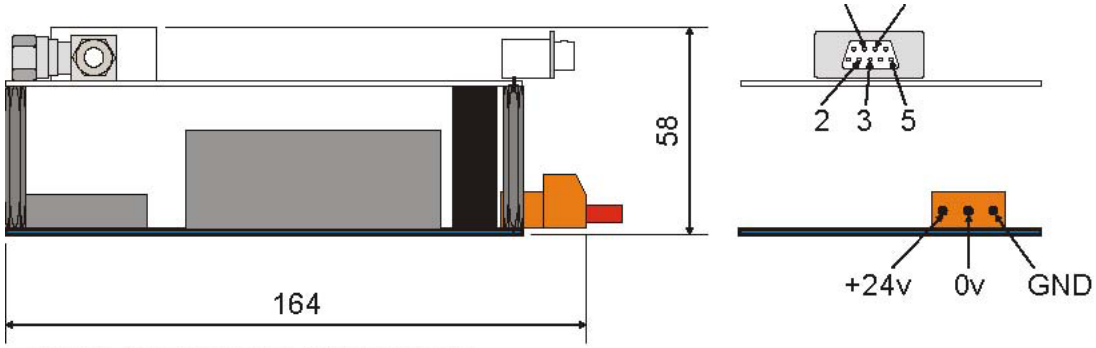


Figure 1: Enclosure dimensions

4.0 CALIBRATION

4.1 General Frequency

The Nitriding Sample Cell based analyzer is an extremely stable instrument and requires only very occasional calibration. The exact calibration period depends on the type of sample and environment the instrument is placed in. We recommend that any quality assurance procedures written for the instrument are written to allow verification as opposed to calibration. Verification involves checking that the instrument provides the correct analysis of a standard gas within the limits of the instrument and only calibrating when a result outside of limits is produced. The frequency of the verification would need to be in line with the quality regime being operated by the user.

4.2 Calibration method

NOTE: Calibration requires a computer (laptop) with an available serial port and HyperTerminal software.

Introduce the calibration gas in the same way as the normal sample.
The sample cell should be isolated from the process gas and the calibration
gas introduced into the Sensor at the correct flow rate. Note that pressure regulators and gauges that may be in the calibration gas lines all have a certain amount of dead space within them and so may require purging for several minutes before the delivered gas matches that of the cylinder contents. Only when the reading is steady has the dead space been purged.

The recommended order of calibration is:
逸***Z****ero=xxx.xx<CR><LF>.command where xxx.xx = 0 (See appendix 1)*
The Zero point will use 100% Nitrogen
逸 ***S****pan=xxx.xx<CR><LF>. command where xxx.xx = 100 (See appendix 1) The Span point will use 100% Hydrogen*

5.0 TECHNICAL INFORMATION

The Nitriding Sample Cell is a device that produces an output that is a function of the thermal conductivity of the gas surrounding its sensor. Gases differ in their thermal conductivity and the thermal conductivity of a mixture is approximately the mathematical average of the thermal conductivity and concentration of each component. Because thermal conductivity is a bulk physical property of the gas its measurement is not specific for any component. The Model 9210 is programmed in such a way that it assumes the components are always the same species, e.g. oxygen, nitrogen and carbon dioxide. If a gas mixture containing other components is introduced into the sample cell it will not produce the correct readings.

6.0 SERVICING

The Nitriding Sample Cell sensor is non-depleting and will last indefinitely if not subjected to misuse. The sensor can only be replaced by the use of specialist equipment and would have to be returned to Super Systems or their agent should a replacement be required.
Questions on the analyzer should be directed to Super Systems Inc. It is important that the serial number or job number are quoted. These numbers may be found on the data label on the rear panel.

Appendix 1

1.1 Communications Protocols.
1.2 RS232 Command communications.

Data is transmitted upon request *in normal operation and calibration* modes.
Transmission is suspended during boot and in edit mode, and in the case of an error. The protocol can be either in a terse format (i.e.**D)** or in instruments supporting the extended readable format (i.e. Data).
Command : DTE to instrument Format : *Command=xxx.xx <CR><LF>.*

Command	function	reply
***D**ata=x<CR><LF>.*	Request for diagnostic data. Optional =”x” is specifying the required line of data	D2 Ref=1234b D1 M1= 2222b
***R**eading=x<CR><LF>.*	Request for Reading. Optional =”x” is specifying the required line of reading in sensor with multiple data sets.	R2 CO2=0.01r R1 H2= 20.0%
***Z**ero=xxx.xx<CR><LF>.*	Request to zero the sensor assumed 0.00. Optional. =”xxx.xx” is specifying the zero point data.	Z1 pass or Z1 fail
***S**pan=xxx.xx<CR><LF>.*	Request to Span the sensor. data assumed 100.00% of sensors span. =”xxx.xx” is optional specifying the Span point data. Otherwise.	S1 pass or S1 fail

=XXX.xx is optional and must be proceeded by an "=" and is used to set the value of the action.
The message is: Reqest Y Quantity = *xxxxx* unit <CR><LF>.
Request: is the first character of the command D R S Z

Y: is the line number for the data.
The highest line number is always presented first hence line 1 is always the last data line of a communication.
Extension is when "x" is specified the only that line number will be returned.

Quantity: is one of H2 CO CO2

xxxx: is the measured quantity. The resolution is the same as the display:
Unit: is one of % percent r compensation ratio
The compensation ratio is the diagnostic data for instruments with a secondary gas background. When requested as a data it will return the present ratio for compensating the primary measured gas "R1"
I.e. for H2 in N2 with a secondary gas of CO2
D1 CO2=0.069r If you know the concentration of the CO2 can calculate the correction in the H2 reading as H2- (CO2 * 0.069)
In over-range condition (when the display shows 'HI') xxxxx will be '+++++' In under-range condition (when the display shows 'LO') xxxxx will be '-----'

Controller.	Sensor	
Reading	R1 H2= 98.5%	Instrument request a reading
Span=99.0	S1 Pass	Controller requests a span setting of 99.0%
Reading	R1 H2= 99.0%	

I.e. this would set the present instrument reading to 99.0% The unit "%" is assumed to be the same as the reading.

Error messages

Error messages take the form '? xx' where 'xx' is a numeric code as explained below Comms. Errors:

Code	Error	Description
90	Buffer overflow	More than 15 characters were received without message terminator (<CR><LF>). Any subsequent characters will begin a new message.
91	Message timeout	10 seconds has elapsed since the last character was received without message terminator.
92	Bad opcode	Message was received correctly terminated but not understood (e.g. 'Fred=1<CR><LF>')
93	Bad operand	Message was received correctly terminated and understood but the line number wasn't (e.g. 'Reading=Q<CR><LF>').

System errors:

Code	Error	Description
71-76	NVRAM CRC error	Three areas exist (1,3 & 5) each with a backup (2,4 & 6). Area 1 contains user parameters i.e. calibration data and the backup is write protected so if this area is restored user calibration etc is LOST. Error 71 will be reported in response to any read request until either a calibration is performed or the instrument is rebooted. Areas 3 & 5 are read only so they can be silently restored. Errors 73 & 75 therefore should never be reported, although they exist internally until they clear themselves. Errors 72,74 & 76 will be reported in response to any read request and cannot be cleared.
77- 78	TCD curve error	In reading curve data from EEPROM the instrument has attempted to read beyond the ends of the curve.
79	Wrong block no.	The serial numbers of the Nitriding Sample Cell stored in areas 1 & 5 (in separate devices) do not match
80	UART missing/error.	For debugging only. Since the only interface available is RS232, this error can never be reported!
81	Reserved	For external EEPROM not found.

Nitriding Sample Cell cleaning

Safety Notes- *Warning!*

Hazardous gas or dangerous chemicals formed by the process may be present.
Check with your site safety officer before handling or removing the sensor.
Isolate all external circuits before removing sensor.

Important!

Do not push objects into the sensor, it is easily damaged!
The sensor must be dry before it is reconnected and power applied.

1. Remove sensor from its mounting bracket by slackening the mount fitting (See Figure 1).

2. Disconnect the cable according to connector type:
   - Terminal: Unscrew the connections ensuring the label specifying color is still present. If removed note the color sequence.
   - Push fit: Gently pull the latching part to remove the connector.

3. Wash the sensor in de-ionized water by filling the sensor tube and repeatedly flushing. Use gentle agitation for a deeper clean.

4. Drying can be achieved by:
   - Washing the sensor with iso-propanol (IPA) then immediately blowing dry air or heating (max 60c).
   - Allowing Nitrogen (dry gas) to flood the cell for a period of 12 hours. Heating (max 60c) can reduce time period.

WARNING: Flammable, do not use on live electrical equipment or other sources of ignition.

5. Refit sensor and allow the reading to settle before following the calibration routine specified in the user manual.

(FIG. 1)

Appendix 2 - TC Type mV Range Chart

TC Type	Range in mV
B	20
C	40
E	80
J	80
K	80
N	80
NNM	80
R	40
S	20
T	20

Revision History

Rev.	Description	Date	MCO #
-	Initial Release	04-24-2001	N/A
A	Added Revision History	01-26-2005	N/A
B	Added Flow Section	04-15-2005	N/A
C	Added Sample Cell Calibration and Cleaning	04-29-2005	N/A
D	Updated "Revision History" section – added "MCO #" column; Update screen shots; Updated Configuration menus; Added newer opcodes; Updated logo on title page; Updated "Valve Configuration" and "Valve Setup" sections	01-10-2008	2057