SuperSystems incorporated

Single Gas Analyzer for H_2

OPERATIONS MANUAL

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Table of Contents

Introduction

SSi provides single gas analysis technology for use in heat treating and other production environments. This manual covers the following product line used for the analysis of single gas composition. The Single Gas Analyzer (SGA) includes a color touch screen and detection cell with intelligent electronics contained in a metal enclosure designed for rugged industrial environments. It also includes an internal pump for gas sampling as well as a visual flow meter to indicate sample flow. The SGA is preconfigured for detection of hydrogen (H_2), carbon monoxide (CO), carbon dioxide (CO_2), or methane (CH_4) depending on customer needs.

Hydrogen Gas Measurement

This manual covers the SGA used for measuring H_2 gas. The H_2 gas sensor uses thermal conductivity to detect the presence of H_2 in the gas sample. Trend charting of H_2 and other calculated values are available via the touch screen. Control and monitoring are possible with the touch screen interface and Ethernet-based web interface. The SGA also includes onboard datalogging and communications via serial connection, USB, or Ethernet.

Oxygen Measurement Option (with Additional Sensor)

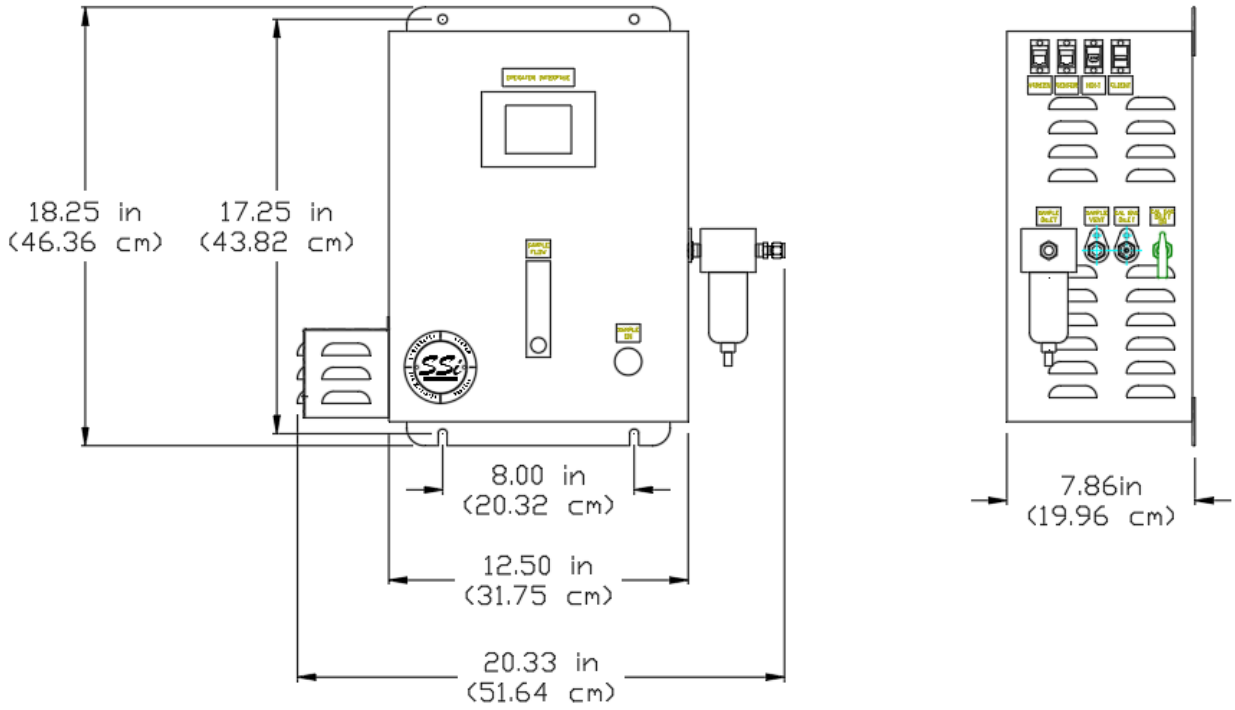
The SGA provides the option of O_2 detection and monitoring with the addition of an external O_2 sensor wired into the unit.

Specifications

H_2 Sensor	
Range	0 – 100% of gas concentration
Accuracy	±1% of full scale (±0.1% of gas concentration, based on 100%)
Resolution	0.1%
Measurement Method	Thermal Conductivity
Response Time	0 – 6 seconds
Power Supply Input Voltage	110VAC or 230VAC
Maximum Operating Temperature	122 °F (50 °C)
Analog Outputs	2 (4-20mA or 0-5 V)
Serial Communications	2 RS485 ports using Modbus RTU, configurable baud rate
Ethernet	1 port
USB	1 Type A port, 1 Type B port

O_2 Sensor (Add-On Sensor, Mounted Externally)	
Part Number	31435
Measurement Range	0 - 21%
Accuracy	±0.1%
Measurement Method	Lambda Zirconia

Mechanical Diagrams



Enclosure and mounting hole measurements

Initial Network Configuration

This section is intended for use by persons familiar with Ethernet network setup. The SGA has two devices capable of communicating through Ethernet; the touch screen and the sensor. The touch screen is setup with a dynamic IP Address assigned by the network to which it is connected. The sensor has a static IP Address. The default IP Address of the sensor is 192.168.1.200.

The simplest way to locate the sensor's IP address is to use the touch screen interface. Go to the Communications screen in the Menu options. Details are provided in the Communications (Menu Options) section of this manual. There, the IP Address, Subnet Mast, and Default Gateway are listed. Those values can be changed by highlighting the value and pressing the Edit button.

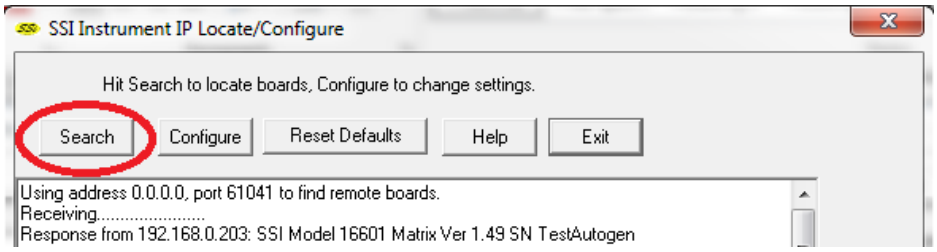
If the touch screen is not available, the IP Address of the sensor can also be found by using SSi's *nLocateIP* software. This method is described in the following subsection.

nLocateIP Method

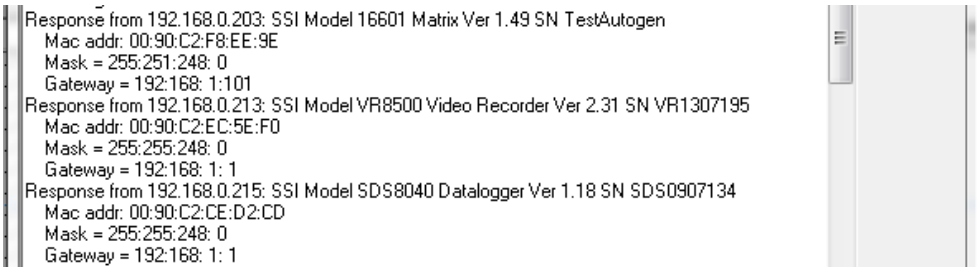
Once the unit is connected to the network, you should be able to locate it using SSi's *nLocateIP* software. This program is available from SSi. To use it in locating the unit on the network, follow these steps on a Windows-based PC:

1. Ensure that the unit is connected to the network.
2. Open the nLocateIP program

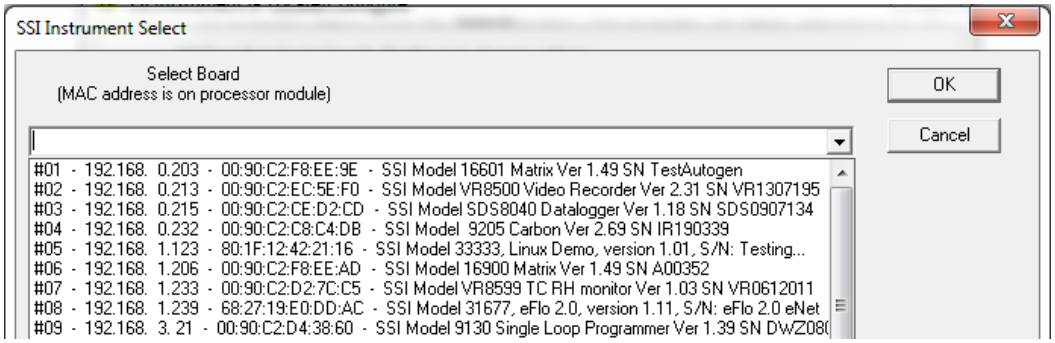
3. Once the program opens, click the **Search** button. The program will begin searching for SSi devices connected to the network.



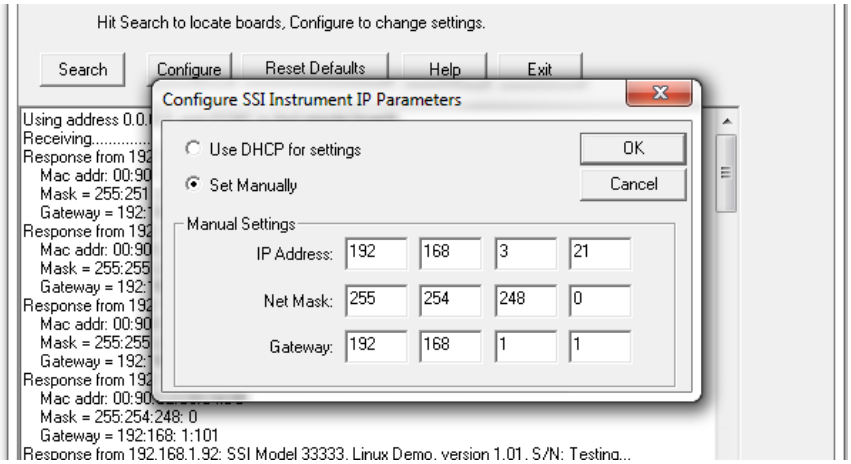
4. Look for identifying text in the list of instruments. It includes the type of instrument and serial number. It also provides the IP Address information for the sensor.



5. Click the **Configure** button and choose the sensor to change its IP Address settings.



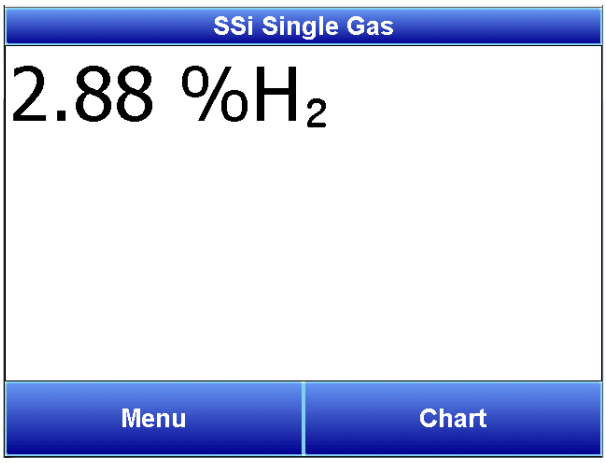
6. Click on the device description to highlight it and click the **OK** button. This will display the device's IP settings, which can be changed to match the network to which it's connected.



The sensor's IP Address settings will be changed immediately to allow it to communicate. If you are unable to find the unit in the list of devices, it is possible that a network setting (such as subnet mask) may be different, the unit may be connected to a different network, or the unit may not be powered on. SSi recommends consulting an IT engineer or network administrator. If needed, call SSi at (513) 772-0060.

Touch Screen Interface

Main Screen



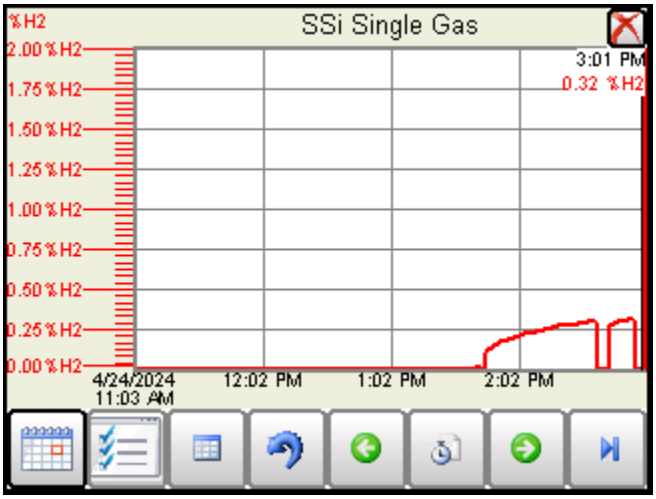
The Main screen shows the current percentage of H_2. From here the user can enter the **Menu** screen or the **Chart** screen.

Menu Screen

The Menu screen also allows the user to log in to gain access to additional functions. Pressing the **Login** key at the bottom of the screen will allow the user to enter a login user and password. User names and passwords are case sensitive. There are three levels of security for the menu system: **Operator**, **Supervisor**, and **Administrator**. Pressing the **Login** button will allow the user to enter a user name and numeric password to log in. When the menu screen is first displayed, the operator-level menu options are visible. The supervisor menu options will be displayed with the login number 1. The Administrator menu options will be displayed with the login number 2.

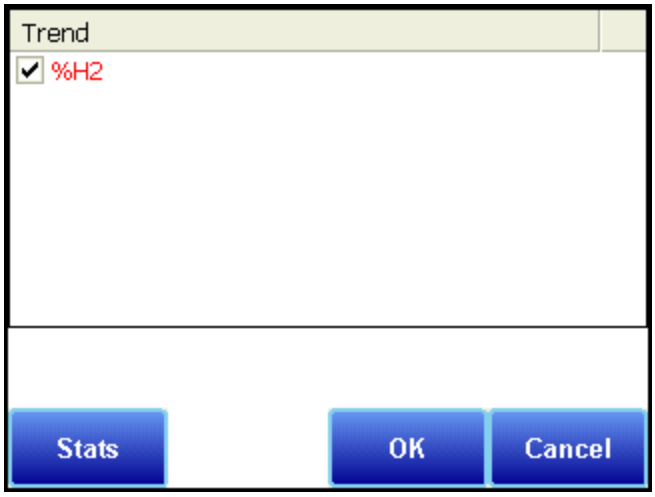
The Menu options are described in the Instrument Information (Menu Options) section of the manual.

Trend Chart



The Trend Chart Display shows between 1 hour and 24 hours of process variable data on the screen and can be scrolled back to view all of the data stored on the hard drive. The vertical timelines change as the time changes on the screen.

The function buttons run along the bottom of the screen.



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

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

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

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

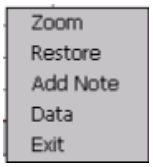
The chart interval button -  - will determine the number of hours displayed on the trend chart. The options are: **1 Hour**, **2 Hours**, **4 Hours**, **8 Hours**, **12 Hours**, or **24 Hours**.

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

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

Chart Sub Menu

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



The sub-menu will have the following options available: **Zoom**, **Restore**, **Add Note**, **Data**, and **Exit**.

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

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

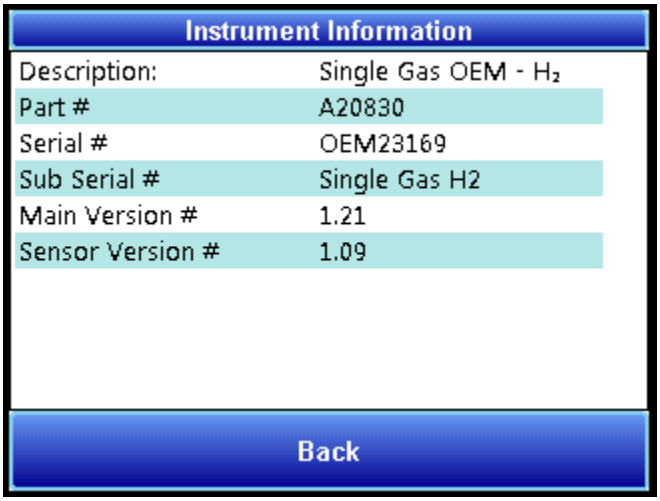
The **Add Note** option allows the operator to enter a note on the chart, similar to writing on a paper chart. The note shows up when the chart is printed out using the utility software included with the SGA instrumentation. Pressing the **Add Note** option displays a screen where the operator can enter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

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

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

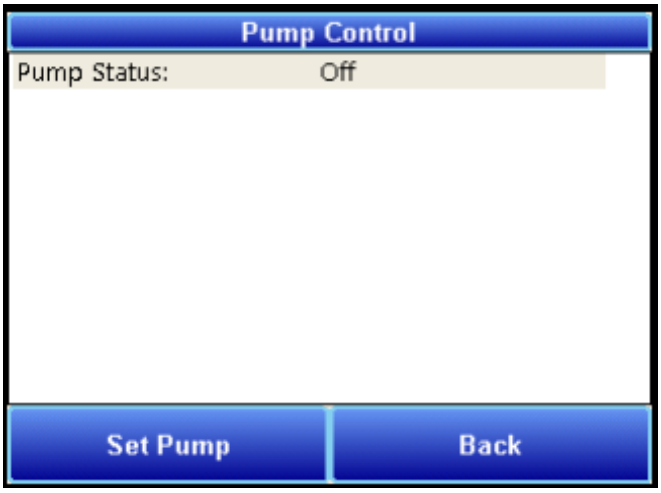
Pressing the red 'X' in the top right-hand corner of the screen will take the user back to the status screen.

Instrument Information (Menu Option)



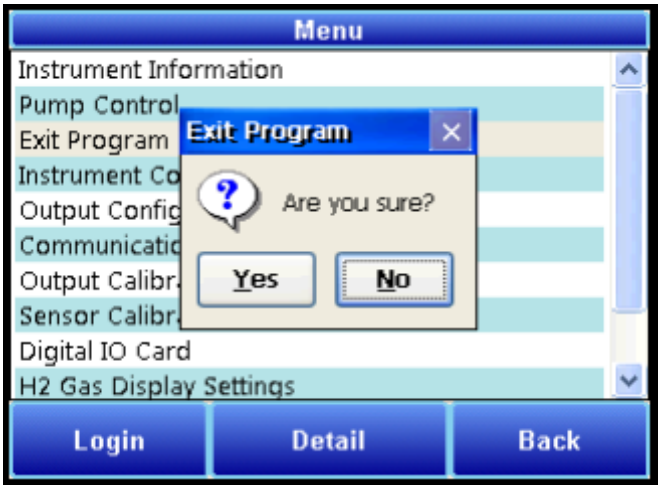
The Instrument Information screen provides basic information about the unit, including **Desciption, Part #, Serial #, Sub Serial #, Main Version #, and Sensor Version #.** This information can be useful for troubleshooting purposes.

Pump Control (Menu Option)



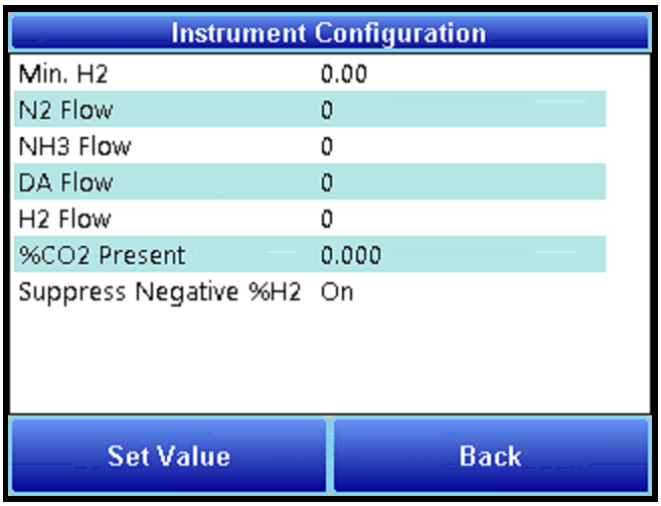
The Pump Control screen allows the user to turn the pump on or off. The current pump status will be displayed on the screen. To change the status, tap the "**Set Pump**" button, select "**On**" or "**Off**," and tap "**Select**." To exit the screen without changing the pump status, tap "**Cancel**."

Exit Program (Menu Option)



The Exit Program option allows the user to shut down the SGA touchscreen, after a confirmation dialog box is displayed.

Instrument Configuration (Menu Option)

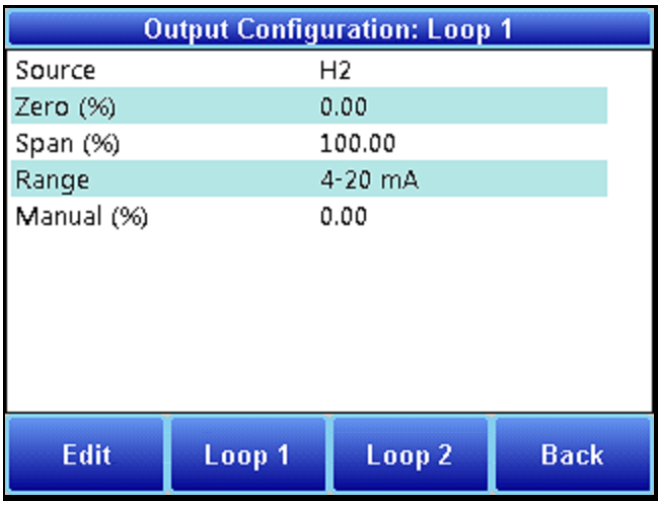


The **Instrument Configuration** menu allows the user to set values for various SGA paramaters.

- Min. H2: This reading indicates the point at which anything below will be read as zero for internal calculations.
- N2 Flow: The value entered here will be used in nitriding calculations. Enter the applicable N2 flow in your system.
- NH3 Flow: The value entered here will be used in nitriding calculations. Enter the applicable NH3 flow in your system.
- DA Flow: The value entered here will be used in nitriding calculations. Enter the applicable DA flow in your system.
- H2 Flow: The value entered here will be used in nitriding calculations. Enter the applicable H2 flow in your system.
- CO2 Pres: (0-10) – Any value entered here will be used in place of the actual CO2 reading for internal calculations. (Zero is the default setting)
- Suppress Negative %H2: When activated, any negative readings will be treated as zero.

To change an item, tap the desired row, then tap "Set Value." Enter the desired value in the "Input" box and click the "Set Val" button. Your new value will be displayed in the "Current" column.

Output Configuration



The SGA has two outputs. These can be configured for **Source**, **Zero Value**, **Span Value**, **Range**, and **Manual**.

The **Source** is the gas that applies to that output.

The **Zero Value** is the value that corresponds to 4mA on a 4-20 mA scale. (4-20 mA is the default **Range** setting. If **Range** is set to 0-20 mA, then the **Zero Value** refers to 0 mA.)

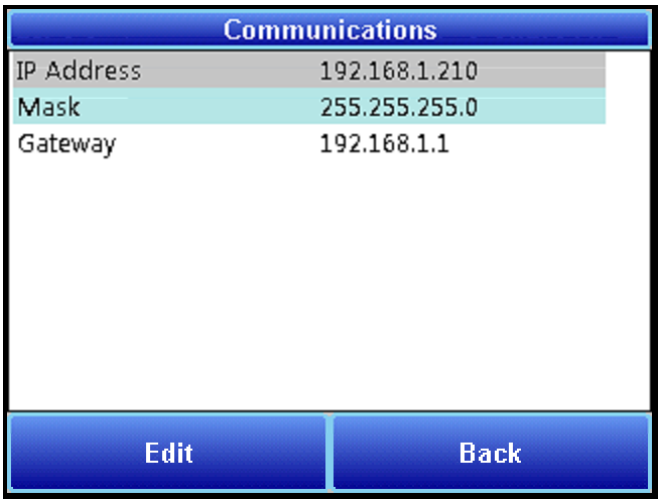
The **Span Value** is the value that corresponds to 20 mA on a 4-20 mA scale. (4-20 mA is the default **Range** setting. If **Range** is set to 0-20 mA, then the **Span Value** still refers to 20 mA.)

Range allows the user to choose between an output signal of 4-20 mA (default) and 0-20 mA.

Manual allows the user to enter an output value to test the analog output. In order for this option to function, **Source** must be set to **External**.

To change an item, tap the desired row, then tap "Edit." Enter the desired value in the "Input" box (or make a selection from the dropdown menu) and click the corresponding button. Your new value will be displayed in the "Current" column.

Communications (Menu Option)

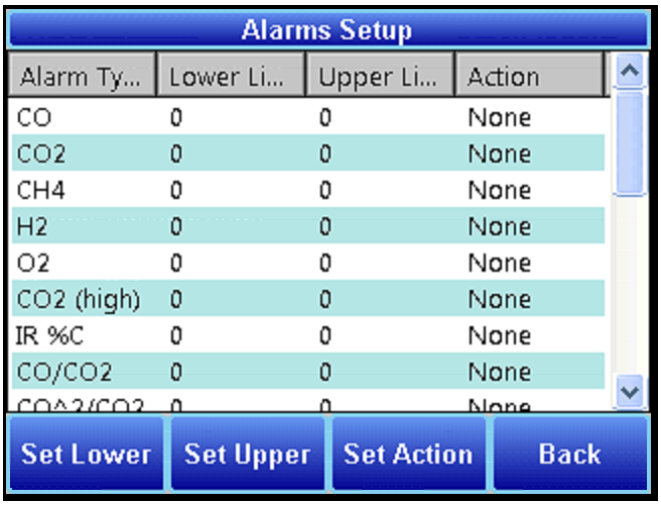


NOTE: Please consult with your network administrator or an IT professional before making changes to the Communications screen.

The Communications option allows you to view and change the current **IP Address**, **Subnet Mask**, and **Gateway** for the SGA. To change this information, tap to highlight an item, then tap "**Edit**" and use the keyboard screen to enter desired information.

Do not change these values without consulting your IT professional. Doing so could cause IP conflicts and other network issues.

Alarms Setup



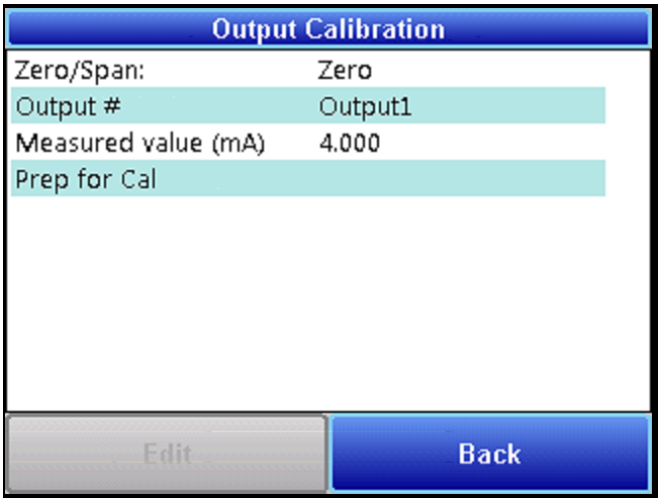
The Alarms option allows you to set lower and upper limits and assign actions to readings for the SGA.

Tap to highligh the desired gas type. Then tap the appropriate buttons to enter a Lower Limit and an Upper Limit. To select an Action, tap "Set Action" to cycle through the available options.

There are four possible actions for the alarms:

- "None" will not energize any relays.
- "AL1" will energize Relay 3;
- "AL2" will energize Relay 4;
- "Both" will energize Relays 3 and 4.

Output Calibration (Menu Option)



Overview

The Output Calibration screen allows the user to perform a zero/span calibration. The SGA is equipped with two analog outputs. These outputs require calibration to ensure that the mA signal corresponds to a given output value (zero value for the lowest value and span value for the highest value). SSi suggests that this device should be calibrated on a routine basis, such as once a year or as prescribed by the user's quality system requirements.

To calibrate each output, first make sure that you have a multimeter (or other appropriate testing instrument) available. Then follow these steps.

Zero Calibration

To calibrate the zero/span range for an output:

1. Attach a measuring device to the selected output.
2. Tap to highlight "**Zero/Span**," then tap the "**Toggle Zero/Span**" button to select "**Zero**." "**Zero**" will now be displayed in the Zero/Span row.

3. To select the desired output, tap to highlight "**Output#**," then tap the "**Toggle Output Number**" button to select the appropriate setting. The current value will be displayed in the "**Output#**" row.
4. Tap to highlight "**Prep for Cal**" and tap the "**Prep for Cal**" button.
5. Let the unit output what it has set for the zero measurement, and note the reading on your attached measuring device.
6. Tap "**Measured value (mA)**" and tap the "**Edit mA**" button.
7. Enter the measured value and tap "**OK**."
8. Then, tap "**Run Cal**" and tap the "**Run Cal**" button.

Span Calibration

To calibrate the span:

1. Use the "**Toggle Zero/Span**" button to select "**Span**."
2. Tap to highlight "**Prep for Cal**" and tap the "**Prep for Cal**" button.
3. Let the unit output what it has set for the span measurement, and note the reading on your attached measuring device.
4. Tap "**Measured value (mA)**" and tap the "**Edit mA**" button.
5. Enter the measured value and tap "**OK**."
6. Then, tap "**Run Cal**" and tap the "**Run Cal**" button.

Sensor Calibration (Menu Option)

Overview

BEFORE YOU BEGIN:

Never perform a span calibration without first performing a zero calibration.

The Zero calibration should be performed with a gas that contains no hydrogen (0% H2). Common gases used include nitrogen, argon, or ammonia. The concentration of the Span calibration gas should closely resemble the gas that is being measured. The span gas should contain a minimum %H_2 that the sensor could be exposed to during normal operations. For example, if the sensor might see up to 75% H_2, the span gas should contain at least 75% H_2 in its chemistry.

NOTE: Since the accuracy of the calibration gas directly influences the resulting accuracy of the instrument, the highest possible accuracy grade should be obtained. Some gas suppliers refer to this as a "Certified Primary Standard". The high degree of accuracy is not required to obtain nominal values that exactly match the values shown above. The accuracy is required to know the exact composition of the gas in the cylinder. The actual composition will be shown on the bottle when it is delivered.

When flowing calibration gas into the analyzer, turn the pump off. The amount of flow from the gas cylinder should be approximately 1.5 cfh at no pressure. The gas cylinders will be under high pressure, so it is recommended that a two stage regulator with a low pressure secondary

stage be used. It is good practice to begin the flow of gas before attaching the calibration gas to the instrument. This will prevent any high pressure bursts from entering the instrument.

Calibration gases can be obtained from Super Systems, however they can also be obtained from any supplier of custom gases.

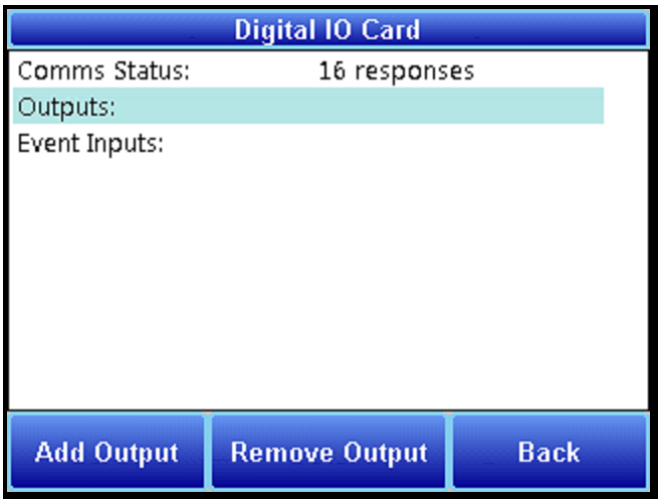
Zero Calibration Procedure

1. Connect the gas to the "Cal Gas Inlet" on the side of the SGA enclosure. It is recommended to let everything (gas and SGA) sit for approximately thirty minutes to allow the temperature to achieve equilibrium.
2. Select "Sensor Calibration" from the Main Menu.
3. Tap "**Zero/Span**" and use the "**Toggle Zero/Span**" button to select **Zero.**
4. Tap to highlight "**Enter Gas Concentration**" and tap the "**Enter Gas %**" button.
5. Enter the appropriate concentration of the calibration gas (in this case 0% since it is a zero calibration).
6. Begin the flow of gas and wait until the gas reading on the display stabilizes. This occurs when the actual values are not moving in a specific direction, and they display only slight movements up and down. This should take several minutes.
7. Once stabilized, tap to highlight "**Run Calibration**" and tap the "**Run Calibration**" button.
8. The Calibration Timer on the screen will count down, and when it reaches zero the current gas value will adjust to match the gas concentration.

Span Calibration Procedure

1. First tap "**Zero/Span**" and use the "**Toggle Zero/Span**" button to select **Span.**
2. Tap to highlight "**Enter Gas Concentration**" and tap the "**Enter Gas %**" button.
3. Enter the appropriate concentration of the calibration gas (see note on the previous page about the gas chemistry certification).
4. Begin the flow of gas and wait until the gas reading on the display stabilizes. This occurs when the actual values are not moving in a specific direction, and they display only slight movements up and down. This should take several minutes.
5. Once stabilized, tap to highlight "**Run Calibration**" and tap the "**Run Calibration**" button.
6. The Calibration Timer on the screen will count down, and when it reaches zero the current gas value will adjust to match the gas concentration.

Digital IO Card (Menu Option)

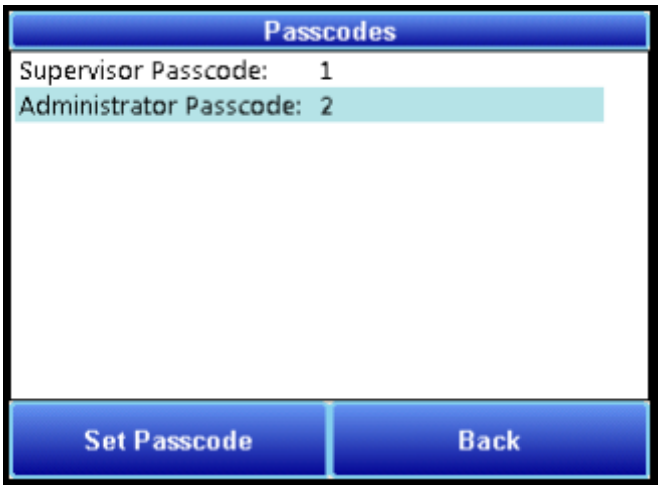


The Digital IO Card menu displays **Communication Status**, **Outputs**, and **Event Inputs**. It also allows the user to set and reset outputs. Tap the **Set Output** button to turn on an output, or tap the **Reset Output** button to turn off an output. Then enter the desired information on the ensuing screen.

Oxygen Units (Menu Option)

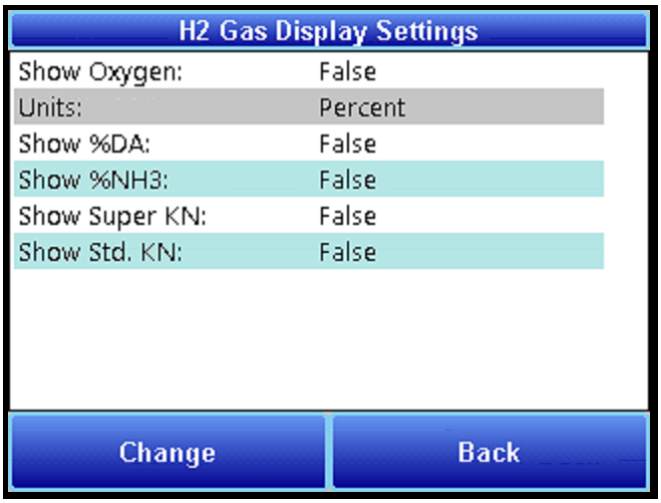
Allows the user to choose the display units for O_2. (This is only available on H_2/O_2 models.)

Passcodes (Menu Option)



The Passcodes menu allows the user to set Supervisor and Administrator Passcodes. To change the passcodes, tap to highlight the desired access level, then tap "**Set Passcode**." Enter the new passcode on the ensuing screen and tap "**OK**."

H2 Gas Display Settings



This menu option allows you to adjust the SGA's display options for H2. Simply tap an option to highlight it, then tap "Change" to bring up the available options. Tap to select your desired option, and tap "Select" to save the change.

Control Interface via a Web Browser

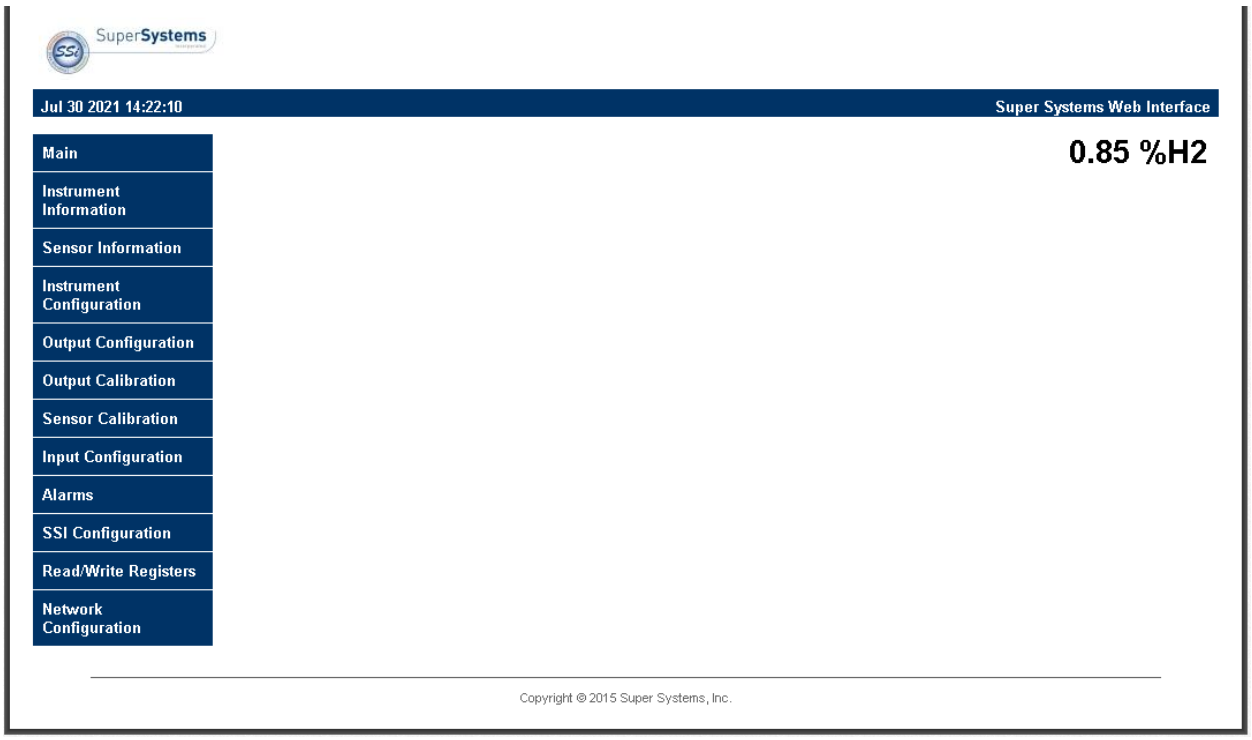
The SGA can be controlled using the touchscreen or a web browser on your computer. The web browser connects to the unit through an Ethernet connection. The computer you are using and the unit need to be on the same network with the same subnet mask. Contact your IT administrator if you have network setup questions.

Access Password: Contact SSi at (513) 772-0060 for more information on the password used to access secured options.

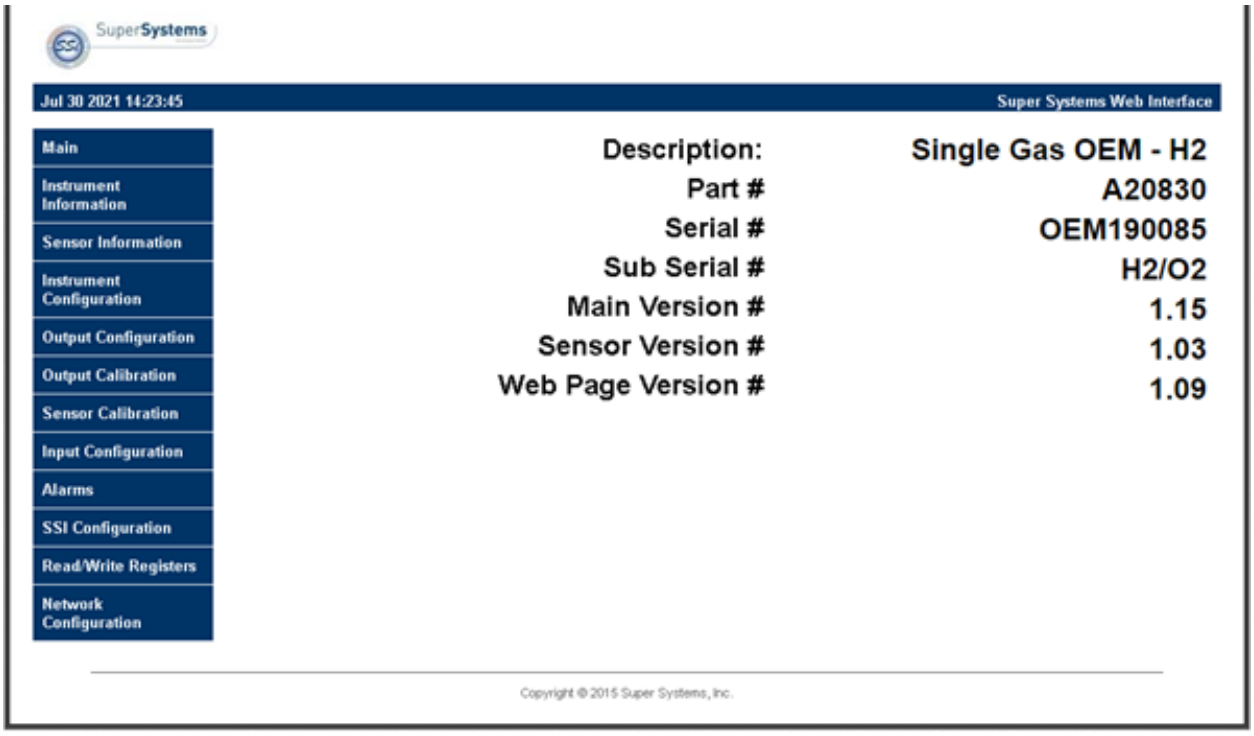
Note that the interface pages shown below are for the H_2 option.

Main

The Main display shows the current percentage of H_2.

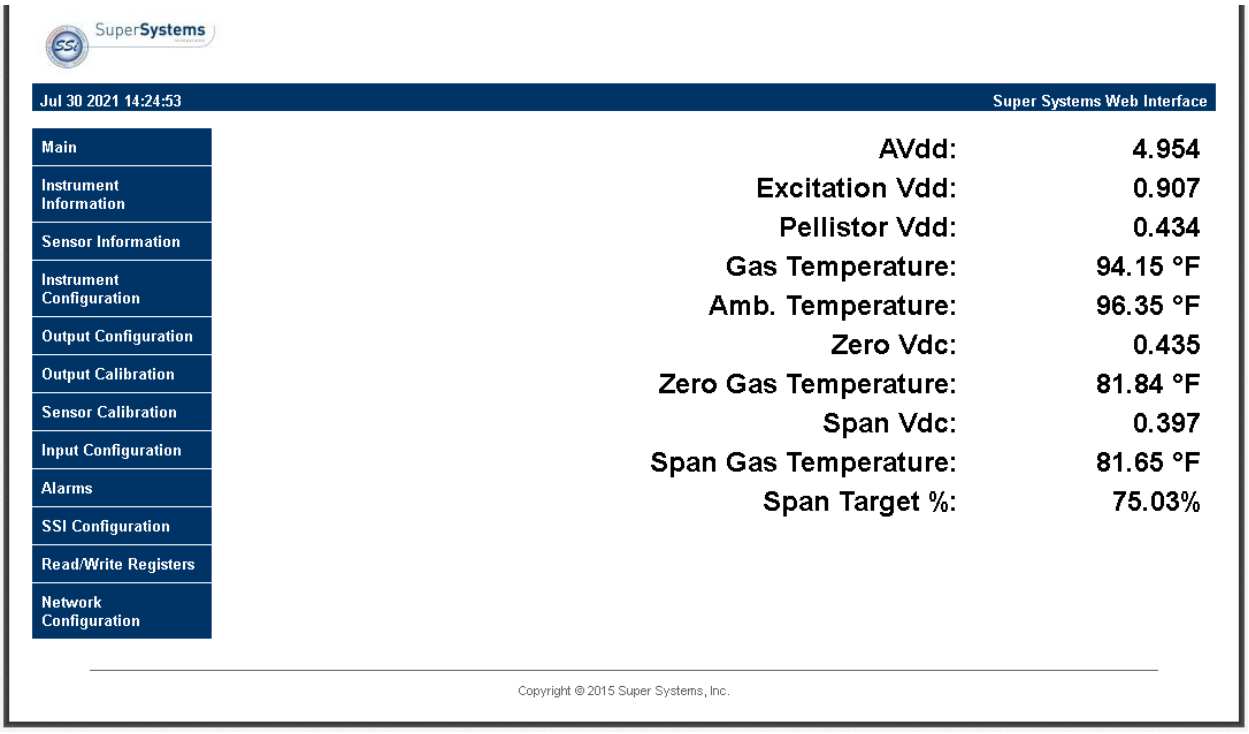


Instrument Information



The Instrument Information screen provides basic information about the unit, including **Desciption, Part #, Serial #, Sub Serial #, Main Version #, Sensor Version #, and Web Page Version #.** This information can be useful for troubleshooting purposes.

Sensor Information

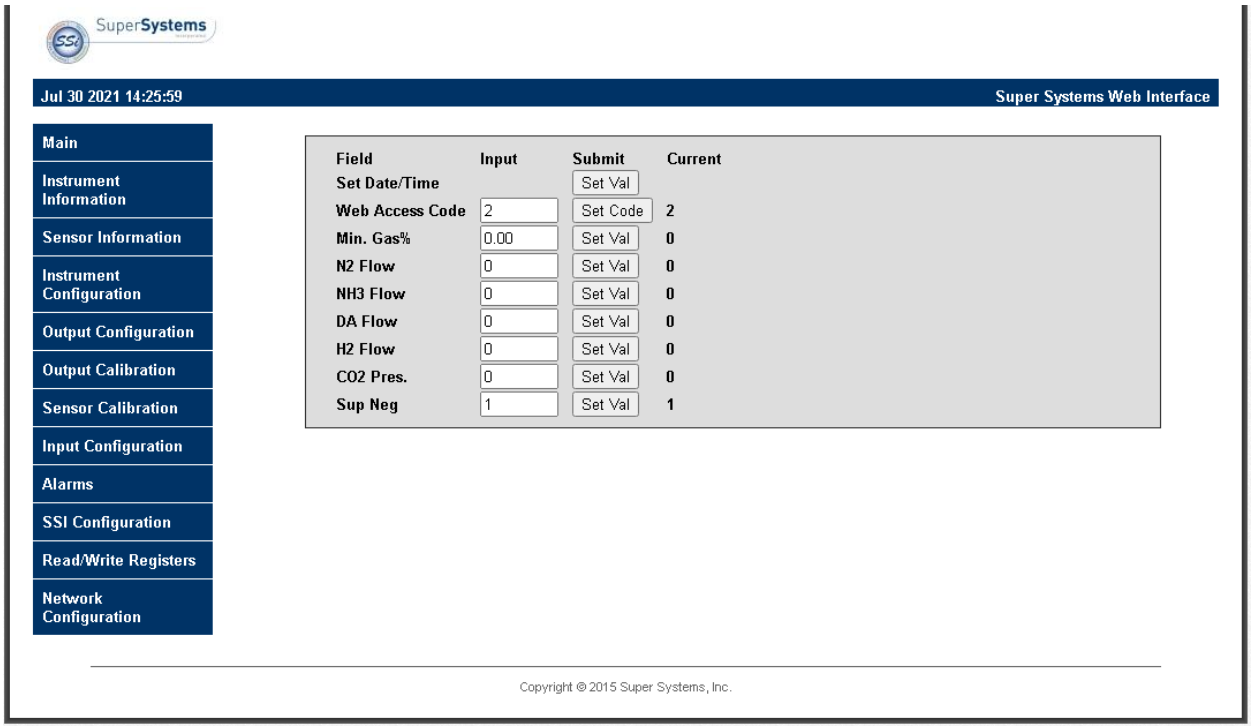


The **Sensor Information** page displays information on the following:

- AVdd: This value is the supply voltage for the analog to digital converter that measures the pellistor voltage. This value is typically about 5V.
- Excitation Vdd: This value is the voltage seen across the pellistor bridge. This value should be approximately 0.9V.
- Pellistor Vdd: This value is the voltage present across the sensing pellistor. This voltage, in air, should be approximately half the excitation voltage.
- Gas Temperature: The temperature of the measured gas
- Ambient Temperature: The ambient temperature where the sensor is located.
  NOTE: The following options are intended primarily for SSi personnel to assist with troubleshooting procedures.
- Zero Vdc: (voltage direct current) A record of the zero vdc reading from the most recent calibration.
- Zero Gas Temperature: A record of the zero gas temperature reading from the most recent calibration.
- Span Vdc: (voltage direct current) A record of the span vdc reading from the most recent calibration.
- Span Gas Temperature: A record of the span gas temperature reading from the most recent calibration.
- Span Target %: A record of the span target % from the most recent calibration.

Note that each of these values is for diagnostic use only. Call SSi at (513) 772-0060 with questions.

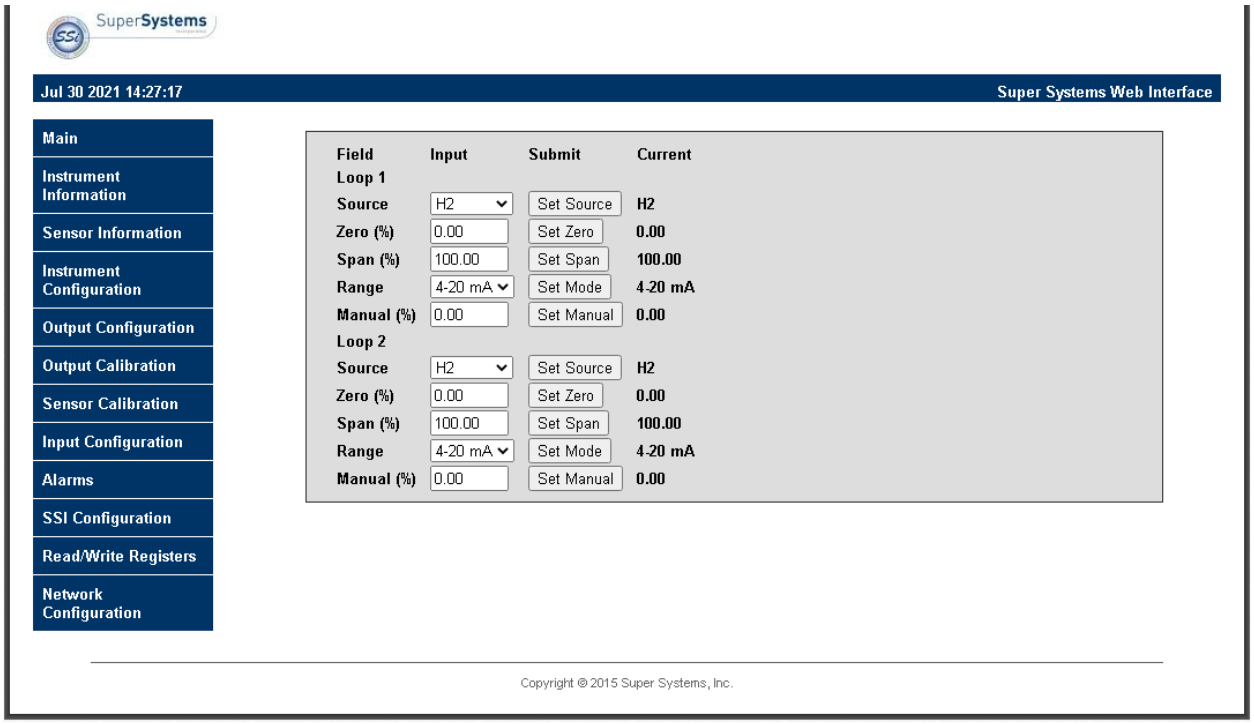
Instrument Configuration



The **Instrument Configuration** page allows you to set values for the following information:

- Set Date/Time: This option, when pressed, will sync the current time of the main board to the computer on which the web interface is running.
- Web Access Code: This allows you to set the required passcode to access the web interface.
- Min. Gas %: This reading indicates the point at which anything below will be read as zero for internal calculations.
- N2/NH3/DA/H2 Flow: Gas flow values can be manually entered into these fields for nitriding calculations such as nitriding potential (Kn), percent dissociation (%DA), percent ammonia (%NH3), and/or super Kn. These calculations are displayed on the Main webpage when selected on the SSI Configuration webpage.
- CO2 Pres: This is a special calculation for specific applications. The input should be set to 0 as a default, unless specifically discussed with SSi.
- Sup Neg: (Suppress Negative) When activated, any negative readings will be treated as zero.

Output Configuration



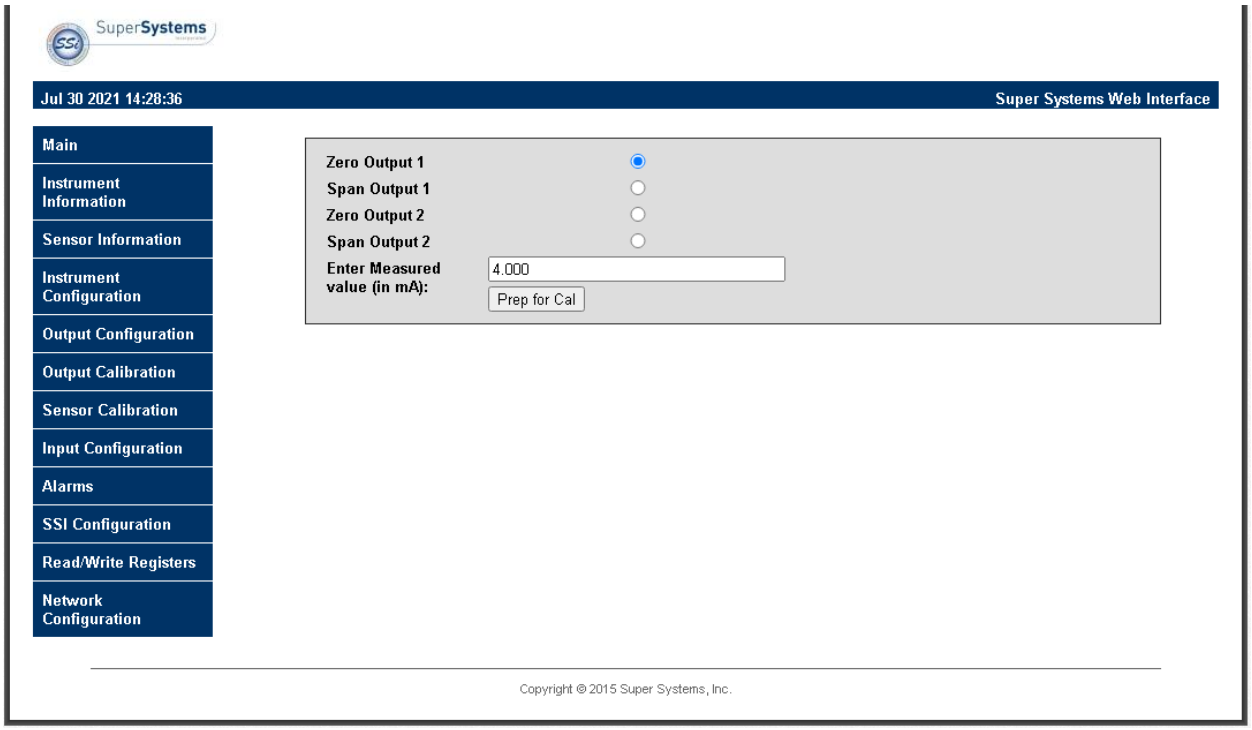
The Output Configuration screen allows you to adjust output parameters for loops 1 and 2.

For each loop, the following parameters can be adjusted:

- Source: A selected source: H_2, DA, NH_3, K_N, External, or Standard K_N.
- Zero (%): Is the value that corresponds to 4 mA on a 4-20 mA scale. (4-20 mA is the default Range setting. If Range is set to 0-20 mA, then the Zero % refers to 0 mA.).
- Span (%): Is the value that corresponds to 20 mA on a 4-20 mA scale. (4-20 mA is the default Range setting. If Range is set to 0-20 mA, then the Span % still refers to 20 mA.).
- Range: Allows the user to choose between an output signal of 4-20 mA (default) and 0-20 mA.
- Manual (%): Allows the user to enter an output value to test the analog output. In order for this option to function, Source must be set to *External*.

Use the applicable "Set" button to set each parameter (for example, use "Set Source" to set the source).

Output Calibration

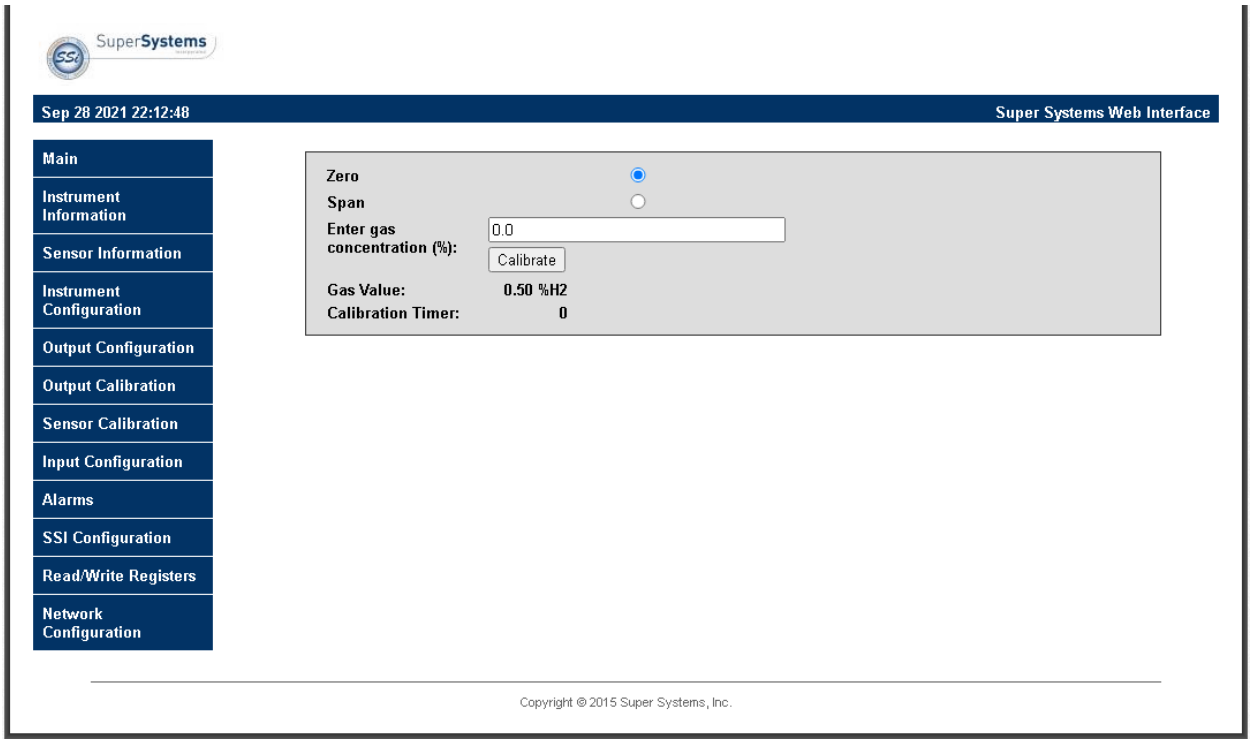


The Output Calibration screen allows the user to perform a zero/span calibration. The SGA is equipped with two analog outputs. These outputs require calibration to ensure that the mA signal corresponds to a given output value (zero value for the lowest value and span value for the highest value). SSi suggests that this device should be calibrated on a routine basis, such as once a year or as prescribed by the user's quality system requirements.

To calibrate each output, first make sure that you have a multimeter (or other appropriate testing instrument) available. SSi recommends that each time an output is calibrated that a zero calibration is performed first and the span calibration is performed second. SSi also recommends that both a zero and span always be performed together. Calibrations steps are provided below.

1. Select the output value that you wish to calibrate (Zero Output 1 or Zero Output 2).
2. Press "Prep for Cal" to enter calibration mode.
3. Ensure that the output signal is being sent for the span or zero value (for whichever you are calibrating).
4. With a multimeter, measure the mA value at the output. Enter that value in the "Entered Measured value" field and press "Calibrate".
5. Repeat the process above for the appropriate Span Output.

Sensor Calibration



Because the H_2 sensors use thermal conductivity to quantify the $\%H_2$ in the gas sample, how the gas is presented to the sensor affects its calibration and resulting accuracy. The in-situ H_2 analyzer does not allow sample gases to flow past the H_2 sensor. Therefore, the calibration must be performed in a similar way. The flow-through H_2 analyzer requires that flows past the H_2 sensor be similar to flows during normal operation to maximize accuracy of the sensor. The setup and calibration methods are detailed below.

Additionally, the gas sensor must be calibrated at both the low end and high end of the measured gas composition range to ensure accurate readings. **Never perform a span calibration without first performing a zero calibration.** Performing only a zero or span calibration will cause the sensor to give an erroneous reading. SSi suggests that this device should be calibrated on a routine basis, such as once a year or as prescribed by the user's quality system requirements.

Connect the gas to the "Cal Gas Inlet" on the side of the SGA enclosure and open the valve. It is recommended to let everything (gas and SGA) sit for approximately thirty minutes to allow the temperature to achieve equilibrium.

To perform a sensor calibration, make sure that the system is set up to flow both zero gas (with 0% of the gas the sensor is designed to detect) and span gas when needed. The gases should be "Certified Primary Standards" or equivalent accuracy. Then follow these steps.

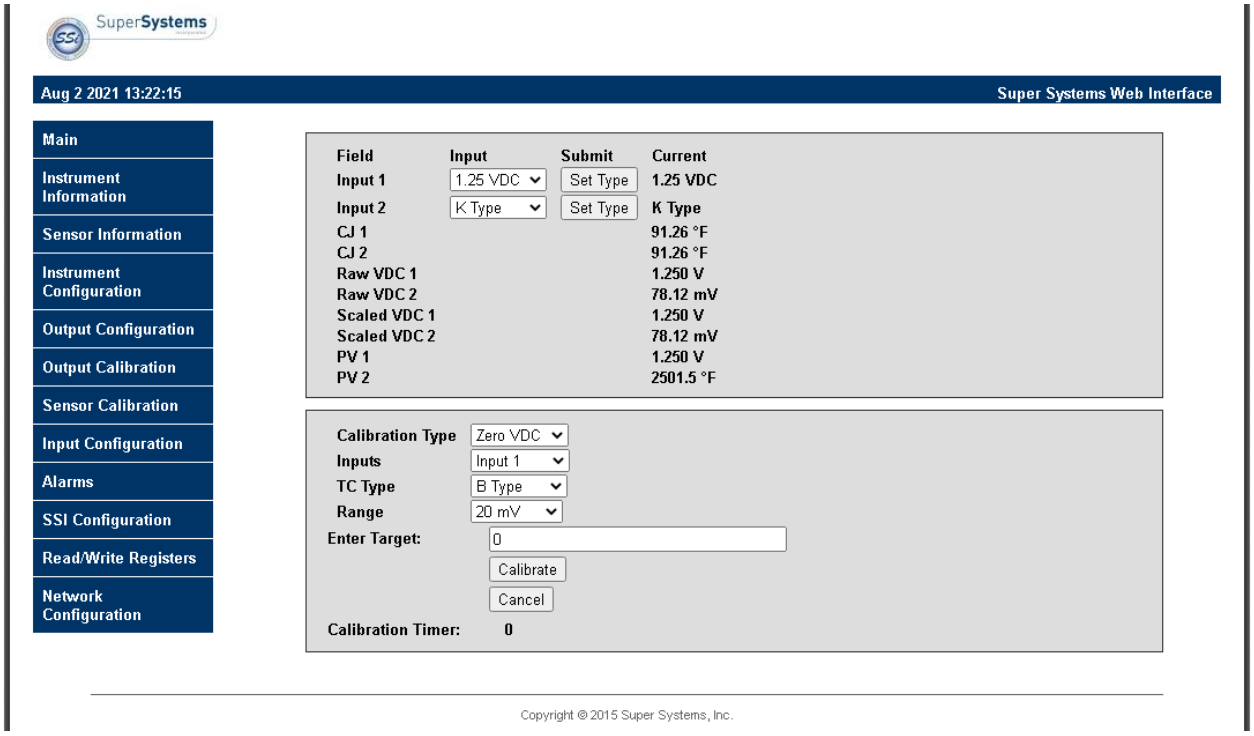
1. Note the percentages of the sensor gas in each gas source (zero and span).
2. Ensure that the system is purged of any latent gas.

3. Flow the zero gas until the gas reading on the web page stabilizes.
4. Enter the target gas concentration in the "Enter gas concentration (%)" field.
5. Press "Calibrate". A Calibration Timer will count down.
6. Once the Calibration Timer has counted down, the zero value will be calibrated.

NOTE: The remaining steps for the span gas will be very similar to the steps performed for the zero gas calibration.

7. Ensure that the system is purged of any latent gas.
8. Flow the span gas until the gas reading on the web page stabilizes.
9. Enter the target gas concentration in the "Enter gas concentration" field.
10. Press "Calibrate". A Calibration Timer will count down.
11. Once the Calibration Timer has counted down, the span value will be calibrated.

Input Configuration



There are two additional inputs, which can be set up on the SGA. One is commonly used for connecting a Lambda analog oxygen probe designed for a 0 – 21% O_2 measurement. There is a second input for a thermocouple if required. The inputs must be calibrated at the low and high ends of input voltage range to ensure accurate readings. SSi suggests that this device should be calibrated on a routine basis, such as once a year or as prescribed by the user's quality system requirements.

To perform a calibration, a certified calibrator(s) with the ability to source and read millivolts and/or thermocouples is required. The appropriate connection leads are also required. The default calibration is performed using a zero and span routine for the pre-defined input sensory

type (i.e. voltage or temperature). Millivolt ranges used for thermocouple inputs are listed in the Table below.

Thermocouple Type	Millivolt Range
B	0 – 20 mV
C	0 – 40 mV
E	0 – 80 mV
J	0 – 80 mV
K	0 – 80 mV
N	0 – 80 mV
NNM	N/A
R	0 – 40 mV
S	0 – 20 mV
T	0 – 20 mV

ThermocoupleTypes and Calibration Voltage Ranges

Zero & Span Calibration:

1. Select the correct input type for **Input 1** from the drop-down menu. Press the **Set Type** button to the right in order to set that type of input.
2. Go down to the **Calibration Type** option and choose the Zero VDC.
3. Select Input 1 for the **Inputs** option.
4. If the input is a thermocouple, select the correct **TC Type**. If the input is not a thermocouple, the value in this field does not matter.
5. Select the appropriate **Range** for the input type selected. For thermocouple inputs, see the table above for the corresponding range.
6. Connect the calibrator and source a zero input signal (0 mV or 0 VDC).
7. Allow the **Raw VDC 1** signal to stabilize.
8. Enter the same zero value as what is being sourced from the calibrator into the **Enter Target** field and press the **Calibrate** button. A timer will count down from 30 seconds.
9. Once the **Calibration Timer** has counted down, the zero calibration is complete. You should see the **Raw VDC 1** value change to match the calibrator.

NOTE: The remaining steps for the span input calibration will be very similar to the steps performed for the zero input calibration.

10. The Input type selected in step 1 remains the same. Change the **Calibration Type** to Span VDC.
11. The **TC Type** and **Range** selected in steps 4 and 5 remain the same.
12. Using the calibrator, source a span input signal. The span signal should be at least 90% of the full range of the sensor (for example, source at least 1.125 VDC for a sensor with a range of 0 to 1.25 VDC).
13. Allow the **Raw VDC 1** signal to stabilize.
14. Enter the same span value as what is being sourced from the calibrator into the **Enter Target** field and press the **Calibrate** button. A timer will count down from 30 seconds.
15. Once the **Calibration Timer** has counted down, the span calibration is complete. You should see the **Raw VDC 1** value change to match the calibrator.

This same procedure can be performed for **Input 2** if it is being used. You just need to select the correct Input type in the **Input 2** field and choose the Input 2 for the **Inputs** field.

Cold Junction Calibration

NOTE: This procedure only applies to thermocouple inputs. It is not necessary for other voltage inputs. Perform zero and span calibrations (see previous section) before following this procedure.

To determine if a cold junction adjustment is needed, connect the calibrator with the appropriate T/C wire attached and source a temperature to the input. It is best to use an operating temperature to source; for example, if the furnace typically runs at 1000°F, then 1000 °F should be sourced to the input. You may want to source a range of temperatures as this will help determine whether any difference in readings is linear.

If the displayed value (**PV 1** or **PV 2**) is not within an acceptable range of the value being sourced, then a Cold Junction Calibration may be necessary. There are two options for calibrating the Cold Junction.

TC Trim

The TC Trim **Calibration Type** will help to apply the correct Cold Junction to the thermocouple input without having the user perform math and determine a Target value.

1. Select the TC Trim **Calibration Type**.
2. Select the correct input being calibrated in the **Inputs** field.
3. Sect the correct **TC Type** and **Range** (reference Table 1 for the corresponding ranges for each T/C type).
4. Source a temperature to that input.
5. Enter the sourced temperature into the **Enter Target** field.
6. Push the **Calibrate** button. A timer will count down from 30 seconds.
7. Once the Calibration Timer has counted down, the corresponding **PV 1** or **PV 2** value should match the sourced temperature.

Compare the sourced temperature with the corresponding **PV 1** or **PV 2** value. Make further adjustments as-needed and perform additional calibrations.

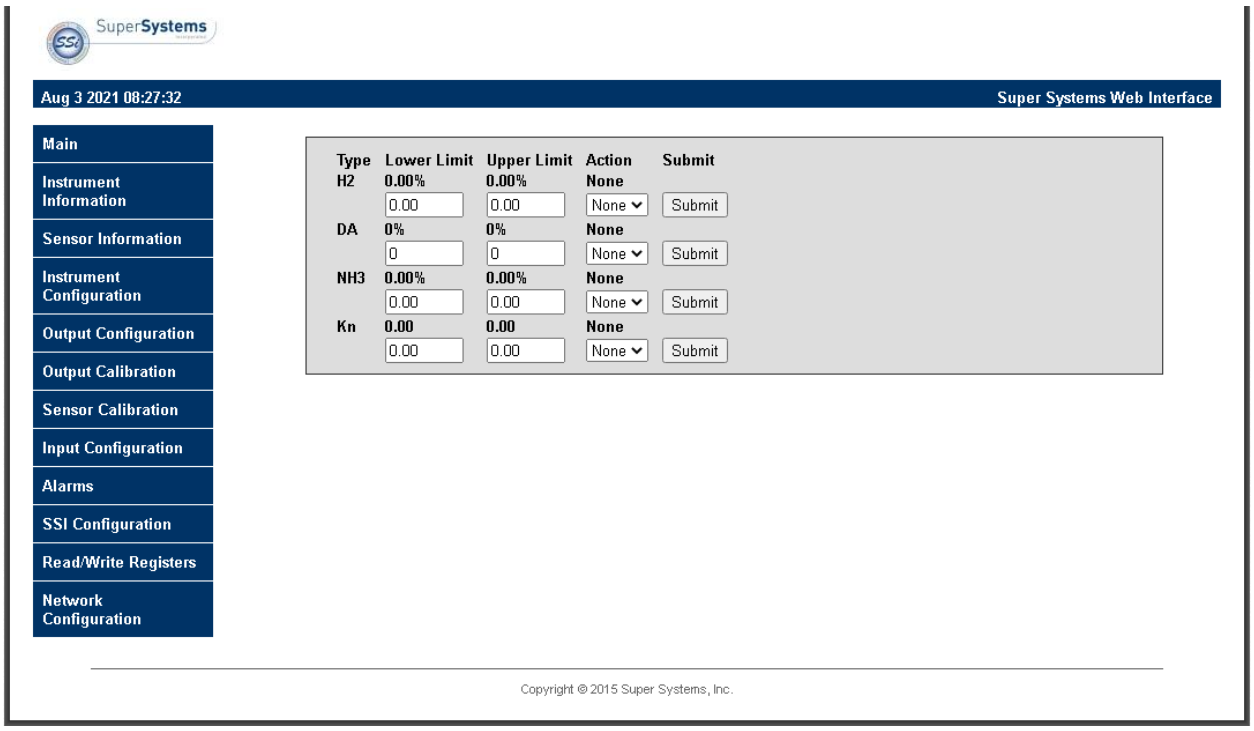
CJ Trim

The CJ Trim **Calibration Type** is a more traditional way to calibrate the Cold Junction temperature. To begin, note the difference between the displayed temperature (**PV 1** or **PV 2** value) and the sourced temperature. The difference between the two is the adjustment in corresponding **CJ 1** or **CJ 2** that will need to be entered.

1. Select the CJ Trim **Calibration Type**.
2. Select the correct input in the **Inputs** field.
3. Source a temperature to that input.
4. Note the difference between the sourced temperature and the value in the corresponding **PV 1** or **PV 2** field.
5. Add/Subtract that value to the corresponding **CJ 1** or **CJ 2** value indicated at the top of the page. For example, PV 2 is being sourced with 1000°F. **PV 2** reads 998°F and **CJ 2** reads 77.95°F. The difference between the sourced temperature and **PV 2** is -2°F so we subtract 2°F to 77.95°F, which equals 75.95°F. This value is what will be entered in step 6.

6. Enter that new value into the **Enter Target** field and push the Calibrate button. A timer will count down from 30 seconds.
7. Once the Calibration Timer has counted down, the corresponding **CJ 1** or **CJ 2** value should match what was entered into the **Enter Target field** and the corresponding **PV 1** or **PV 2** value should matched the source temperature.
8. Compare the sourced temperature with the corresponding **PV 1** or **PV 2** value. Make further adjustments as-needed and perform additional calibrations.

Alarms



The SGA comes with several alarm settings for monitoring the gas percentages and/or reactions involving nitriding. This page allows the user to set low and high limits for the $\%H_2$, %DA, $\%NH_3$, and Kn.

For the desired gas type, enter a Lower Limit, an Upper Limit, select an Action from the dropdown menu, and click "Submit" to save that information.

When connected to a digital card, if desired, one of the two relays (or both simultaneously) can be energized. There are four possible actions for the alarms:

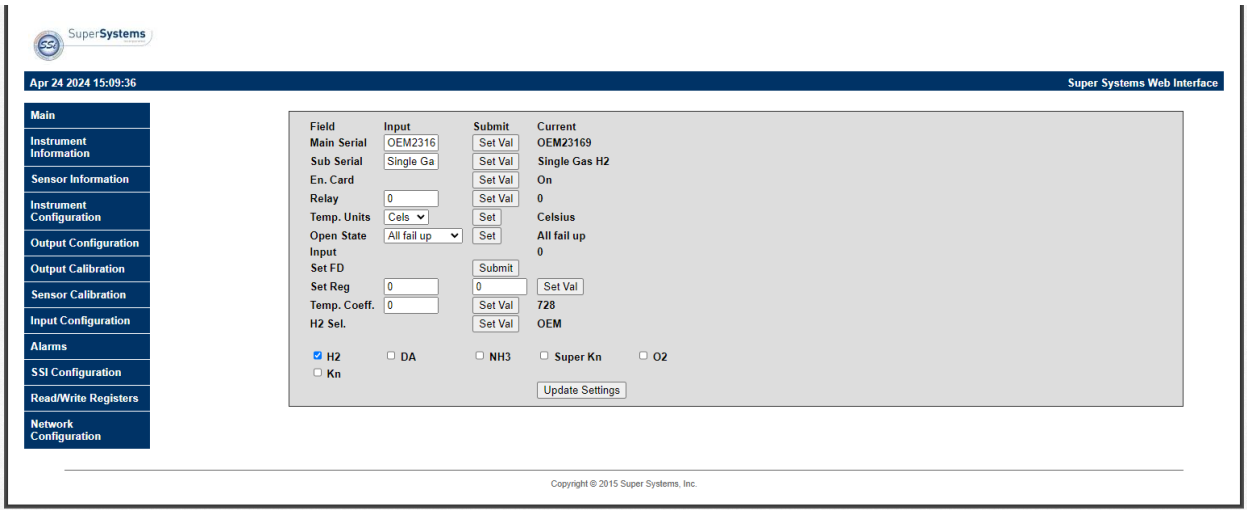
- "None" will not energize any relays.
- "AL1" will energize Relay 3.
- "AL2" will energize Relay 4.
- "Both" will energize Relays 3 and 4.

Call SSi at (513) 772-0060 with questions or additional help with setting up these alarms.

SSI Configuration

IMPORTANT!

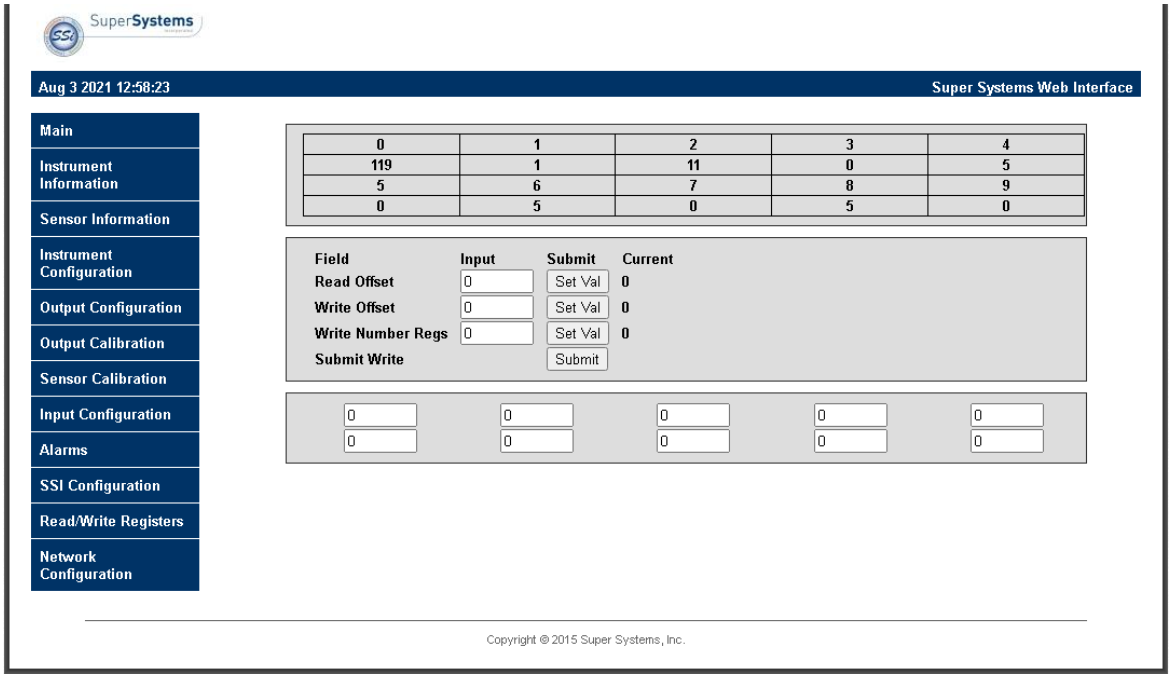
It is highly recommended that changes on this page be made only in consultation with SSi technical personnel. Call (513) 772-0060 for more information.



The SSi Configuration page contains fields that can be adjusted to change various strings contained in memory and also change certain functions.

- Main Serial: The serial number of the main board.
- Sub Serial: The serial number of the sensor board.
- En. Card: Enable Card. This option allows a digital I/O card to be added.
- Relay Input: This option allows a value to be written to enable relays. Possible values are 0 to 255, and they are binary values corresponding to one of the eight relays.
- Set FD: This option resets the sensor board to factory defaults.
- Set Reg: This option allows a value to be written to the main board. The first value is the register location that will be written to; the second value is the value that will be written to the specified register location. The "Set Val" button, when pressed, will commit the entered value to the specified register location.
- H2 Sel.: This is a setting that should not be changed except in the factory.
- Additional Settings: This unit allows for additional calculation displays associated with gas nitriding.

Read/Write Registers

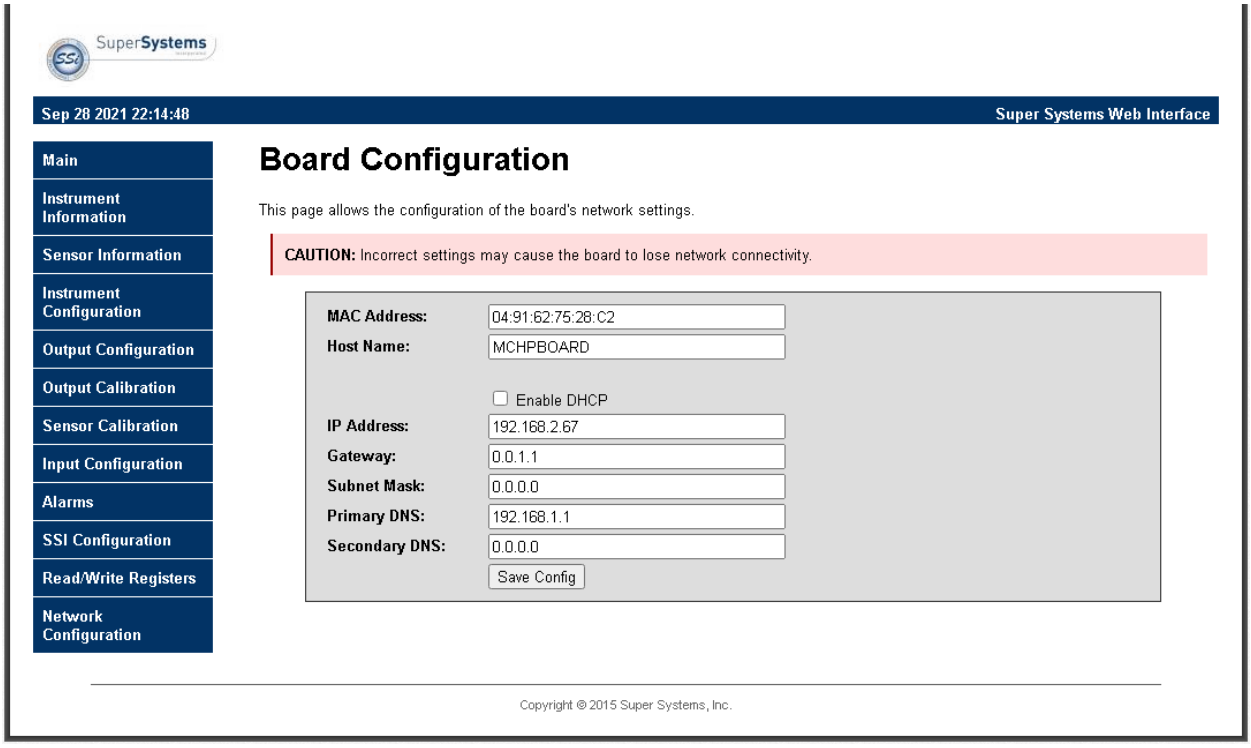


The Read/Write Registers page is used for troubleshooting, verification, and setup of the instrument. Modifications to the SGA can also be written from this page. Its use is intended for SSi personnel and SSi support personnel who have been trained and authorized. Accessing this page requires a special code to prevent unwanted changes to critical settings.

Please contact SSi before attempting to make any changes to the settings on this page.

Network Configuration

The Network Configuration page allows you to view network settings and change certain settings as well. **SSi recommends consulting an IT engineer or network administrator before changing any of these settings.**



The first two fields on the page show the MAC address and Host Name. The MAC address should not be changed. The Host Name can be changed as needed.

To enable dynamic assignment of IP addresses, click on the **Enable DHCP** checkbox. Dynamic assignment means that the unit's IP address on the network will be assigned automatically, preventing IP address conflicts. The network must support dynamic IP assignment in order for this to work.

If Enable DHCP is not checked, IP and other settings can be changed manually. **These settings should be verified with your network administrator before being changed.** Failure to do so could result in IP conflicts and other network issues.

Modbus Registers

The following table shows the Modbus registers for the sensor module. The name of the register, address location, and description are provided.

Register Name	Register Location	Description
VERSION_NUMBER	0	current version number of the firmware
UART_1_MODE	1	0 = slave, 1 = Sensor Driver
UART_1_BAUD_RATE	2	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_2_MODE	3	0 = slave, 1 = Sensor Driver
UART_2_BAUD_RATE	4	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_3_MODE	5	0 = slave, 1 = Sensor Driver
UART_3_BAUD_RATE	6	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_4_MODE	7	0 = slave, 1 = Sensor Driver
UART_4_BAUD_RATE	8	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_5_MODE	9	0 = slave, 1 = Sensor Driver
UART_5_BAUD_RATE	10	Baud Rate: 0=1200,...,5=19200,...10=115200.
BOARD_ADDR	14	Board modbus address (important for slave only)
MODEL_NUM	15	MODEL number Map as reg 900
SET_FACT_DEF	16	23205 = Full Defaults, 23206 = H2 Defaults, 23207 = Loop 1 Defaults, 23208 = Loop 2 Defaults
DEGREE_REG	17	0 = °F, 1 = °C, 2 = °R, 3 = K
CUR_LOOP_CAL_REG	18	Calibration state. 0 = normal, 1 = prep zero, 2 = store zero, 3 = prep span, 4 = store span
CUR_LOOP_CAL_CHN	19	Calibration channel
CUR_LOOP_CAL_VAL	20	Cal value. 20.12 mA would be 20120

Register Name	Register Location	Description
CUR_LOOP_TARGET_VALUE	22	Actual request value
CUR_LOOP_ZERO_TO_TWENTY	24	0-20 mA enable
CUR_LOOP_SOURCE	26	0 = H2, 1 = DA, 2 = NH3, 3 = KN, 4 = External, 5 = Standard Kn, 6 = NDIR gas
CUR_LOOP_ZERO	28	Zero value. This value equates to either 4 mA or 0 mA
CUR_LOOP_SPAN	30	Span value. This value equates to either 20 mA
CUR_LOOP_MANUAL	32	If manual mode is set, then this register controls (0-20000)
INST_PV_MODE	34	0 = H2, 1 = DA, 2 = NH3, 3 = KN, 4 = Standard Kn, 5 = NDIR single gas
PV_VARIABLE	35	Actual process variable.
H2_SELECTION	36	0 = Single gas OEM, 1 = In-Situ Sensor
DISP_OPT	37	Display option bitmap: bit 0 = H2, 1 = DA, 2 = NH3, 3 = Super KN, 4 = Standard KN
SER_NUM_REG	444	actual mapping from Advantech
MB_SET_TIME_WRITE	506	1 = SNTP server write, 2 = manual write
MB_SET_TM_YEAR	507	set year
MB_SET_TM_MON	508	set month
MB_SET_TM_MDAY	509	set day of month
MB_SET_TM_WDAY	510	set day of week, 0 = Sunday
MB_SET_TM_HOUR	511	set hour
MB_SET_TM_MIN	512	set minute
MB_SET_TM_SEC	513	set second
MB_TM_YEAR	514	year
MB_TM_MON	515	month
MB_TM_MDAY	516	day of month
MB_TM_WDAY	517	day of week, 0 = Sunday

Register Name	Register Location	Description
MB_TM_HOUR	518	hour
MB_TM_MIN	519	minute
MB_TM_SEC	520	second
MB_COMP_TIME_YEAR	580	compile year
MB_COMP_TIME_MON	581	compile month
MB_COMP_TIME_MDAY	582	compile day of month
MB_COMP_TIME_WDAY	583	compile day of week, 0 = Sunday
MB_COMP_TIME_HOUR	584	compile hour
MB_COMP_TIME_MIN	585	compile minute
MB_COMP_TIME_SEC	586	compile second
MODEL_NUM_OLD	900	MODEL number
RESET_FACT_DEFAULTS	909	Resets everything to factory settings
MB_IP_ADDR	914	IP Address
MB_IP_MASK	918	Subnet Mask
MB_IP_GTWY	922	Gateway
SENSOR_COMM_STATUS_REG	1100	H2O2 comm status (0-16)
SENSOR_N2_FLOW	1101	N2 flow
SENSOR_NH3_FLOW	1102	NH3 flow
SENSOR_DA_FLOW	1103	DA flow
SENSOR_H2_FLOW	1104	H2 Flow
SENSOR_PV_MODE	1105	Process variable (0 = H2, 1 = DA, 2 = NH3, 3 = Kn, 4 = Standard Kn)
SENSOR_INPUT_TYPE_REG	1106	Input for voltage inputs
SENSOR_MIN_H2	1108	minimum H2 value
SENSOR_CO2_PRESENT	1109	concentration of CO2 present. Important for H2 measurement only
SENSOR_PV_REMOVE_NEGATIVE	1110	Makes any negative number zero
SENSOR_GEN_QUEUE_ENABLE	1150	Allows for a generic write

Register Name	Register Location	Description
SENSOR_NH3_FLOW	1102	NH_3 flow
SENSOR_DA_FLOW	1103	DA flow
SENSOR_H2_FLOW	1104	H_2 Flow
SENSOR_PV_MODE	1105	Process variable (0 = H_2, 1 = DA, 2 = NH_3, 3 = Kn, 4 = Standard Kn)
SENSOR_INPUT_TYPE_REG	1106	Input for voltage inputs
SENSOR_MIN_H2	1108	minimum H_2 value
SENSOR_CO2_PRESENT	1109	concentration of CO_2 present. Important for H_2 measurement only
SENSOR_PV_REMOVE_NEGATIVE	1110	Makes any negative number zero
SENSOR_GEN_QUEUE_ENABLE	1150	Allows for a generic write
SENSOR_GEN_QUEUE_START	1151	Start of write. E.g., register 45.
SENSOR_GEN_QUEUE_ADDRESS	1152	Address of board to write to.
SENSOR_GEN_QUEUE_NUM_WORDS	1153	Number of words to write down up. Up to 30
SENSOR_GEN_QUEUE_BLOCK	1154	write up to 30 words
SENSOR_READ_REGISTERS	1200	just designates where to start writing
MB_READ_VERSION_NUMBER	1200	current version number of the firmware
MB_READ_PELLISTOR_AVDD	1201	A/D analog voltage supply
MB_READ_PELLISTOR_EXCV	1202	Pellistor bridge excitation voltage
MB_READ_PELLISTOR_VDC	1203	Pellistor voltage
MB_READ_PELLISTOR_NA	1204	Pellistor Normalized Absorbance
MB_READ_PERC_H2	1205	H2 x 10000
MB_READ_PER_H2_MANT	1206	H2 mantissa
MB_READ_PER_H2_EXP	1207	H2 exponent
MB_READ_PER_DA	1208	DA value
MB_READ_PER_NH3	1209	NH3 value
MB_READ_PER_SUPER_KN	1210	Super Kn

Register Name	Register Location	Description
MB_READ_STANDARD_KN	1211	Standard Kn
MB_READ_PROC_VAR	1212	Process variable
MB_READ_GAS_TEMP	1213	Gas temperature
MB_READ_BOARD_ADDR	1214	Board modbus address (important for slave only)
MB_READ_MODEL_NUM	1215	MODEL number Map as reg 900
MB_READ_SET_FACT_DEF	1216	23205 = Full Defaults
MB_READ_DEGREE_REG	1217	Sets the unit used to display temperature.
MB_READ_N2_FLOW	1218	N2 flow
MB_READ_NH3_FLOW	1219	NH3 flow
MB_READ_DA_FLOW	1220	DA flow
MB_READ_H2_FLOW	1221	H2 Flow
MB_READ_PV_MODE	1222	Process variable (0 = H2, 1 = DA, 2 = NH3, 3 = Kn, 4 = Standard Kn)
MB_READ_INPUT_TYPE_REG	1223	Input for voltage inputs
MB_READ_MIN_H2	1225	minimum H2 value
MB_READ_CO2_PRESENT	1226	Amount of CO2 present up to 10%.
MB_READ_PV_REMOVE_NEG	1227	Remove negative number
MB_READ_SET_TAPS_REG	1228	Sets the digital trim pot
MB_READ_UART_1_BAUD_RATE	1229	Baud Rate: 0=1200,...,5=19200,...10=115200.
MB_READ_UART_2_BAUD_RATE	1230	Baud Rate: 0=1200,...,5=19200,...10=115200.
MB_READ_PV_FP	1231	Process variable in floating point
MB_READ_PELLISTOR_DIAG	1233	Pellistor Diagnostics
MB_READ_AMBIENT_TEMP	1234	Ambient temperature
MB_READ_CJ_TEMP_REG	1235	Cold junction temperature
MB_READ_AD_RAW_VDC	1237	Raw VDC
MB_READ_GAIN_REG	1239	Gain

Register Name	Register Location	Description
MB_READ_AD_SCALED_VDC	1241	Scaled VDC
MB_READ_TC_PROC_VAR	1243	TC process variable
MB_READ_PERC_O2	1245	Based on Nernst equation
MB_READ_PERC_O_DP	1246	decimal point for O2
MB_READ_PERC_O2_FP	1247	floating point value for O2 (w registers)
MB_READ_LAMBDA_TEMP	1249	Typically 800F
MB_READ_LAMBDA_CNV_MV_EN	1250	Convert mV to probe mV
MB_READ_AMB_PRESSURE_REG	1251	Ambient pressure (absolute)
MB_READ_GAS_PRESSURE_REG	1252	Gas pressure (absolute)
MB_READ_NDIR_GAS_SELECTION	1253	[0-7]. TBD
MB_READ_NDIR_GAS_VPP	1254	Peak-peak voltages
MB_READ_NDIR_GAS_VPP_SF	1258	Peak-peak voltages. No high/low values
MB_READ_NDIR_GAS_VPP_FIR	1262	Peak-peak voltages FIR filtered
MB_READ_NDIR_GAS_NA	1266	Gas Normalized absorbance
MB_READ_NDIR_GAS_NA_TC	1269	Gas Normalized absorbance, temperature compensated
MB_READ_NDIR_GAS_CONC	1272	Gas concentration
MB_READ_NDIR_GAS_CONC_DP	1275	Gas concentration decimal point
MB_READ_NDIR_GAS_CONC_FP	1278	Gas concentration floating point
MB_READ_CAL_ENABLE_REG	1284	enables a calibration
MB_READ_CAL_REQUEST_REG	1285	CJ cal or zero/span voltage cal
MB_READ_CAL_RANGE_REG	1286	Calibration Range register. Sets the voltage gain for a calibration.
MB_READ_CAL_CHANNELS_REG	1287	bitmap of channels to be calibrated
MB_READ_CAL_VALUE_REG	1288	Calibration value
MB_READ_CAL_TIMER_REG	1293	First of 5 calibration timers
MB_READ_CAL_PROGRESS_REG	1294	0 = no calibration, 1 = calibration in progress

Register Name	Register Location	Description
MB_READ_CAL_ERROR_REG	1295	First of 5 calibration error calculations
MB_DIGIO_OUTPUT_SET	1600	Bitmap that sets the output of a digital I/O card
MB_DIGIO_COMM_STATUS_REG	1601	Communication status for digital I/O card
MB_DIGIO_VERSION_NUMBER	1610	current version number of the firmware
MB_DIGIO_UART_1_MODE	1611	Determines mode: modbus slave = 0, modbus master = 1
MB_DIGIO_UART_1_BAUD_RATE	1612	Baud Rate.
MB_DIGIO_UART_2_MODE	1613	Determines mode: modbus slave = 0, modbus master = 1
MB_DIGIO_UART_2_BAUD_RATE	1614	Baud Rate.
MB_DIGIO_BOARD_ADDR	1615	Board modbus address (important for slave only)
MB_DIGIO_MODEL_NUM	1616	MODEL number Map as reg 900
MB_DIGIO_RESET_FACT_DEFAULTS	1618	SFD 23205 sets factory defaults Map as reg 909
MB_DIGIO_UART_3_MODE	1619	Determines mode: modbus slave = 0, modbus master = 1
MB_DIGIO_UART_3_BAUD_RATE	1620	Baud Rate. 0=1200 ,..., 10=115200
MB_DIGIO_SER_NUM_0	1621	Start of Serial number
MB_DIGIO_SER_NUM_1	1622	serial number 1
MB_DIGIO_SER_NUM_2	1623	serial number 2
MB_DIGIO_SER_NUM_3	1624	serial number 3
MB_DIGIO_SER_NUM_4	1625	serial number 4
MB_DIGIO_SER_NUM_5	1626	serial number 5
MB_DIGIO_SER_NUM_6	1627	serial number 6
MB_DIGIO_SER_NUM_7	1628	serial number 7
MB_DIGIO_SER_NUM_8	1629	serial number 8
MB_DIGIO_SER_NUM_9	1630	serial number 9
MB_DIGIO_EVENT_IN_CP	1636	Copy of Event Input

Register Name	Register Location	Description
MB_DIGIO_EVENT_OUT_ACT_CP	1637	Actual Output
MB_DIGIO_EVENT_OUT_SP_CP	1638	Copy of Output setpoint
SENSOR_SUB_SERIAL_NUM	1700	serial number of sensor board

Replacement Parts

Part	Part Number
Card, SD 2 GB	31604
Power Supply	31135
Stylus	31295
Touch Screen	31296
Circuit Board - Digital I/O	31628
Terminal Block, Pluggable 6-Position	33305
Terminal Block, Pluggable 3-Position	33310
Terminal Block, Pluggable 2-Position, Plug	33312
Terminal Block, Pluggable 5-Position	33362
Terminal Block, Pluggable 9-Position	33363
Flow Meter	36114
Bowl Filter	37050
Filter	37051
Sensors	
Hydrogen Sensor, Flow-Through	A20830
Oxygen Sensor, 4-Wire Analog	31435

Warranty

Limited Warranty for Super Systems Products:

The Limited Warranty applies to new Super Systems Inc. (SSI) products purchased direct from SSI or from an authorized SSI dealer by the original purchaser for normal use. SSI warrants that a covered product is free from defects in materials and workmanship, with the exceptions stated below.

The limited warranty does not cover damage resulting from commercial use, misuse, accident, modification or alteration to hardware or software, tampering, unsuitable physical or operating environment beyond product specifications, improper maintenance, or failure caused by a product for which SSI is not responsible. There is no warranty of uninterrupted or error-free operation. There is no warranty for loss of data—you must regularly back up the data stored on your product to a separate storage product. There is no warranty for product with removed or altered identification labels. SSI DOES NOT PROVIDE ANY OTHER WARRANTIES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOME JURISDICTIONS DO NOT ALLOW THE LIMITATION OF IMPLIED WARRANTIES, SO THIS LIMITATION MAY NOT APPLY TO YOU. SSI is not responsible for returning to you product which is not covered by this limited warranty.

If you are having trouble with a product, before seeking limited warranty service, first follow the troubleshooting procedures that SSI or your authorized SSI dealer provides.

SSI will replace the PRODUCT with a functionally equivalent replacement product, transportation prepaid after PRODUCT has been returned to SSI for testing and evaluation. SSI may replace your product with a product that was previously used, repaired and tested to meet SSI specifications. You receive title to the replaced product at delivery to carrier at SSI shipping point. You are responsible for importation of the replaced product, if applicable. SSI will not return the original product to you; therefore, you are responsible for moving data to another media before returning to SSI, if applicable. Data Recovery is not covered under this warranty and is not part of the warranty returns process. SSI warrants that the replaced products are covered for the remainder of the original product warranty or 90 days, whichever is greater.

Revision History

Rev.	Description	Date	MCO #
New	Initial release	6/5/2020	2291
A	Specs updated	2-15-2022	2319
B	Various corrections and updated screenshots	5/1/2024	2354

Appendix A: Dip Switch Setting Examples