SuperSystems

incorporated

PGA 3510
Portable Multi-Gas IR Analyzer

(CO, CO_2, and CH_4 Gas Analyzer
with O_2 and Optional H_2 Measurement and
% Carbon, % Dissociated Ammonia, % NH_3, K_N, and
K_C Calculation Capabilities)

Operations Manual

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

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Introduction

The Model PGA 3510 (see part numbers in the Parts List on page 38) is a portable Multi-Gas IR analyzer with an Oxygen (O_2) cell. It measures Carbon Monoxide (CO), Carbon Dioxide (CO_2) and Natural Gas (CH_4) typically found in an endothermic atmosphere. The measurement of these gases, combined with furnace temperature information, allows the PGA 3510 to calculate the percent Carbon (%C) of the measured gas. A Hydrogen (H_2) sensor can also be incorporated as an option to provide a more complete picture of the measured gas.

For nitriding and ferritic nitrocarburizing (FNC) applications, the PGA 3510 can calculate carburizing potential (K_C) and nitriding potential (K_N).

Finally, the PGA 3510 can be configured for compatibility with environments containing ammonia (NH_3) gas. NH_3 compatibility must be specifically requested when the PGA 3510 is ordered.

IMPORTANT!

Do not use a PGA 3510 for gas analysis with NH_3-containing gas if the PGA 3510 has not been configured with NH_3 compatibility. Any use of a non-NH_3 compatible PGA 3510 with NH_3-containing gas will void the product warranty.

WARNING!

The exhaust of the PGA 3510 should be burned or vented outside to avoid exposure to carbon monoxide. Extended exposure to the exhaust could be hazardous to your health.

Specifications

The unit is designed and manufactured for the atmosphere heat treating industry; however, its uses go beyond the scope of these applications.

CO range:	0.00 to 30.00 %
CO_2 range:	0.000 to 2.000 %
CH_4 range:	0.00 to 20.00 %
O_2 range:	0.1 to 25.0%
H_2 range:	0.00 to 100%

* Note: These sensors have been optimized for use at the levels normally seen in an Endothermic atmosphere. The ranges can be adjusted to fit other applications. For information regarding modifications to the ranges shown above, please contact Super Systems.

Sampling method:	Extraction by internal pump (when necessary)

Measurement Method (CO, CO_2, CH_4):   Non-Dispersive Infrared (NDIR)
Measurement Method (O_2):   Electrochemical
Measurement Method (H_2):   Thermal Conductivity
Accuracy and repeatability: $\pm$ 1% of full scale
Recommended Calibration Interval: Annual
Flow Meter: Inside case lid and also on-screen
AC Power Requirements: 90 to 230 VAC, 50 to 60 Hz, 60 Watts
DC Power Source: 12VDC rechargeable NiCd battery with Integral charger
Communications: Ethernet, USB(A), USB(B), RS485 Modbus
Data Storage: Continuous automatic data logging
Data Retrieval: XGA Viewer Software (included) or on-screen
Operating Temperature: 32° to 122° F (0° to 50° C)
External Dimensions: Approx. 16"H X 20"L X 8"D
Weight: Approx. 28 lbs.

Unpacking the Device

The following items should be included with the PGA:
1. Portable Gas Analyzer
2. Bowl Filter
3. Sample Tubing
4. In-Line Filter
5. Notepad
6. Touch Screen Stylus
7. XGA Viewer Software CD
8. USB Cable
9. CO_2 Scrubber
10. Power Cord
11. Product Manual

Basic Operating Description

The Model PGA 3510 has been designed for the simultaneous analysis of CO, CO_2 and CH_4 in heat-treat furnace atmosphere gases. It uses a color touch screen display / operator interface for data entry and for viewing. Selections can be made on the screen using a finger or a stylus. Avoid the use of sharp objects (pens, paperclips, screwdrivers, etc.) as they can cause permanent damage to the screen and void the warranty of the instrument.

After the power switch is turned on, it will take approximately 30 seconds for the PGA 3510 software to automatically load. Once the software is properly loaded, the instrument is ready to use. When the power switch is turned off, the PGA 3510 initiates a controlled shutdown procedure which takes about 15 seconds. Following the controlled shutdown, the instrument will completely turn off.

Hydrogen Cell Note:
For highest H_2 accuracy, it is recommended that the instrument be powered on for 60 minutes before measurements are taken.

Default Screen

Once the PGA 3510 has successfully loaded its software, the default screen will be displayed.
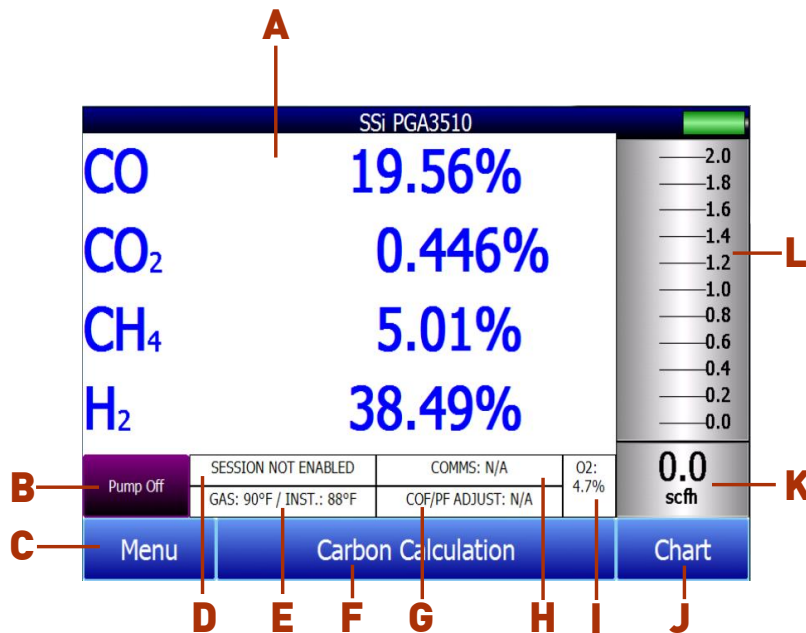
A – Measured values of CO, CO_2, and CH_4 (and H_2, if the H_2 sensor is present)
B – Pump status indicator / Button to change pump status
C – Button to access menu list
D – Session status indicator
E – Temperature / Instrument Temperature indicator
F – Button for Carbon Calculation screen
G – Automatic Carbon Calculation Adjustment indicator
H – External Instrument Communications status indicator
I – Measured value of Oxygen
J – Button for Trend Chart screen
K – Numeric Flow indicator
L – Visual Flow indicator

Pressing the **Return** button at the bottom right of the operator interface on any screen will take the display to the default. It may be necessary to press the **Return** button multiple times.

Pump Operation

Initially, the pump will be off. The pump should remain off while sampling an endothermic generator or any other atmosphere under positive pressure. The pump should also remain off during calibration. For proper operation, the flow of gas through the sensors should be between 1.0 and 2.0 SCFH. If the flow meter on the right of the screen or on the inside of the lid does not indicate sufficient flow, turn the pump on. When accessed from the main screen, the pump has two possible modes: **On** and **Off**.
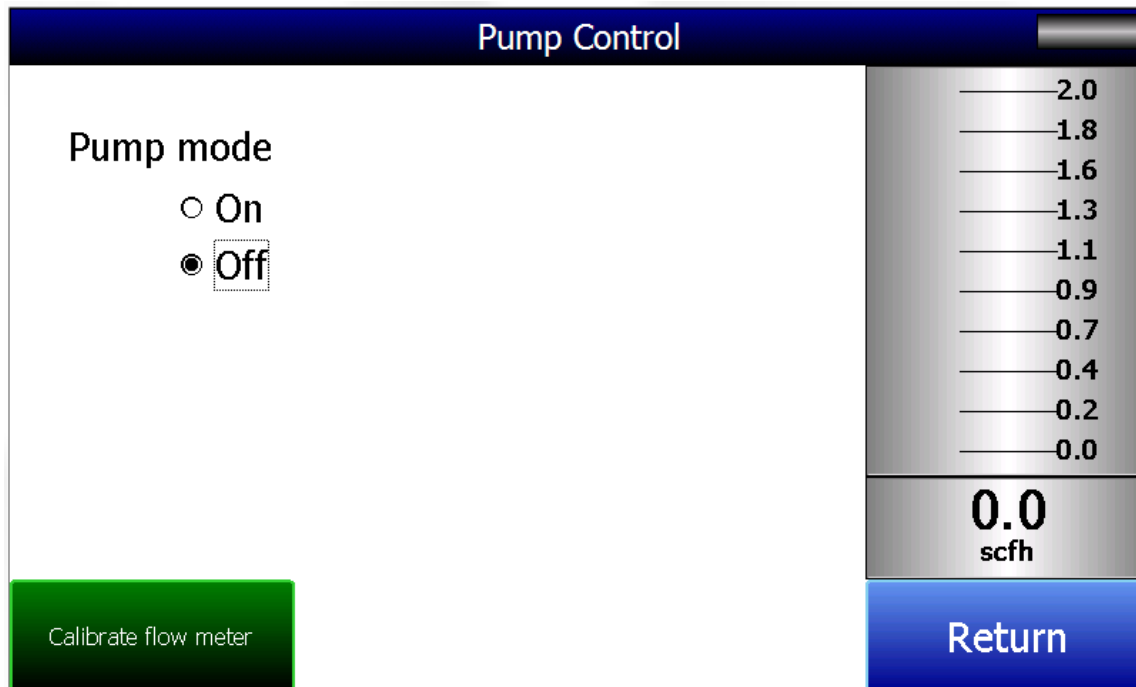
Carbon Calculation

The PGA 3510 determines the percent carbon in the sample gas using measured amounts of CO, CO_2, and CH_4 along with the Furnace Temperature. The Furnace Temperature is either entered by the user or obtained automatically from the Furnace Temperature Controller via RS-485 communications.

Additionally, the carbon percentage measured by the PGA 3510 can be used as a comparison to the carbon percentage measured by a furnace's oxygen probe. This is accomplished either by manually entering the Probe Temperature, Probe Millivolts, and the Probe CO Factor into the PGA 3510 or by obtaining the information automatically via RS-485 communications to the Furnace Carbon Controller. Providing the probe information allows the PGA 3510 to suggest an adjustment for the probe CO Factor (or Process Factor) in order to keep the oxygen probe measuring properly.

Carbon Calculation			
Furnace	1701 °F	Probe Temperature	1698 °F
Measured CO	21.88 %	Probe Millivolts	1072 mV
Measured CO2	0.737 %	%C (probe)	0.28 %
Measured CH4	8.55 %	Probe CO Factor	200
%C (gas analyzer)	0.27 %	Suggested CO	191

Pump Off	SESSION IN PROGRESS	COMMS: N/A	O2: 16.2%
	INTERNAL TEMP: 84°F	COF/PF ADJUST: N/A	

		Chart	Return

Using infra-red analysis is considered a more accurate method for determining the percent carbon of a gas compared to using an oxygen probe alone. The single point oxygen probe assumes a theoretical mixture of endothermic gas to infer the percent carbon whereas the gas analyzer will measure the exact composition of the process gas. The percent carbon determined by the gas analyzer can then be used to adjust the carbon percentage determined by the oxygen probe.

Chart

The Chart Display shows between 1 hour and 24 hours of process variable data on the screen and can be scrolled back to view all of the data stored on the flash card. 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 right-pointing arrow with the vertical line next to it button - [▶|] - will toggle between viewing the chart in or out of real-time. When in real-time mode, the chart will automatically be updated once a minute.
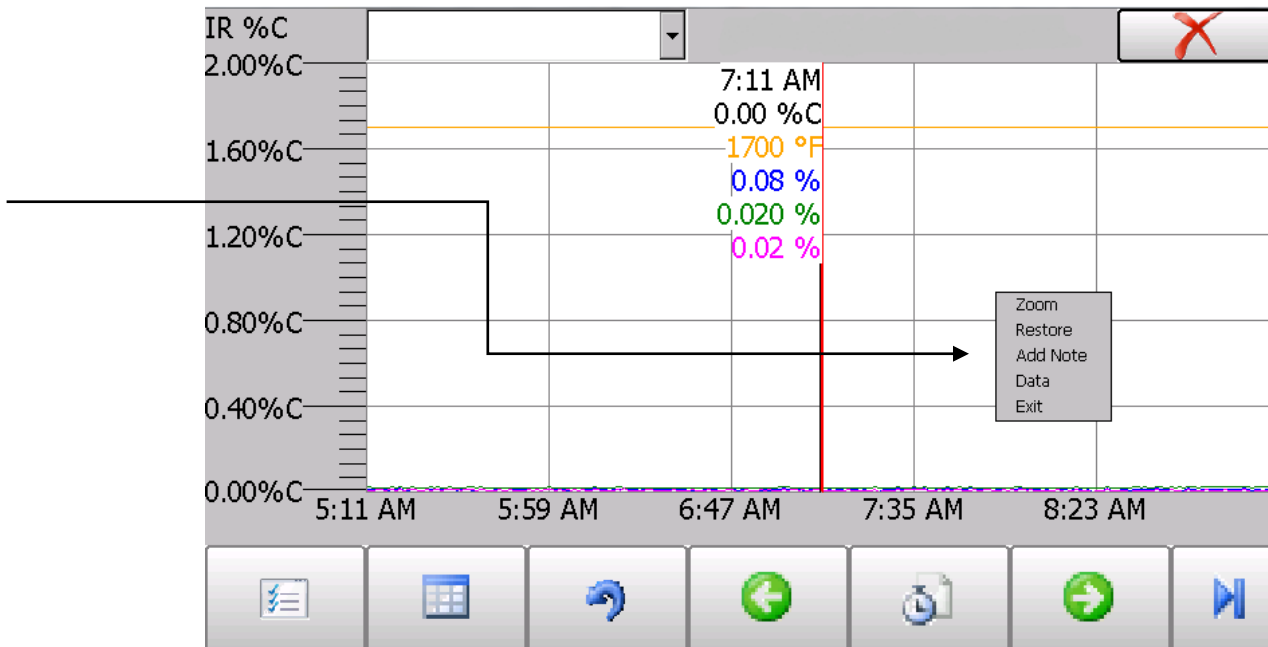
Chart Sub Menu

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

The **Zoom** option will allow the user to zoom in on a particular part of the screen. Once this has been selected, the user can take a stylus or a finger and create a box around the 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 initial chart screen.

The **Add Note** option allows the operator to enter a note on the chart, similar to writing on a paper chart. The note is available when the chart is printed out using the utility software included with the Series 9010 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 either the operator interface keyboard and typing or using the Signature mode and writing the note with the 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.

Menu Lists

Accessing the menu screen will show three or four available options, depending on whether the Nitrider Calculation feature is installed.

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Carbon Calculation
Nitrider Calculation
Sessions
Instrument Information

Login	Detail	Return
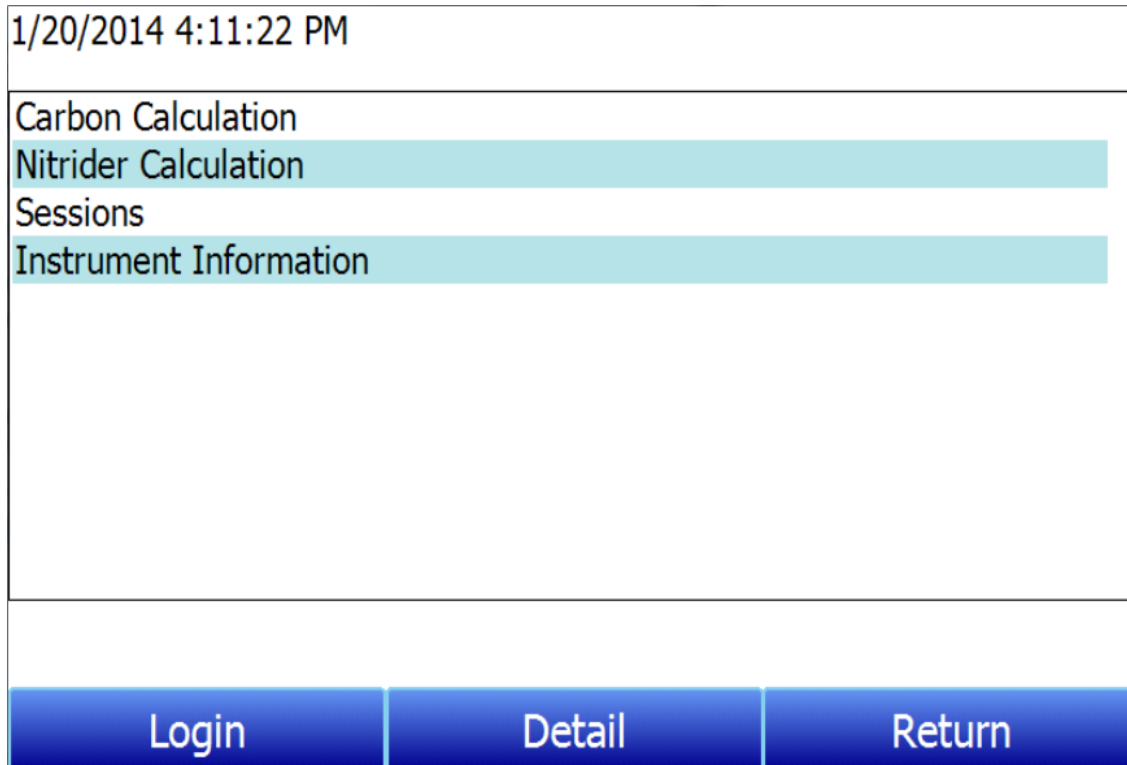
Carbon Calculation, Nitrider Calculation (if installed), Sessions, and Instrument Information can be accessed by any users. Additional menu items are available when an authorized user logs in using an appropriate Pass Code. When the Supervisor Pass Code is entered (default = 1), the user will also be able to access the Pump Control and Instrument Information screen.

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| Carbon Calculation |
| Nitrider Calculation |
| Sessions |
| Pump Control |
| Instrument Information |

| Login | Detail | Return |

To see the full range of options available, the user must use the Configuration Pass Code (Default = 2). This provides the user with all available options including calibration and setup functions.

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| Carbon Calculation |
| Nitrider Calculation |
| Sessions |
| Pump Control |
| Sensor Calibration |
| Automatic Sampling Parameters |
| Communications and Source Setup |
| Instrument Setup |
| Instrument Information |
| Tools |

| Login | Detail | Return |

To access any items on the menu list, touch the item to highlight it and then press Detail. A specific description of each item on the list follows.

Carbon Calculation

Please see the Carbon Calculation section starting on page 8.

Nitrider Calculation (Available on Units Configured for Nitriding & FNC Applications)

When configured for nitriding and ferritic nitrocarburizing (FNC) applications, the PGA 3510 has the ability to provide a calculation of values essential those processes—specifically, nitriding potential (K_N) and carburizing potential (K_C). To access these values, open the Nitrider Calculation page. NOTE: If the PGA 3510 unit you are using does not have the Nitrider Calculation option, and you would like this feature added, please contact SSi at (513) 772-0060.

The Nitrider Calculation page displays data on current atmosphere parameters such as temperature and measured values for % CO, % CO_2, % CH_4, % O_2, and % H_2 (if the H_2 sensor is installed). The calculated value for %C is also shown.

User-provided flow values for N_2, NH_3, DA, and CO_2 are used by the PGA 3510 in performing calculations. The flow values are visible on the right side of the Nitrider Calculation page. To change a flow value, simply tap on the blue field for that value. A numeric entry page will appear, allowing you to change the value. For the purpose of K_N and K_C calculations, any valid gas flow unit (for example, cubic feet per minute, or cfm) may be used. The flow unit must be the same for all gases. NOTE: If one or more of the flow gases do not show up in the list, it is likely that the gas flow valve is not enabled in the Tools → Valve Setup menu. Refer to the Valve Setup section on page 34 for more information.
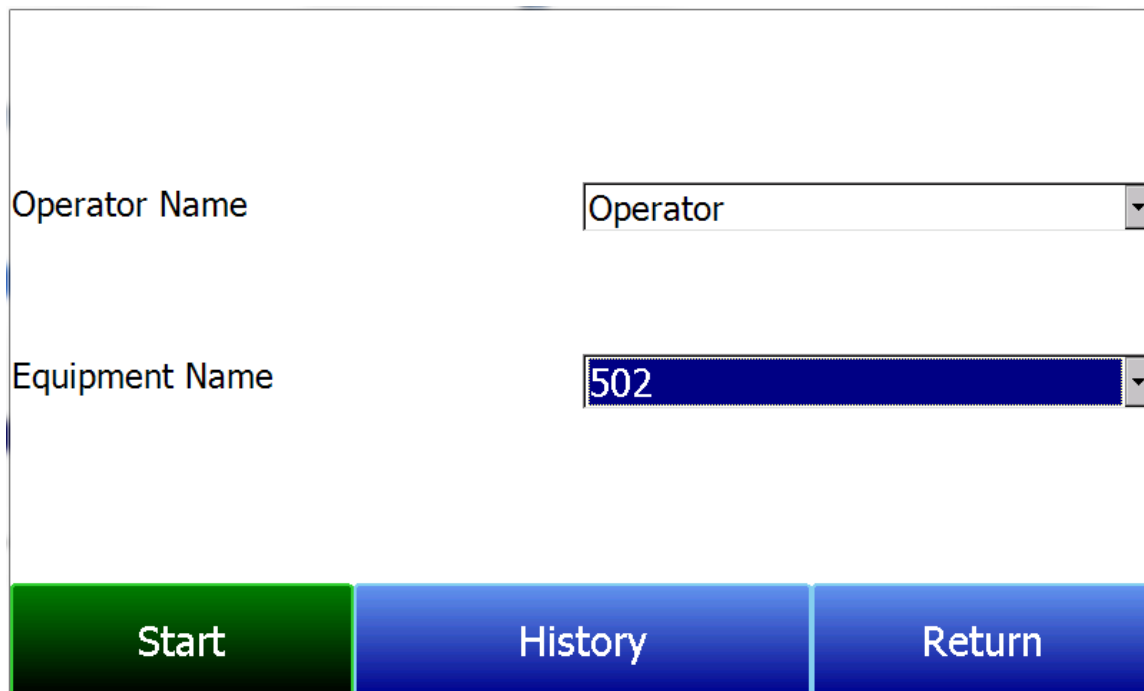
K_N provides a measurement of the amount of nitrogen that can be diffused into a metal (e.g., iron); it is a derived measurement based on the partial pressures of NH_3 and H_2. The PGA 3510 performs the calculation of K_N using user-provided flow values and displays the calculated K_N value on the Nitrider Calculation page.

K_C provides a measurement of the amount of carbon that can be diffused into a metal; it is derived from a calculation involving the partial pressures of CO_2, H_2, CO, and H_2O. The PGA 3510 performs the required calculation using user-provided flow values and displays the calculated K_C value on the Nitrider Calculation page.

Sessions

The instrument is logging data any time that it is powered on. Data of interest can be viewed by entering its date and time. Users can apply custom tags to sections of data, allowing for easy identification of viewing and recalling data. These tags can include the name of the operator and the name of the equipment that is being measured.

The instrument has default values for each of these variables. However, it is highly recommended that the selections be modified so that data may be tagged in a way that is easily recognized. For more information on how to set up these selections with custom entries, see the "Tools – Database Maintenance" section of this manual.

Operator Name	Operator
Equipment Name	502

Start	History	Return

Using the pull-down menus, select the **Operator Name** and **Equipment Name** from the list of available selections. Then begin the session by pressing **Start**. After confirming the beginning of a session, a sessions summary screen will be displayed. To end the session, press the red **End** button.

| Display Sessions between | 5/15/2011 | ▼ | and | 6/18/2011 | ▼ |

Start	End	Equipment	Operator
6/16/2011 2:32:23 PM		502	Troy
5/25/2011 8:27:11 AM	5/25/2011 1:16:22 PM	502	Troy
5/19/2011 8:11:30 AM	5/19/2011 10:41:40 PM	1586 Lindberg	Troy
5/18/2011 8:17:01 AM	5/18/2011 2:49:30 PM	1586 Lindberg	Troy
5/17/2011 10:19:41 AM	5/17/2011 2:40:26 PM	1586 Lindberg	Troy
5/16/2011 8:09:37 AM	5/16/2011 4:31:22 PM	1586 Lindberg	Troy

End   **Detail**   **Return**

This screen will identify sessions within the date range specified at the top of the screen. As a default, sessions from the past 24 hours are shown. By expanding the data range, additional sessions can be seen. These sessions are sorted with the newest entry at the top, but they can be sorted by **End Time**, **Equipment Name**, or **Operator Name** by touching the header of each column.

To see the details of any session, highlight it by touching it, and then press **Detail**. This will display a graphical representation of the data from the selected session.
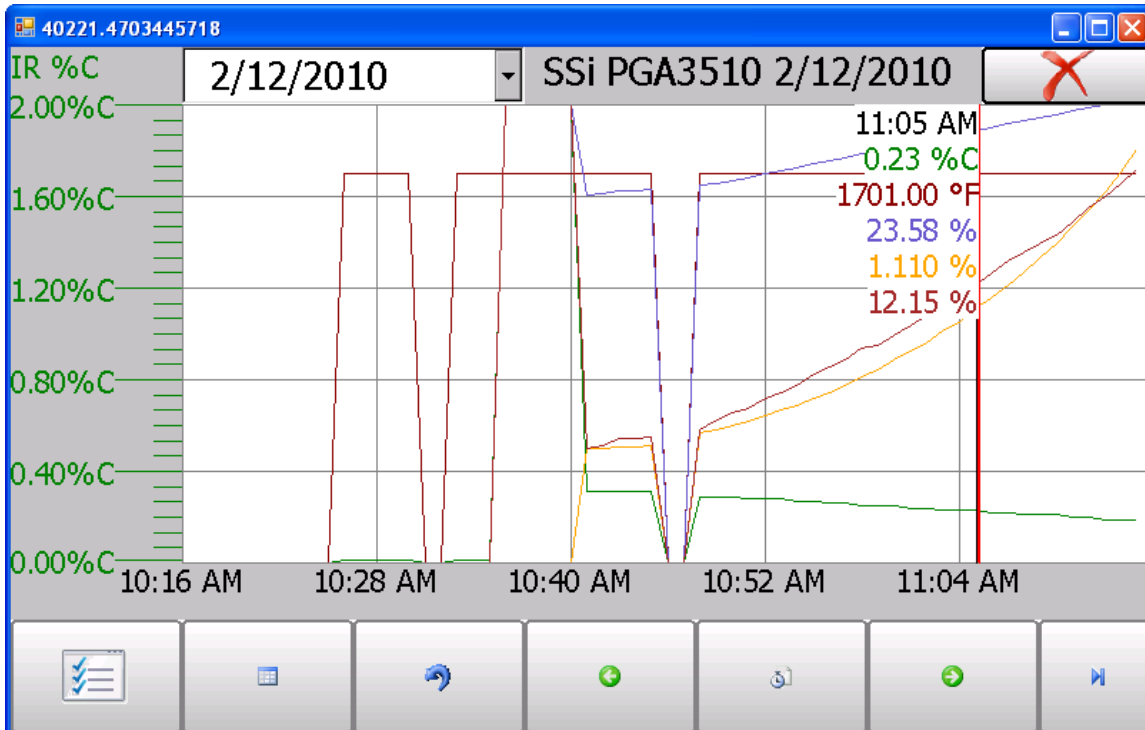
For more information on navigating the Chart Screen see the "Chart" section of this manual. To leave the Chart view, press the red X in the upper right hand corner of the screen.

Pump Control

The Pump Control screen will identify and allow the modification of the pump status (**On** or **Off**).

Pump Control	
Pump Status	Off

Edit	Return
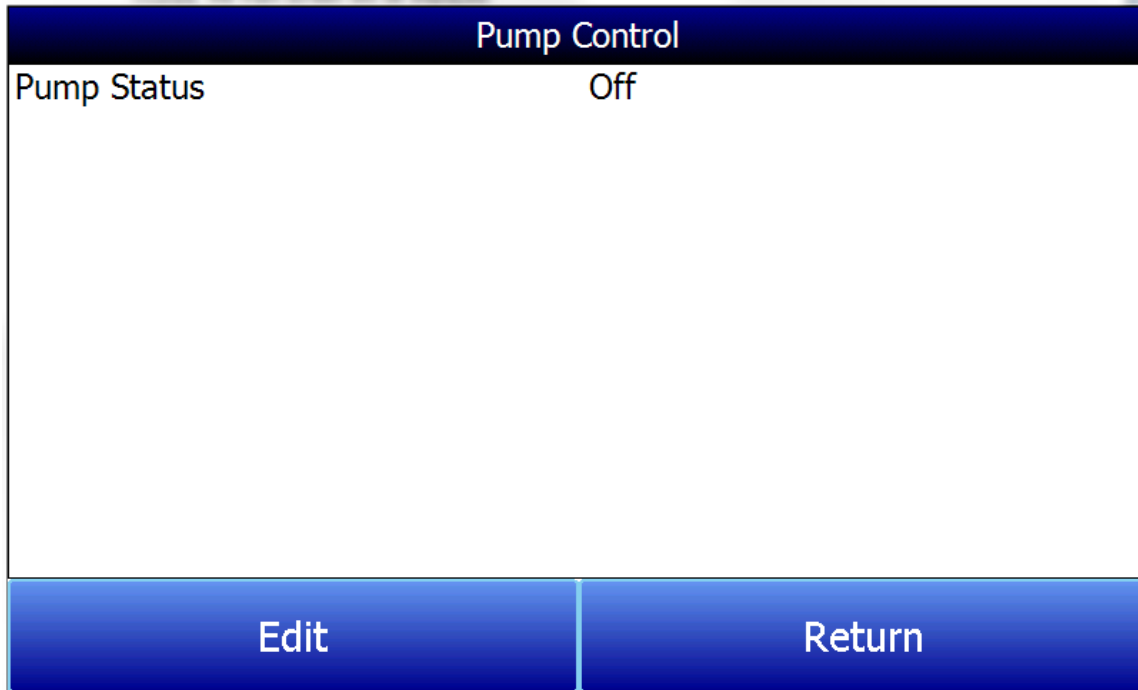
Sensor Calibration

SSi Recommends the following user calibration schedule for the PGA3510:

If the device is used…	Then perform a calibration…
Daily	Weekly
Weekly	Monthly
Less than weekly	Prior to use

NOTE: This does not refer to SSi Factory Calibration. Factory Calibration should be performed annually, and is described in more detail on pages 33-36.

Two types of calibrations can be performed on the NDIR sensor; Zero and Span. The Zero calibration should be performed with a gas that has none of the measured gases in it. Ideally this would be pure Nitrogen or Argon. The concentration of the Span calibration gas should closely resemble the gas that is being measured. For a heat treating application measuring endothermic gas, the ideal composition would be:

- CO: 20%
- CO_2: 0.5%
- CH_4: 5.0%
- H_2: 40%
- N_2: Balance

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 is into the analyzer, turn the pump off. The amount of flow from the gas cylinder should be approximately 1.5 SCFH 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.

Hydrogen Cell Note:
It is recommended that the instrument be turned on for three hours prior to performing an H_2 calibration.

Performing a Zero Calibration
From the Sensor Calibration screen, be sure that the button at the upper left of the instrument is selecting **Zero Calibration** and not **Span Calibration**.

When this is selected, the target values will automatically go to zero. Begin the flow of gas at the appropriate rate, and allow the readings to come to equilibrium. 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 approximately 45 seconds.

There is a column showing the Status of each gas. In this area the instrument is making a comparison between the Target value and the Actual value and providing feedback based on the amount of difference between the two. There are three possible words that can appear in this area:

"**OK**" – The gas is within 10% of where it is expected to be.
"**OK?**" – The gas is between 10% and 20% of where it is expected to be. This could indicate an issue with the calibration gas, so the calibration gas and the associated tubing should be checked and verified to be free from leaks or improper gas composition. This message does not necessarily indicate that there is a problem with the sensor or the calibration. It is meant only to have the operator make sure that the proper procedures are being followed.
"**BAD**" – The gas is more than 20% from where it is expected to be. The same items should be checked as described above. This message could indicate an issue with the sensor.

Regardless of the status of each of the gases, the instrument can be calibrated by waiting for the readings to stabilize and pressing **Start Calibration**. Timers will begin to count down, and when they reach zero the Actual values should be the same as the Target values (allowing for slight variations as a result of gas fluctuations).

Use of a CO_2 Scrubber for Zero Calibrations

If an appropriate Zero calibration gas is not available, the included CO_2 Scrubber can be used.

The scrubber is designed to remove CO_2 from ambient air. Ambient air should not have a significant amount of CO or CH_4. However it does have some CO_2 in it. Using the scrubber will result in the instrument measuring a gas with no CO, CO_2, or CH_4 which is the function of a good zero gas. Unfortunately, depending on the environment where the calibration is being performed, ambient air may contain trace amounts of CO and/or CH_4. Also, the scrubber uses an expendable media that loses its effectiveness after repeated uses. For these reasons, Super Systems Inc. recommends the use of Nitrogen or Argon instead of the scrubber whenever possible.

To use the CO_2 scrubber: Remove the protective caps from the scrubber and attach it to the inlet hose on the PGA 3510. The pump should then be turned on. This will pull ambient air through the scrubber and into the analyzer.

Always replace the caps on the CO_2 scrubber after use. If it is left exposed to ambient air, the media will lose its effectiveness. The amount of time that the Scrubber is exposed to ambient air is directly related to its effective life span. If the protective caps are replaced after each use, the scrubber will provide years of service.

Never mistake the scrubber for a particulate filter. Not only is it not designed for this purpose, but because it removes the CO_2 from the gas it will result in very inaccurate readings. For these reasons, it should never be used during a Span calibration.

Performing a Span Calibration

A Span calibration is performed the similarly to the zero calibration but with two small changes. First, the selector button at the top should be on **Span Calibration** instead of **Zero Calibration**.
Second, the gas values for the specific cylinder of gas being used need to be entered into the Target values. To do this, press the blue box associated with each gas and enter the value shown on the cylinder. For example, the nominal value for CO may be 20%, but your cylinder may actually have 19.96% CO. 19.96 is the value that should be entered as a Target.

After the gas values have been entered, proceed with the calibration in the same manner as with the zero calibration. Never perform a span calibration without first doing a zero calibration.

Calibrating the Oxygen Sensor

The PGA 3510 uses an electrochemical oxygen sensor that should last approximately two years (depending on usage). It measures oxygen to a resolution of 0.1%, so it is not suitable for calculating carbon in a furnace. Its intended use is for troubleshooting problems such as air and/or water leaks. The information from this sensor is not used in the calculation of percent carbon.

Calibration of the Oxygen sensor does not require a special calibration gas. Ambient air contains 20.9% O2, and since that concentration is relatively stable, it can be used to perform a span calibration on the sensor. There is no drift at the low range of the sensor so there is no Zero Calibration function for the Oxygen sensor. There is only a **Span Calibration**.

To perform a Span calibration: Take the instrument to an office or outdoors where it will be in fresh air. Press the **Calibrate O2** button on the Sensor Calibration screen. When the Oxygen Calibration screen is entered, the pump automatically turns on. When the Actual value stabilizes, press the **Start Calibration** button. This will make the Actual value match the Target value.
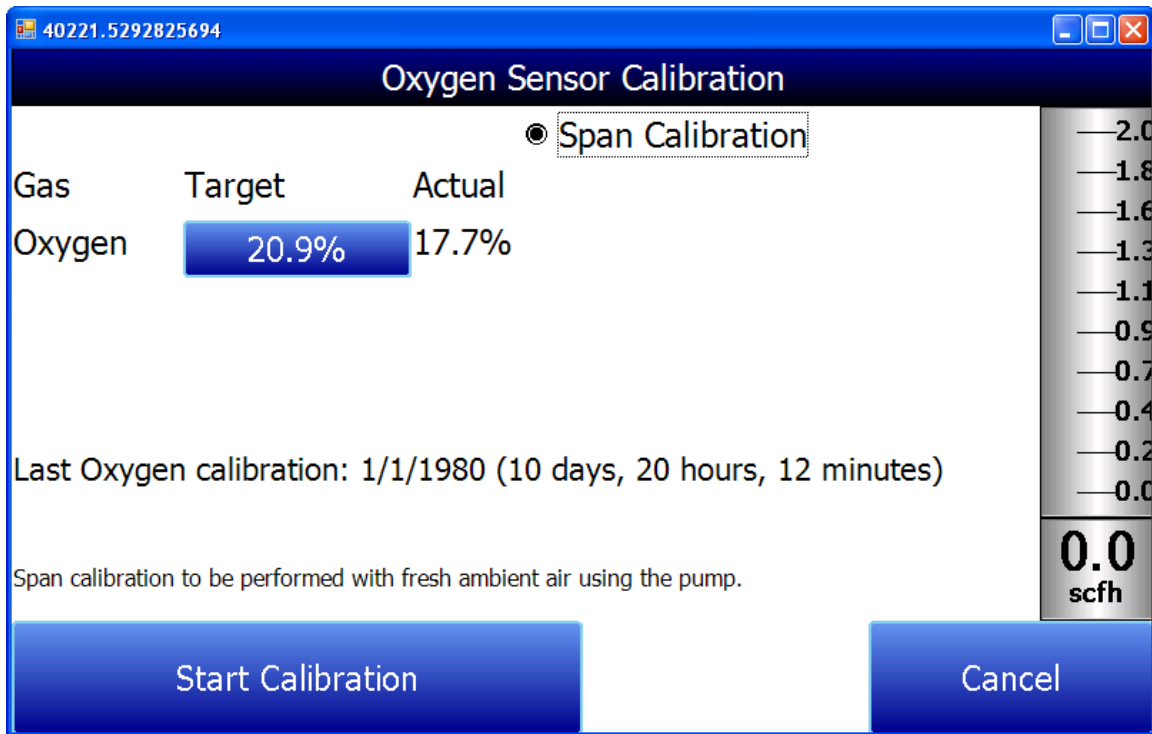
Automatic Sampling Parameters

This instrument is capable of communicating directly with a control instrument. This is valuable because it will provide real-time entry of the temperature and millivolt information from the probe, allowing for an accurate comparison between the IR % Carbon and the Probe %Carbon. To establish this communications link, see "Communications and Source Setup – Atmosphere/ Temp Sources."

The Automatic Sampling Parameters screen will allow the user to adjust the way that the PGA 3510 updates the COF / PF in the atmosphere controller. All of the parameters on this page can be disregarded if the "**COF/PF Adjustment Mode**" is set to **Monitor** mode. These parameters only apply when the instrument is in **Control** mode.

Automatic Sampling Parameters	
COF/PF Adjustment Increment	1
COF/PF Adjustment Interval (minutes)	1
Minimum COF/PF Value	130
Maximum COF/PF Value	220
COF/PF Adjustment Mode	Monitor

Edit	Return

COF/PF Adjustment Increment

When adjustments are made automatically, this value indicates the size of the step that is made when the COF/PF is changed. It is recommended that this number remain low to avoid making sudden changes to the process that could be caused by temporary conditions.

COF/PF Adjustment Interval (minutes)

This indicates the frequency that automatic adjustments are made. We recommend making small changes at a frequent interval instead of making large changes at longer intervals. This will prevent temporary changes in atmosphere from making dramatic adjustments to the COF/PF.

Minimum COF / PF Value

As a safeguard, the COF/PF can be prevented from dropping below a certain point. This point is the Minimum COF/PF value.

Maximum COF / PF Value

The Maximum COF/PF can also be entered as a safeguard.

COF / PF Adjustment Mode

This selection determines if changes to the COF/PF will be made automatically or if the instrument will monitor the conditions without making any changes. When in **Monitor** mode, a COF/PF will continue to be suggested, but no modifications will be made to the atmosphere controller.

Communications and Source Setup

This screen allows the user to view and modify the method of communications between the instrument and external devices.
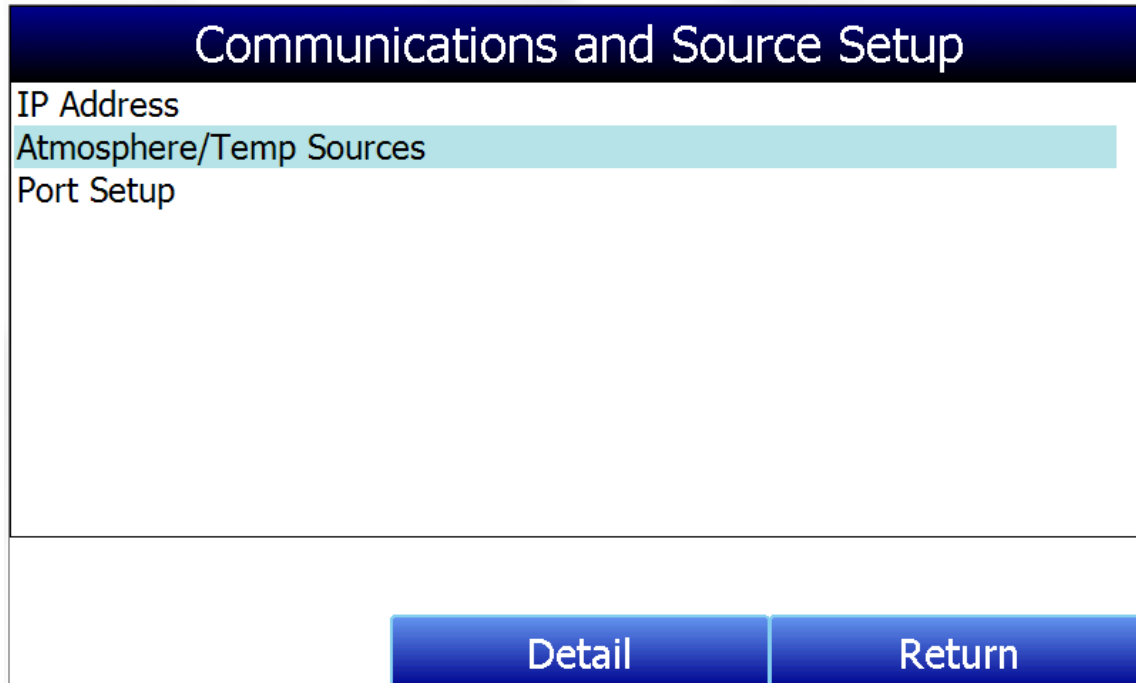
IP Address

This section identifies the IP Address of the instrument. When connected to a network, the PGA 3510 screen will obtain its own IP Address. It does this during the power-up procedure, so if communication via Ethernet is preferred, plug the cable into the instrument before turning it on. To use a specific IP address, it must be entered on the Windows CE screen. This can only be accessed when the Gas Analyzer software has been shut down.

Manually Setting the IP Address
1. Log in to the PGA 3510 touch screen using the supervisor access code (by default, this code is '2').
2. Access the Instrument Setup → General Setup menu.
3. Select "Shut Down Software" followed by "Yes".
4. The program will shut down and a Windows CE screen will appear.
5. Click the Start menu in the lower left corner.
6. Select 'Settings" and then "Network and Dial-up Connections".
7. Select "CS89001"
8. Select the option for "Specify an IP Address"
9. Enter the desired IP Address, Subnet Mask, and Default Gateway.
10. Select "OK"
11. Close open windows to return to the main Windows CE Screen.
12. Double-click on the "SaveRegs" icon.
13. Select "OK" from the Registry Save Complete notification.
14. Turn the instrument off and wait for the screen to turn off.
15. Turn the instrument back on.
16. The instrument will automatically boot up as a gas analyzer with the IP address that has been manually entered.

Atmosphere/Temp Sources

RS485 communications can be set up to automatically enter and update data from the oxygen probe and, if desired, make modifications to the COF/PF in the atmosphere controller.

Communications and Source Setup-Atmosphere/Temp Sources	
Port Usage	Modbus Master
Port Baud Rate	19200
Probe Temp/mV Instrument	SSI AC20
Probe Temp/mV Instrument Address	0
Status	Not configured
Furnace Temp Instrument	SSI 7EK
Furnace Temp Instrument Address	0
Status	Not configured

Edit	Return

Port Usage
This is the communication method used to supply information to the instrument. The possible values are:
Modbus Master
Modbus Host

Port Baud Rate
This is the speed of communications which can range between 1200 and 115200.

Probe Temp/mV Instrument
This is the make and model of the device that will be supplying the instrument with information on: probe temperature, probe millivolts, and COF/PF. Possible choices are:

- SSi AC20
- SSI 9200/9205 Loop 1
- Yokogawa UDP750
- Honeywell UDC3300
- Dualpro Loop 1 Modbus
- Dualpro Loop 2 Modbus

Probe Temp/mV Instrument Address
This is the address of the atmosphere controller. It can be directly entered using the numeric keypad on the touch screen.

Furnace Temp Instrument
This is the make and model of the device that will be supplying the instrument with information on furnace temperature. If there is no instrument associated with this input, the probe temperature will be used. Possible selections are:

- SSi AC20
- SSI 9200/9205 Loop 1
- SSI 9200/9205 Loop 2
- SSI 9200/9205 Loop 3
- SSI 9100 Loop 1
- Yokogawa UDP750
- Honeywell UDC3300
- Dualpro Loop 1 Modbus
- Dualpro Loop 2 Modbus

Furnace Temp Instrument Address
This is the address of the furnace temperature instrument. It can be directly entered using the numeric keypad on the touch screen.

Port Setup

This page is used to set the parameters for the communications ports. The factory default settings are shown below, and they should not need to be changed by the operator.

Communications Setup-Port Setup	
Host Address	1
RS232 Port A Baud Rate	19200
RS232 Port A Mode	Modbus Master
RS485 Port C Baud Rate	19200
RS485 Port C Mode	Modbus
RS485 Port D Baud Rate	19200
RS485 Port D Mode	Modbus Master

Edit	Return

Instrument Setup

The items shown in this menu list are settings that should only need to be changed once. Any modifications to the default values will be saved in the instrument.

Instrument Setup
Calculation Factors
General Setup
Security Settings
Factory Default Settings
Other Settings
Language Setup

| Detail | Return |

Calculation Factors

Instrument Setup-Calculation Factors	
IR Factor	CO Factor
IR Shim Factor	115
CH4 Factor	20
Current Working IR Factor	115
IRF Adjustment Matrix	
Use IRF Matrix	False
Equipment Specific IRF Matrices	
Set Setpoints based on IR Factor	
Use Furnace Temp for Furnace Se...	True

| Edit | Return |

In this menu, there are two factors that will influence the calculation of carbon: **IR Shim Factor** and **CH$_4$ Factor.** Each of these factors is incorporated in the equation used to calculate %C; they are described in

further detail below. The calculation factors should be changed only after determining that additional adjustments are required based on the specific conditions and equipment at each facility. Neither of them should be modified without significant testing or consultation from Super Systems, Inc.

IR Factor
This setting determines which of two parameters is incorporated in the %C calculation: **CO Factor** or **Process Factor (PF)**.

IR Shim Factor
Changing the IR Shim Factor is a way of modifying the computed percent carbon. The nominal value is 180. There is an inverse relationship between the IR Shim Factor and computed percent carbon. To increase the computed percent carbon, this number should be lowered, and to decrease the computed percent carbon it should be increased.

CH_4 Factor
This factor increases or decreases the significance of CH_4 in the calculation of carbon. CH_4 does not have a significant impact on the computed percent carbon, so it has a minor role in the equation. If the measured gas has over 5% CH_4, its role in the equation becomes greater than it should be. In these cases the CH_4 factor should be reduced. In cases where the CH_4 is present in excess of 7 or 8%, this factor can be reduced to zero.

Current Working IR Factor
This field shows the current IR Shim Factor adjustment value. It is not directly modifiable.

Three Methods of %Carbon Calculation

The PGA 3510 is able to calculate %Carbon using one of three methods: **Default Settings, IRF Matrix**, or **Equipment-Specific IRF Matrices**.

1. *Default Settings.* This is the method used when **Use IRF Matrix** is set to False (off). The sample gas composition (%CO, %CO_2, %CH_4) and temperature, along with the programmed IR Shim Factor and CH_4 Factor, are used to arrive at a calculation of atmospheric %Carbon.
2. *IRF Matrix.* When **Use IRF Matrix** is set to True (on), the PGA 3510 will use values configured in the **IRF Adjustment Matrix** to set the current IR Shim Factor. Configuring the adjustment matrix is described in more detail in the IRF Adjustment Matrix section below.
3. *Equipment Specific IRF Matrices.* This method allows you to configure an IRF Matrix specific to a configured piece of equipment and change the calculation method based on the equipment whose gas composition is being analyzed. This method is described in more detail in the Equipment Specific IRF Matrices section below.

IRF Adjustment Matrix
The IRF Adjustment Matrix, sometimes referred to simply as the IRF Matrix, is used to set conditions under which the IR Shim Factor will be changed. Using the IRF Matrix, a total of 16 different IR Shim Factors can be configured if both temperature and atmosphere are considered; a total of 4 different IR Shim Factors can be configured if only temperature is considered. **NOTE: Use IRF Matrix** must be set to "True" for this function to be used.

IRF Adjustment Matrix	
Temp Only	No
Atmosphere Limit	0.25
Atmosphere Limit	0.4
Atmosphere Limit	0.6
Temperature Limit	1200
Temperature Limit	1400
Temperature Limit	1600
IRF (Atm < 0.25, Temp < 1200)	95
IRF (Atm < 0.25, 1200 <= Temp < 1400)	105
IRF (Atm < 0.25, 1400 <= Temp < 1600)	115
IRF (Atm < 0.25, 1600 <= Temp)	125

Edit	Return

The following steps describe how to configure the IRF Matrix.

1. To begin, decide whether both atmosphere and temperature should be considered in setting the IR Shim Factor, or only temperature.
   - If both atmosphere and temperature apply, set **Temp Only** to "No" (and then go to step 2 below).
   - If only temperature applies, set **Temp Only** to "Yes" (and then go to step 3 below).

2. Configure up to 3 atmosphere limits. Each atmosphere limit marks a boundary line within the matrix. Atmosphere values above and below each limit will be evaluated in determining the IR Shim Factor.

   For example, if the atmosphere limits are 0.25, 0.4, and 0.6, the following ranges will be evaluated in helping to determine the IR Shim Factor:
   - Less than 0.25 (Atm < 0.25)
   - 0.25 – 0.39 (0.25 <= Atm < 0.4)
   - 0.4 – 0.59 (0.4 <= Atm < 0.6)
   - 0.6 and higher (0.6 <= Atm)

3. Configure up to 3 temperature limits. Each temperature limit marks a boundary line within the matrix. Temperature values above and below each limit will be evaluated in determining the IR Shim Factor.

   For example, if the temperature limits are 1200, 1400, and 1600, the following ranges will be evaluated in helping to determine the IR Shim Factor:
   - Less than 1200 (Temp < 1200)
   - 1200 - 1399 (1200 <= Temp < 1400)
   - 1400 - 1599 (1400 <= Temp < 1600)
   - 1600 and higher (1600 <= Temp)

4. Now, enter an IR Shim Factor for each set of ranges. Do this by tapping on a set of ranges and then tapping "Edit". A numeric entry screen will appear, allowing you to enter a value for the IR Shim Factor.
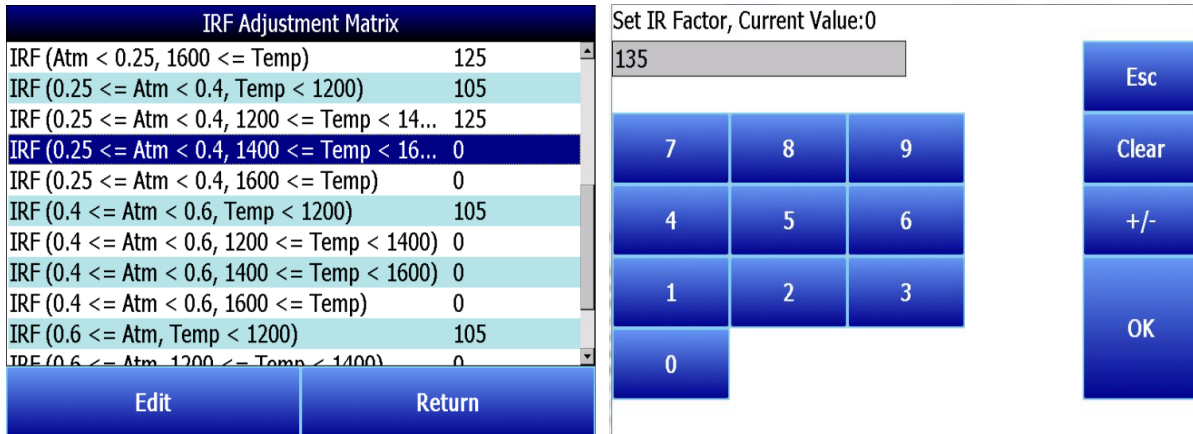
Once IR Shim Factor values have been entered for each set of ranges, the IRF Matrix is configured. The IRF Shim Factor will be set to the configured value for a set of ranges when the atmosphere and temperature (or temperature only, if configured that way) are within those respective ranges. For example, if the atmosphere is 0.3% and the temperature is 1230°, and the IRF for range set (0.25 <= Atm < 0.4, 1200 <= Temp < 1400) is 125, the PGA 3510 will set the current IR Shim Factor to 125.

Click **Return** to return to the Calculation Factors screen.

Use IRF Matrix
This setting determines whether or not the IRF Adjustment Matrix is used to set the IR Shim Factor. There are two possible settings: **False** (default) and **True.** If Use IRF Matrix is set to False, the IRF Adjustment Matrix will not be used (and Default Settings will be applied). If Use IRF Matrix is set to True, the IRF Adjustment Matrix will be applied to the IR Shim Factor.

Equipment Specific IRF Matrices
The PGA 3510 can be set up to use different IRF Adjustment Matrices based on the specific equipment whose gas composition is being analyzed. To use this feature, follow the steps below. **NOTE:** This procedure requires administrator access (default login: '2').

1. Make sure that the piece of equipment for which you want to set up an IRF Adjustment Matrix is configured in the Tools → Database Maintenance → Maintain Equipment menu. If the equipment has not been added, you will need to add it. Remember that Equipment is tied to Equipment Types; therefore, you may need to add an Equipment Type in the Tools → Database Maintenance → Maintain Equipment Type menu first.
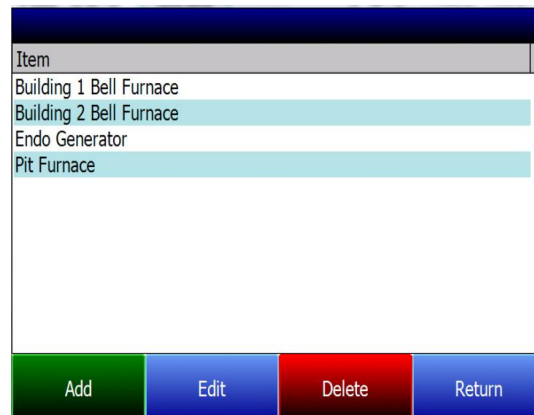
2. Open the Instrument Setup → Calculation Factors menu.

Instrument Setup-Calculation Factors	
IR Factor	CO Factor
IR Shim Factor	115
CH4 Factor	20
Current Working IR Factor	115
IRF Adjustment Matrix	True
Use IRF Matrix	False
Equipment Specific IRF Matrices	
Set Setpoints based on IR Factor	
Use Furnace Temp for Furnace Se...	True

| Edit | Return |

3. Open the Equipment Specific IRF Matrices menu option. Select the equipment for which you want to set up an IRF Matrix. Then click **Edit.**

Select Equipment
Building 1 Bell Furnace
Building 2 Bell Furnace
Endo Generator
Pit Furnace

| Edit | Return |

4. IRF Matrix parameters for the selected equipment will be displayed. Edit the parameters for the equipment. Parameters are described in the IRF Adjustment Matrix section above.

Building 1 Bell Furnace IRF Adjustment Matrix	
Temp Only	No
Atmosphere Limit	0.5
Atmosphere Limit	1
Atmosphere Limit	2
Temperature Limit	1000
Temperature Limit	1500
Temperature Limit	2000
IRF (Atm < 0.5, Temp < 1000)	180
IRF (Atm < 0.5, 1000 <= Temp < 1500)	180
IRF (Atm < 0.5, 1500 <= Temp < 2000)	180

| Edit | Save | Cancel |

5. Click **Save** when finished editing parameters. The IRF Matrix for this particular equipment is now set up.

When ready to start a Session for this piece of equipment:

6. Open the Sessions menu from the main PGA 3510 menu.
7. Using the **Equipment Name** drop-down box, select the piece of equipment for which you want to want to apply an Equipment Specific IRF Matrix.
8. Make sure that the **Use Equipment Specific IRF Matrix** box is checked.
9. Press **Start** to begin the Session.

Operator Name	Operator
Equipment Name	Building 1 Bell Furnace

| Input Session ID |

☑ Use Equipment Specific IRF Matrix

| Start | History | Return |

Set Setpoints based on IR Factor

The PGA 3510 has the ability to automatically adjust temperature and atmosphere setpoint in an effort to get the Process Variables (PVs) for temperature and atmosphere within a selected range set in the IRF Matrix. This option allows you to select an IRF Matrix range set based on which the PGA 3510 will make adjustments to temperature and atmosphere setpoints. Of course, if the IRF Matrix is configured so that only temperature is used in determining changes to the IR Shim Factor, only temperature will be displayed in the menu for **Set Setpoints based on IR Factor**, and only the temperature setpoint will be adjusted by the PGA 3510 when this option is used. Note that **Use IRF Matrix** and **Use Furnace Temp for Furnace Setpoint** must both be set to "True" for this option to work. In addition, the PGA 3510 must not be configured to communicate with slave instruments; see the **IMPORTANT!** box below.

IRF Adjustment Matrix	
IRF (Atm < 0.25, Temp < 1200)	95
IRF (Atm < 0.25, 1200 <= Temp < 1400)	105
IRF (Atm < 0.25, 1400 <= Temp < 1600)	115
IRF (Atm < 0.25, 1600 <= Temp)	125
IRF (0.25 <= Atm < 0.4, Temp < 1200)	135
IRF (0.25 <= Atm < 0.4, 1200 <= Temp < 1400)	125
IRF (0.25 <= Atm < 0.4, 1400 <= Temp < 1600)	125
IRF (0.25 <= Atm < 0.4, 1600 <= Temp)	125
IRF (0.4 <= Atm < 0.6, Temp < 1200)	105
IRF (0.4 <= Atm < 0.6, 1200 <= Temp < 1400)	95
IRF (0.4 <= Atm < 0.6, 1400 <= Temp < 1600)	95

Select Input   **Return**

An example of how this option is used can be given as follows. Assume that, in the IRF Matrix, one of the range sets is (0.25 <= Atm < 0.4, Temp < 1200) with a corresponding IR Shim Factor of 135. Because this range set is set up in the IRF Matrix, it will appear as an option in the **Set Setpoints based on IR Factor** selection list. To apply this range set to the atmosphere and temperature setpoints, the user first taps on the IRF (0.25 <= Atm < 0.4, Temp < 1200)   135 line in the menu list until that option is highlighted. Next, the user taps on the **Select Input** button to apply that option.

Once the range set is selected and applied, the PGA 3510 will automatically change the temperature setpoint and (if applicable) atmosphere setpoint. In the **Carbon Calculation** screen, the **Temperature Setpoint** and **Carbon Setpoint** will not be visible or editable while control is based on IR Factor.

IMPORTANT!	Communications and Source Setup-Atmosphere/Temp Sources

IMPORTANT!

This option will work <u>only</u> when the PGA 3510 is not communicating with any slave instruments. If you attempt to use this option by tapping it and then tapping "Edit" when the PGA 3510 is communicating with a slave instrument, the message "Cannot use this feature with Slave Instrument configured" will be displayed. To disable slave instruments, open the Communications and Source Setup → Atmosphere/Temp Sources menu; then set both the **Probe Temp/mV Instrument Address** and **Furnace Temp Instrument Address** to "0".

Screen fields:
Port Usage	Modbus Master
Port Baud Rate	19200
Probe Temp/mV Instrument	SSI AC20
Probe Temp/mV Instrument Address	0
Status	Not configured
Furnace Temp Instrument	SSI 7EK
Furnace Temp Instrument Address	0
Status	Not configured

Edit | Return

Use Furnace Temp for Furnace Setpoint
When this option is set to "True", the PGA 3510 will use the <u>furnace temperature</u> as the value used to select an IR Shim Factor. When this option is set to "False", the PGA 3510 will use the <u>temperature setpoint</u> as the value used to select the IR Shim Factor.

General Setup

This screen shows the current time and date for the instrument, as well as the temperature scale. The temperature mode can be changed from this screen, but the time cannot be changed unless the PGA software is closed. This can be done through the following steps:

Manually Setting the Time, Date, and Time Zone
1. Log in to the PGA 3510 touch screen using the supervisor access code (by default, this code is '2').
2. Access the Instrument Setup → General Setup menu.
3. Select "Shut Down Software" followed by "Yes".
4. The program will shut down and a Windows CE screen will appear.
5. Click the time in the lower right corner (press the stylus in this corner if the time does not automatically appear).
6. Set the time, date, and time zone to the desired settings
7. Select "OK"
8. Double-click on the "SaveRegs" icon.
9. Select "OK" from the Registry Save Complete notification.
10. Turn the instrument off and wait for the screen to turn off.
11. Turn the instrument back on.
12. The instrument will automatically boot up as a gas analyzer with the IP address that has been manually entered.

NOTE: If touch screen is recording data with date and time information that is "shifted" from that displayed in the external datalogging software (e.g., readings at 9am are displayed as 11am), then the time zone and daylight savings settings *on the external computer* may need to be adjusted, in addition to performing the procedure above.

Security Settings

This page is used to change the pass code used for logging into the menu list. The default setting for the Supervisor Pass Code is 1, and the default setting for Configuration is 2. The maximum value for either code is 32767.
The Configuration Code will also work for all items on the Supervisor Pass Code items, so entering the Configuration Code (default =2) will provide access to all available menus.

Factory Default Settings

Selecting this option will cause the instrument to revert back to the settings that it contained when it came from Super Systems. Any changes or modifications made since then will be lost.

Other Settings

This screen displays calculated dew point. This value is not normally displayed because it is only accurate during certain conditions. Calculating dew point by using the gas values requires assumptions to be made regarding the composition of the gas being sampled. Since these assumptions are not always accurate the resulting dew point is not always accurate. When using Endothermic gas in a heat treating environment, the calculated dew point will usually be close to the correct value, but there is no substitute for a dew point that is determined through direct measurement of the moisture content of the gas.

When the dew point is enabled, it will appear near the bottom left of the Carbon Calculation screen.

Language Setup

The instrument language should be pre-configured at Super Systems prior to shipment but can also be changed by making a selection from the drop-down list. For the language change to take effect, the instrument must be powered off and then back on again.

Instrument Information

These items cannot be modified; they can only be viewed.

General Information

This is information on the revision levels of various components of the instrument. This can be valuable when consulting with Super Systems about issues with the instrument.

Calibration Dates

This area describes the last time the instrument was calibrated at Super Systems, plus any calibrations that have been performed since then. These dates and times are automatically computed and cannot be manually entered.

Power Status

This screen will identify the amount of voltage that is available to the instrument and also indicate if the instrument is being charged or not. When plugged in, the Internal Supply Voltage will show the amount of power coming from the internal power supply. When unplugged, the Internal Supply Voltage will indicate the battery voltage.

Tools

Database Maintenance

To make the information recorded during a Session more valuable, the Sessions database should be populated with relevant information regarding the people who will be using the instrument and the equipment that they will be working on. Taking the time to enter this information will provide additional fields to sort by after the data has been collected in a session.

Maintain Equipment Types
Many of the common types of heat treating equipment have been added into the PGA 3510 as default entries. This screen allows irrelevant items to be removed and additional items to be added.

Maintain Equipment
Each organization has different names for the various pieces of equipment in their shop. Those names should be entered here. Each name needs to be associated with a specific Equipment Type, so that database should be populated first.

Maintain Sessions
The PGA 3510 is designed to delete the oldest files first in the event that the storage capacity has been exceeded. It is also possible to delete old files manually by entering a date on this screen. All files that were made before that date would be permanently deleted. It is important to note that after the data has been downloaded to a computer, a copy is stored on that computer. The data will always be available on the computer even if it has been deleted from the screen.

Maintain Users
The names of all potential users can be entered here. Names can be added and deleted as required.

Compact Database
Periodic database compaction will help make data storage more efficient and allow more data to be stored before it is automatically deleted. Nothing is deleted or lost when this button is pressed, and the only result will be a performance improvement.

<u>Pressure Sensor Calibration</u>

The pressure it set at Super Systems for local conditions. For optimal performance, the ambient pressure should be reset at the final destination. This can be done by determining the barometric pressure and the elevation and entering them on this screen. After the two values have been entered, press the **Calibrate** button and the pressure sensor calibration will be complete.

<u>Thermister Calibration</u>

This will be set at Super Systems and should not need to be adjusted by the end user. It allows for the sample gas temperature and the ambient temperature inside the instrument to be set. This should only be performed after the instrument has been powered on long enough for it to achieve temperature equilibrium.

<u>SuperCalc</u>

SuperCalc is a proprietary software tool developed by SSI to allow the user to perform different scenarios and view the resulting percent carbon. It allows the user to enter gas percentages, probe information, and temperatures to see the effects of each variable on the calculated percent carbon. The data on this screen is independent of any values that are determined by the PGA 3510, and it is only provided as a reference tool.

<u>User Manual</u>

An electronic version of the User Manual is located within the instrument for ease of reference.

<u>Set User Cal / Load User Cal</u>

This feature allows the user to create new factory default calibration settings for the sensor. Instead of reverting to the factory calibration values, it can revert back to different calibration settings. This is accomplished by first setting the user calibration values. At any time after they are set, they can be restored by selecting Load User Cal.

<u>Calibration Log</u>

The calibration log is not used on the PGA 3510. If this option is selected, a screen that reads "Not valid for PGA" will appear.

<u>Analog Input Calibration</u>

The True Temp PGA 3510 is equipped with an analog input card that is calibrated at the factory before the True Temp unit is shipped. Optionally, you can verify the calibration or re-calibrate the unit at a later time if desired. The Analog Input Calibration includes Zero and Span calibrations for millivolt input and calibration of the actual thermocouple inputs based on the type of thermocouple wire used (the PGA 3510 supports calibration with type "K" and type "S" wire). This section provides more information on performing those calibrations, if you wish to perform them. Note the warning below.

> **IMPORTANT!**
>
> SSi strongly recommends that anyone who performs these calibrations have previous experience with and strong working knowledge of this type of procedure. If in doubt, contact SSi at (513) 772-0060 to request assistance or to have the unit returned to the factory for calibration. An improperly performed calibration will significantly impact temperature readings in a negative way.

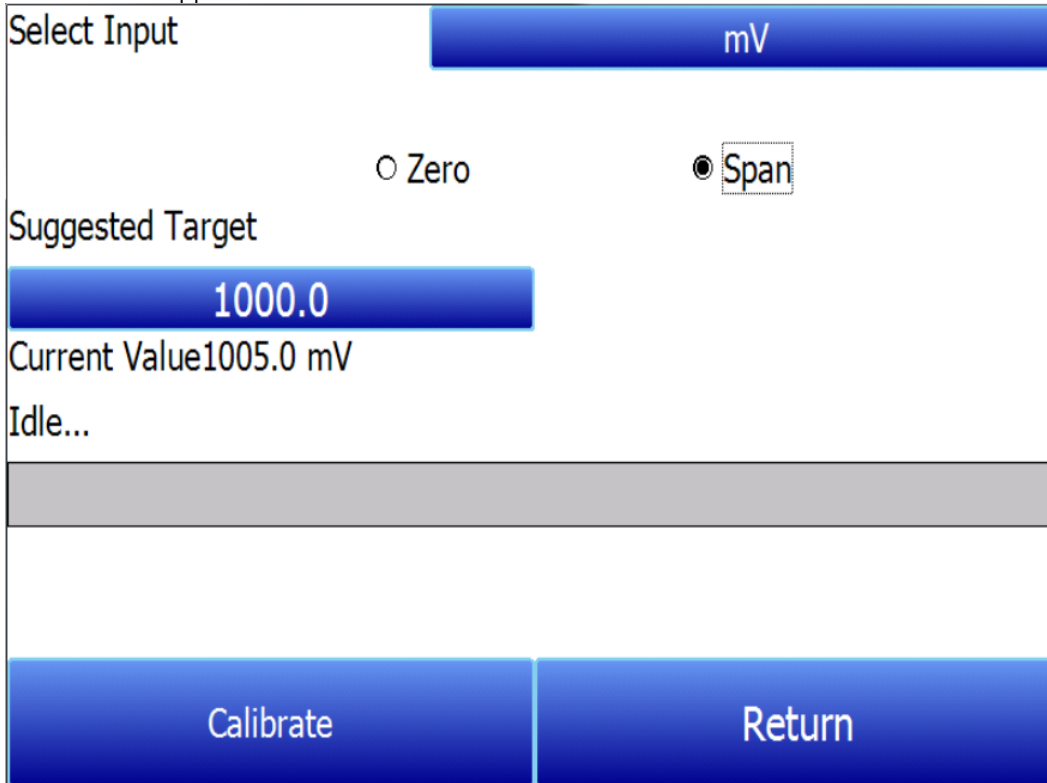**To perform a millivolt calibration (Zero and Span):**

Needed: Copper wire (<u>not</u> thermocouple wire), millivolt sourcing device

1. Open the Analog Input Calibration page.
2. Make sure that the selected input at the top of the screen is **mV**.
3. Prepare the millivolt sourcing device. This device should be capable of sourcing a specified raw voltage between 0 and 1 volt.
4. Connect the copper wire from the millivolt device to the white input jack labeled "CU" (uncompensated) on the side of the case.
5. Tap **Zero** on the touch screen.
6. Configure the millivolt sourcing device to deliver zero millivolts.
7. Wait for the "Current Value" displayed on the screen to get as close to zero as possible.
8. Tap **Calibrate.** Tap "Yes" when asked if you want to proceed with the calibration. A progress indicator will appear.

Select Input | mV

◉ Zero   ○ Span

Current Value-0.1 mV

17 seconds remaining

Calibrate | Return
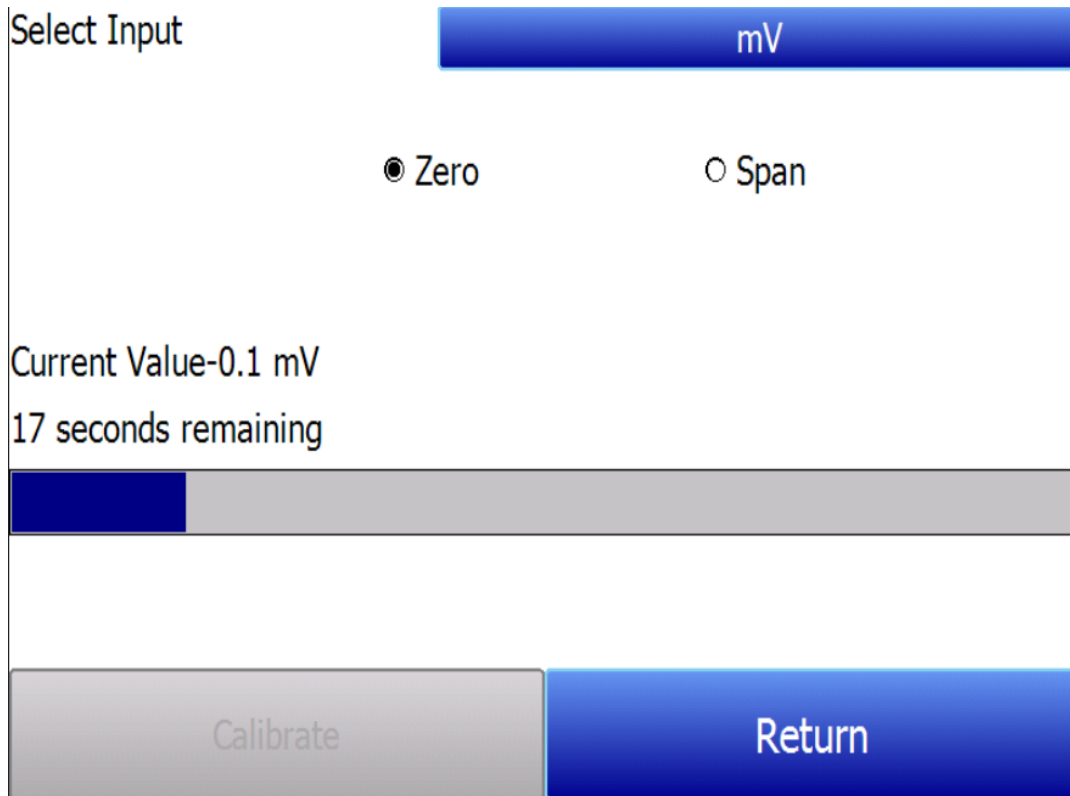
9. When the process completes, Zero calibration is finished.
10. Tap **Span** on the touch screen.
11. Configure the millivolt sourcing device to deliver the desired voltage at the high end of the desired span.

12. Wait for the "Current Value" displayed on the screen to get as close as possible to the voltage being delivered by the millivolt sourcing device.
13. Tap **Calibrate.** Tap "Yes" when asked if you want to proceed with the calibration. A progress indicator will appear.

Select Input	mV

○ Zero   ● Span

Suggested Target

1000.0

Current Value1005.0 mV

Idle...

Calibrate	Return

14. When the process completes, Span calibration is finished.

To perform a temperature calibration ("Cold Junction Trim"):

Needed: Thermocouple wire type "S" and/or "K", temperature sourcing device

1. Open the Analog Input Calibration page.
2. Make sure that the selected input at the top of the screen is **T/C K** or **T/C S**, depending on which thermocouple wire type you are using.

Select Input	T/C S

◉ Cold Junction Trim
Supplied temperature

1700.0

Current Value 1698.3°

Idle...

Calibrate	Return

3. Prepare the temperature sourcing device. This device should be capable of sourcing a temperature from type "S" and type "K" thermocouple types.
4. Connect the thermocouple wire from the temperature sourcing device to the appropriate input on the side of the case.
5. Enter the desired temperature value based on which to deliver a corresponding voltage.
6. Configure the temperature sourcing device to deliver the proper voltage.
7. Wait for the "Current Value" displayed on the screen to get as close to the target voltage as possible.
8. Tap **Calibrate.** Tap "Yes" when asked if you want to proceed with the calibration. A progress indicator will appear.
9. When the process completes, temperature calibration is finished.

Valve Setup

The PGA 3510 uses four flow control valves for nitriding gas analysis. These valves are enabled and set up in the Valve Setup window.

The Valve Setup window contains the following items:

A – Valve Selection Drop-Down List. Using this drop-down list, you can select the valve number (through 4) that you want to configure.

B – Valve Maximum. This field is used to set the maximum valve that can be entered for the valve gas flow. Tap on the field to change it.

C – Valve Decimal Place. This field is used to set the number of decimal places that will be used in the valve gas flow value in the Nitrider Calculation page. For example, if the valve decimal place is set to "1" in this menu, and "600" is entered for valve 1 flow on the Nitrider Calculation page, the displayed value will be "60.0". **NOTE:** This field will also change the number of decimal places used for the Valve Maximum field in the Valve Setup menu.

D – Gas Selection Drop-Down List. This drop-down list allows you to select the gas used in the selected flow control valve. If used, valve 1 must be used with N_2, and valve 2 must be used with NH_3 (these are fixed). Valve 3 may be used with Dissociated Ammonia (DA), NH_3, a miscellaneous gas (Misc), endothermic gas (Endo), or CO_2. Valve 4 may be used with H_2, NH_3, a miscellaneous gas (Misc), endothermic gas (Endo), or CO_2.

E – "Enabled" checkbox. If this box is checked, the selected flow control valve number is enabled and will be displayed on the Nitrider Calculation page. If it is not checked, the valve is disabled; it will not be displayed on the Nitrider Calculation page.

When finished with valve setup, tap the "Done" button.

Parts List

The following items can be purchased as needed for the PGA 3510.

Part Number	Description
32012	Battery 12VDC
20623	IR Cell
31409	O_2 Cell
20624	H_2 Sensor
31274	Touch Screen Display
33018	Power Cord, AC
20634	Notepad, Universal portable instruments
36033	Flow scope, .2 to 2.0scfh
13112	CO_2 Scrubber
33095	Fuse, 2 amp slow blow
20315	Sample Tubing Assembly
31033	In-Line Filter
37048	Bowl Filter Assembly
31027	Element for Bowl Filter
13084	Span Gas Calibration Kit (including regulator)
30054	Zero Gas Calibration Kit (including regulator)
Full PGA Units	
13533	Standard 3-Gas PGA [CO, CO_2, & CH_4 (with O_2)]
13544	4-Gas PGA (Standard plus H_2 measurement)
13548	3-Gas PGA for Corrosive Gases (Standard plus compatibility with NH_3 gas)
13549	4-Gas PGA for Corrosive Gases (Standard plus H_2 measurement and compatibility with NH_3 gas)

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.

IMPORTANT!

Do not use a PGA 3510 for gas analysis with NH_3-containing gas if the PGA 3510 has not been configured with NH_3 compatibility. Any use of a non-NH_3 compatible PGA 3510 with NH_3-containing gas will void the product warranty.

Revision History

Rev.	Description	Date	MCO#
-	Initial Release		N/A
A	Please Reference MCO #2084	9/1/2011	2084
B	Updated for revised capability of H_2 sensor	11/16/2012	2107
C	Updated for added nitriding calculations, available compatibility with ammonia gas. Updated parts list. Tools menu updated as needed.	2/7/2014	2135
D	Added Calculation Factors; Added Appendix 1 for common Modbus registers.	6/20/2014	2138
E	Added suggested calibration schedule. Added CO exhaust warning	2/21/2017	2207
F	Added time zone and daylight savings note to General Setup	5/26/2017	2217
G	Corrected CH4 range	2/6/2019	2254
H	Removed Change Adjustment Factor button		2300

Appendix 1: PGA 3510 Common Modbus Registers

This appendix covers Modbus registers most commonly accessed by PGA 3510 users. These are Modbus registers 200 through 227 and their descriptions. There are other Modbus registers used by the PGA 3510. If you need information on other registers, call SSi at (513) 772-0060.

Register Location	Parameter	Description
200	co_data	Measured CO value
201	co2_data	Measured CO_2 value
202	o2_data	Measured 0_2 value
203	ch4_data	Measured CH_4 value
204	Bench_off	Turn off bench, pump, and sample
205	IR_carbon	IR %C
206	IR_COF	Suggested COF (CO Factor)
207	IR_PF	Suggested PF (Process Factor)
208	IR_MV	IR equivalent millivolts
209	probe_MV	Probe millivolts
210	probe_COF	Probe COF
211	probe_temperature	Probe temperature
212	probe_PF	Probe PF
213	probe_carbon	Probe %C
214	pump_run_min	The total time in minutes that the pump has run since the last time memory was cleared or a manual reset took place. This value, plus pump_run_wks, will provide the total amount of time the pump has been running. When this number reaches 10080, pump_run_wks is increased by 1, and pump_run_min is reset to zero.
215	pump_run_wks	The total time in weeks that the pump has run since the last time memory was cleared or a manual reset took place. This value, plus pump_run_min, will provide the total amount of time the pump has been running.
216	pump	Pump status
217	pump_run_now	The time in minutes that the pump is running (reset to zero if pump is turned off). Maximum value is 30000. If pump_run_now is greater than pump_run_max, then pump_run_max is set to pump_run_now.
218	pump_run_max	The longest time in minutes of a pump session. If pump_run_now is greater than pump_run_max, then pump_run_max is set to pump_run_now.
219	calib_status	Calibration status
220	IR_temperature	IR temperature
221	output_percent	Control output in percent
222	sample_flow	Sample flow

Register Location	Parameter	Description
223	sample_valve	Sample valve state
224	sample_control	Sample valve control
225	flow_timer	Flow control
226	base_status	Status of base (0=OFF, 1=pump ON, 2=sample delay, 3=measure delay, 4=delay OFF, 5=ON)
227	alarm_bits	Alarm bit map (Bit 0=low flow, Bit 1=base communications, Bit 2=max factor, Bit 3=min factor, Bit 6=programmer alarm, Big 7=high byte is acknowledge; Bit 4 and 5 not used)