



**SuperSystems**  
incorporated

# **MZA 6010**

## **Multi-Zone, Multi-Gas IR Analyzer**

(CO, CO<sub>2</sub>, and CH<sub>4</sub> Gas Analyzer  
with % Carbon Calculation and Optional H<sub>2</sub>  
Measurement)

## **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 MZA 6010 is a Multi-Gas IR analyzer intended for analysis of gases in multiple zones of a furnace. It measures Carbon Monoxide (CO), Carbon Dioxide (CO<sub>2</sub>) and Natural Gas (CH<sub>4</sub>) typically found in an endothermic atmosphere. The measurement of these gases, combined with furnace temperature information, allows the MZA 6010 to calculate the percent Carbon (%C) of the measured gas. A Hydrogen (H<sub>2</sub>) sensor can also be incorporated as an option to provide a more complete picture of the measured gas.

### CAUTION!

Do not use an MZA 6010 for gas analysis with NH<sub>3</sub>-containing gas. Any use of an MZA 6010 with NH<sub>3</sub>-containing gas will void the product warranty.



The MZA 6010 is built as a system made up of enclosures. Typically, there will be two or three enclosures in one MZA 6010 system. One enclosure—the interface/IR enclosure—houses the touch screen interface, IR cell, analog output cards, digital inputs, and digital outputs. A second enclosure—the pump enclosure—houses the pumps for pumping sample air and digital inputs for inhibiting pump operation. Each pump enclosure contains four pumps, allowing one pump enclosure to sample gases from up to four different zones. If gases will be sampled from more than four zones, a second pump enclosure can be used, allowing for a maximum of eight zones to be analyzed by one MZA system.

## Specifications

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

### CO:

Range: 0 – 30% of gas concentration.

Accuracy: +/-1% of full scale (+/-0.3% of gas concentration, based on 30%).

Resolution: 0.01%

**CO2 Low:**

Range: 0 – 2% of gas concentration.

Accuracy: +/-1% of full scale (+/-0.02% of gas concentration, based on 2%).

Resolution: 0.001%

**CO2 High:**

Range: 0 – 20% of gas concentration.

Accuracy: +/-1% of full scale (+/-0.2% of gas concentration, based on 20%).

Resolution: 0.01%

**CH4:**

Range: 0 – 20% of gas concentration.

Accuracy: +/-1% of full scale (+/-0.2% of gas concentration, based on 20%).

Resolution: 0.01%

**H2:**

Range: 0 – 100% of gas concentration.

Accuracy: +/-1% of full scale (+/-1% of gas concentration, based on 100%).

Resolution: 0.1%

***\* 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.***

Number of supported zones (maximum):8

Sampling method: Extraction by internal pump (when necessary)

Measurement Method (CO, CO<sub>2</sub>, CH<sub>4</sub>): Non-Dispersive Infrared (NDIR)

Measurement Method (H<sub>2</sub>): Thermal Conductivity

Accuracy and repeatability: ± 1% of full scale

Recommended Calibration Interval: Annual

AC Power Requirements: 110VAC (can be modified to 220V upon request)

Communications: Ethernet, USB (Host), USB (Client), RS485 Modbus

Data Storage: Continuous automatic data logging

Operating Temperature: 32° to 122° F (0° to 50° C)

External Dimensions: Approx. 16"H X 20"L X 8"D per enclosure

## Unpacking the Device

The following items should be included with the MZA:

(1) MZA 6010 Gas Analyzer

(4 - 8) Bowl Filter Assemblies (attach to "Sample Inlet" ports). Four bowl filter assemblies are attached to each pump enclosure;

(1) ¼" Male NPT to 3/16" barb fitting (attach to "Aux. Cal. Gas Inlet" if desired)

(1) Operations Manual

(2 ) ¼" Male NPT to calibration gas inlet hose fitting (attach to "Zero and Span Cal. Gas Inlet" if desired)

If any of these items is missing or damaged, please contact Super Systems Inc. at 513-772-0060.

## Mechanical Installation

### Enclosure Mounting

It is recommended that the MZA 6010 enclosures be mounted as close to the sampling points as possible, since that will reduce the length of the plumbing lines that will need to be maintained. The MZA 6010 is intended for use in a heat treating environment, but care should be taken not to mount the enclosures too close to a furnace or other heat source. The operating temperature of the enclosures should be maintained below 122°F (50°C). If necessary, a heat shield can be mounted behind the enclosures to reduce the amount of radiant heat that the system is exposed to. In most cases, this will not be necessary.

The enclosures are heavily vented to prevent the buildup of potentially harmful gases in the unlikely event of an internal leak. This venting will also reduce the internal temperature by allowing the free flow of ambient air around the internal components.

## Wiring Connections

Terminal blocks inside the instrument are available for the following purposes:

1000	○		○	1000	INCOMING LINE
1002	○		○	1002	INCOMING NUETRAL
GND	○	○	○	GND	INCOMING GROUND
2311	○		○	2311	SYSTEM ALARM #01 CONTACT
2312	○		○	2312	SYSTEM ALARM #01 CONTACT
2341	○		○	2341	SYSTEM ALARM #02 CONTACT
2342	○		○	2342	SYSTEM ALARM #02 CONTACT
1540	○		○	1540	COMMS TO IR-143, MTX-303, AND HS-403 (RS-485)
1550	○		○	1550	COMMS TO IR-143, MTX-303, AND HS-403 (RS-485)
1560	○		○	1560	COMMS TO EXTERNAL CLIENT INSTRUMENT(S) (RS-485)
1570	○		○	1570	COMMS TO EXTERNAL CLIENT INSTRUMENT(S) (RS-485)
3661	○		○	3661	COF / PF INHIBIT ZONE #04
1080	○		○	1080	DIGITAL INPUT COMMON
3681	○		○	3681	COF / PF INHIBIT ZONE #03
3701	○		○	3701	COF / PF INHIBIT ZONE #02
1080	○		○	1080	DIGITAL INPUT COMMON
3721	○		○	3721	COF / PF INHIBIT ZONE #01
4101	○		○	4101	H2 SENSOR ANALOG OUTPUT #01 %HYDROGEN (4-20mA)
4111	○		○	4111	H2 SENSOR ANALOG OUTPUT COMMON
4121	○		○	4121	H2 SENSOR ANALOG OUTPUT #02 SPARE (4-20mA)
4481	○		○	4481	ANALOG OUTPUT #01 CARBON MONOXIDE 0-30% (4-20mA)
4501	○		○	4501	ANALOG OUTPUT #01 CARBON MONOXIDE 0-30% (4-20mA)
4561	○		○	4561	ANALOG OUTPUT #02 CARBON DIOXIDE 0-2% (4-20mA)
4581	○		○	4581	ANALOG OUTPUT #02 CARBON DIOXIDE 0-2% (4-20mA)
4641	○		○	4641	ANALOG OUTPUT #03 METHANE 0-30% (4-20mA)
4661	○		○	4661	ANALOG OUTPUT #03 METHANE 0-30% (4-20mA)
4721	○		○	4721	ANALOG OUTPUT #04 CARBON 0-2% (4-20mA)
4741	○		○	4741	ANALOG OUTPUT #04 CARBON 0-2% (4-20mA)

Each terminal block is numbered according to the included electrical drawing. Knockout holes in the enclosure have been provided to simplify wiring connections. Knockouts are located on the bottom of the enclosure. Additional or alternate locations can be added as needed. Please note that due to the potential for electrical interference, it is recommended that communication wires not be run in parallel to AC power wires.

The right side of the enclosure also contains two Ethernet ports, one USB A port (Host) and one USB B port (Client). These can be used to communicate to the MZA 6010. For detailed information on the use of these ports, please see the section of this manual, Communications and Source Setup. Appendices A and B show the wiring connections.



## Plumbing Connections

Interface/IR enclosure	Pump enclosure
<ul style="list-style-type: none"> <li>• Sample Inlet – The incoming gas from the pump enclosure.</li> <li>• Sample Vent – After sampling, the gas will exit the enclosure through this port. Due to the potentially harmful nature of the gas being measured, the gas should be vented to a place in accordance with local regulations and safety standards.</li> <li>• Zero and Span Calibration Gas Inlets – These are ¼" NPT female ports for connecting to calibration gases. For more information on acceptable calibration gases see the Sensor Calibration section of this manual. The incoming pressure of the gas will need to be adjusted to allow the flow to be the same for the calibration gas and the sample gas flow rate. The incoming pressurized gas goes through a small fixed orifice inside the analyzer, which should require between 20 and 50 psi to maintain proper flow. These ports are used with the automatic calibration system to provide calibrations at predetermined intervals or events. The use of these ports is not required for the operation of the MZA 6010.</li> <li>• Auxiliary Calibration Gas Inlet – This ¼" NPT female port provides another entry point for both zero and span calibration gases. If calibrations are being performed manually, this port should be used for both gases.</li> </ul>	<ul style="list-style-type: none"> <li>• (4) Sample Inlets</li> <li>• (1) Outlet to Vent</li> <li>• (1) Outlet to Analyzer</li> </ul>

The flow of gas through the MZA 6010 is controlled by solenoid valves. Each valve is normally closed, and for safety purposes all valves will shut to prevent unwanted furnace gases from entering the instrument when power to the enclosure is lost or the specified sampling parameters are not met.

Appendix A: Plumbing Diagram shows the plumbing connections.

## Basic Operating Description

The Model MZA 6010 has been designed for the simultaneous analysis of CO, CO<sub>2</sub> and CH<sub>4</sub> 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 MZA 6010 software to automatically load. Once the software is properly loaded, the instrument is ready to use. Power to any of the MZA enclosures can be turned off by tripping the circuit breaker inside the enclosure. Before the breaker is tripped in the interface/IR enclosure, select the "Shut down interface" option from the main menu and allow the screen to close the MZA software in a controlled manner. Doing so will help minimize any damage to data that could be done by an unexpected shutdown.

### Hydrogen Cell Note:

For highest H<sub>2</sub> accuracy, it is recommended that the system be powered on for 60 minutes before measurements are taken.

## Zones

The MZA 6010 can analyze gas compositions from up to eight zones. The gases are circulated into the interface/IR enclosure by a pump in a pump enclosure. The gas composition is then analyzed by the IR sensor (and the H<sub>2</sub> sensor, if the MZA 6010 is equipped with one) before the gas is burned off.

A single zone is analyzed for a period of time known as the **dwelt time**. The dwell time for each zone is configured by the user on the touch screen by using the Edit Active Zones option under the Zones Overview menu (described later in this manual). Zones can be enabled and disabled using the same option.

Because many options are associated with individual zones or must be configured at the zone level, several sub-menus on the MZA 6010 touch screen feature a Select Zone menu. The Select Zone menu allows you to select the zone for which you want to change specific settings. Examples of sub-menus that will bring up the Select Zone menu are Pump Mode Selection, Carbon Calculation, Automatic Sampling Parameters, Atmosphere/Temp Sources, Calculation Factors, Analog Output Setup (for board number), Gas Alarm Setup, SuperCalc, and Analog Input Calibration. These sub-menus are described in greater detail below.

Select Zone
Zone 1
Zone 2
Zone 3
Zone 4

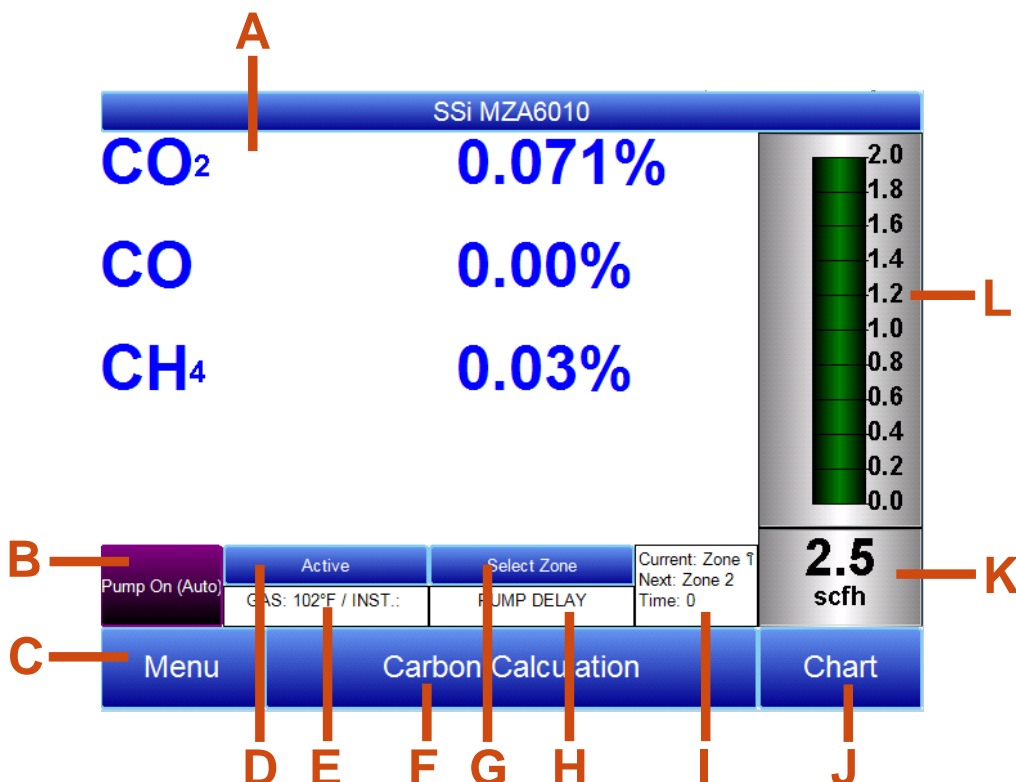
Select	Return
--------	--------



Sub-menus that require zone selection will be identified in this manual by the Zone Selection icon shown at left.

## Default Screen

Once the MZA 6010 has successfully loaded its software, the default screen will be displayed.



A – Measured values of CO, CO<sub>2</sub>, CH<sub>4</sub>, and IR %C (and H<sub>2</sub>, if the H<sub>2</sub> sensor is present)

B – Pump status indicator / Button to change pump mode



NOTE: Option B requires zone selection.

C – Button to access menu list

D – Active / Inactive toggle to make the Current Zone active or inactive (requires login)

E – Temperature / Instrument Temperature indicator

F – Button for Carbon Calculation screen

G – Button to select which zone is currently displayed (if the button is tapped again, the default Zone view is displayed)



NOTE: Option G requires zone selection.

H – External Instrument Communications status indicator (NOTE: "PUMP DELAY" indicates the 2-second delay that occurs when the pump is placed in Automatic mode.)

I – Zone Status indicator: by default, this indicator shows which zone is active (Current), which zone is next to be analyzed (Next), and what the dwell time for the current zone is in seconds (Time)

J – Button for Trend Chart screen

K – Numeric Flow Indicator  
L – Visual Flow Indicator

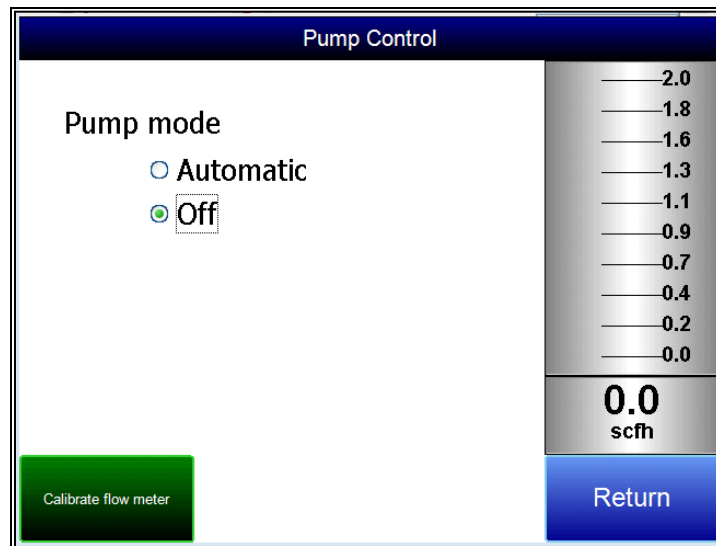
Pressing the **Return** button at the bottom right of the operator interface on any screen will take the display to the default. It may be necessary to press the **Return** button multiple times.

## Pump Operation



**NOTE:** This function requires zone selection.

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: **Automatic** and **Off**. (NOTE: when the pump is placed in Automatic mode, there is a 2-second delay before the pump is activated. During this time, the External Instrument Communications status indicator will read "PUMP DELAY.")



## Carbon Calculation



**NOTE:** This option requires zone selection.

The MZA 6010 determines the percent carbon in the sample gas using measured amounts of CO, CO<sub>2</sub>, and CH<sub>4</sub> 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 MZA 6010 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 MZA 6010 or by obtaining the information automatically via RS-485 communications to the Furnace Carbon Controller. Providing the probe information allows the MZA 6010 to suggest an adjustment for the probe CO Factor (or Process Factor) in order to keep the oxygen probe measuring properly.


Carbon Calculation: Zone 1			
Furnace Temperature	1700 °F	Probe Temperature	1700 °F
Measured CO	0.00 %	Probe Millivolts	1100 mV
Measured CO <sub>2</sub>	0.000 %	%C (probe)	0.00 %
Measured CH <sub>4</sub>	0.00 %	Probe CO Factor	200
%C (gas analyzer)	0.01 %	Suggested CO Factor	4
<div> <div>Pump On (Auto)</div> <div> <div></div> <div>GAS: 94°F / INST.: 95°F</div> </div> </div>			
		Chart	Return

Using infrared 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.



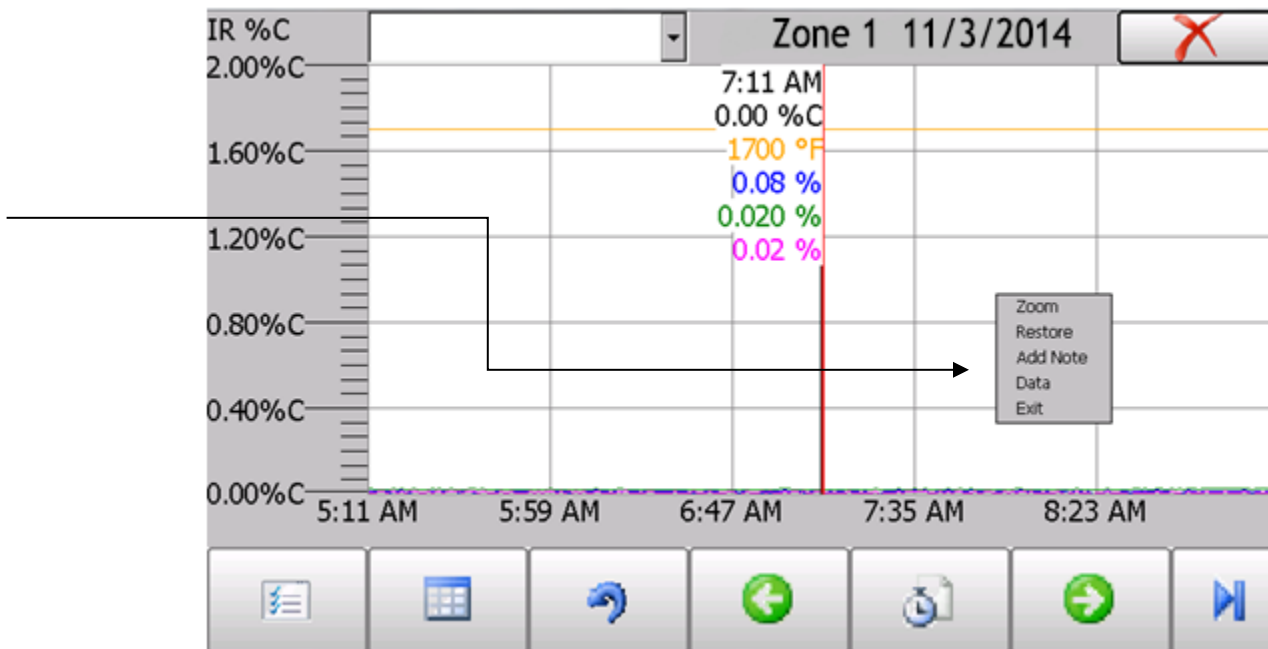
The right-pointing arrow with the vertical line next to it button -  - will toggle between viewing the chart in or out of real-time. When in real-time mode, the chart will automatically be updated once a minute.

### Chart Sub Menu



**NOTE:** This option requires zone selection.

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

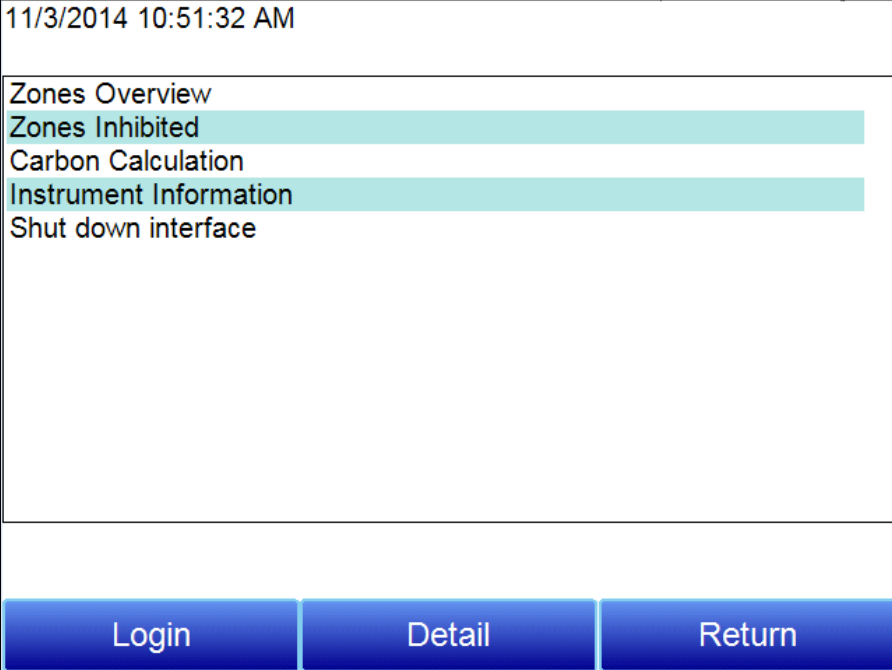
functionality is exactly the same as if the user pressed the Datagrid View button -  - from the chart screen.

**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 available options.

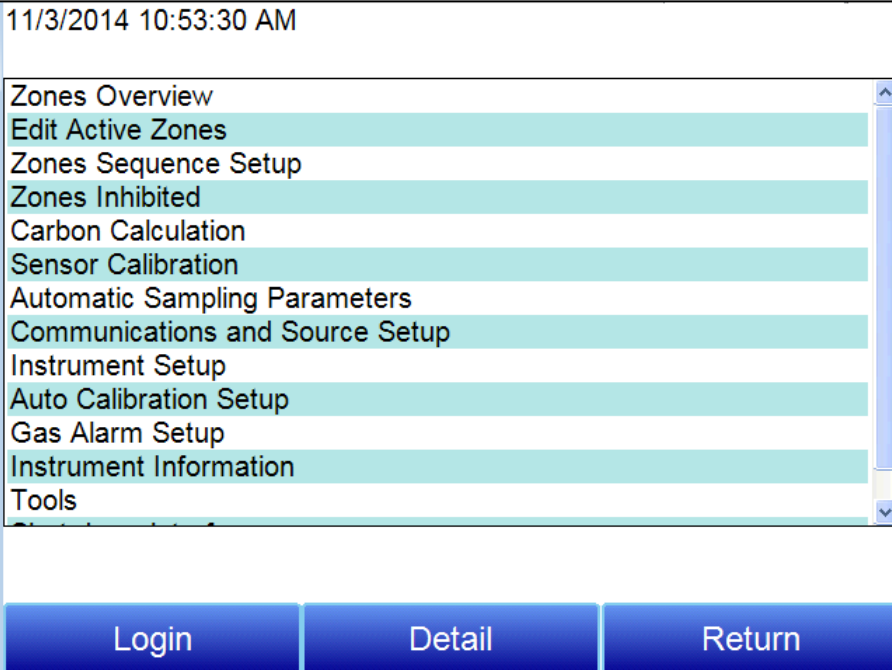


11/3/2014 10:51:32 AM

- Zones Overview
- Zones Inhibited
- Carbon Calculation
- Instrument Information
- Shut down interface

Login Detail Return

Zones Overview, Zones Inhibited, Carbon Calculation, Instrument Information, and Shut Down Interface 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 Edit Active Zones and Zones Sequence Setup menus.



11/3/2014 10:53:30 AM

- Zones Overview
- Edit Active Zones
- Zones Sequence Setup
- Zones Inhibited
- Carbon Calculation
- Sensor Calibration
- Automatic Sampling Parameters
- Communications and Source Setup
- Instrument Setup
- Auto Calibration Setup
- Gas Alarm Setup
- Instrument Information
- Tools

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.



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.

## Zones Overview

The **Zones Overview** menu displays information on:

- Which zone is currently being analyzed (labeled **Current**);
- Which zone is next to be analyzed (**Next**, with a remaining dwell time shown); and

This menu also allows you to:

- Edit settings for active zones (**Edit Active Zones**) and
- View an overview screen on each active zone (**View Detail** on the currently selected zone). This will show the default screen for the selected zone.

Zones Overview			
	CO2	CO	CH4
Zone 1 (Current)	0.000%	0.00%	0.00%
Zone 2 (Next 24)	0.000%	0.00%	0.00%
Zone 3	0.000%	0.00%	0.00%
Zone 4	0.000%	0.00%	0.00%

View Detail

Return

## Edit Active Zones

The Edit Active Zones menu allows you to:

- Change the status of each zone between Active and Inactive (**Edit Status**)
- Edit the dwell time, in seconds, for each zone (**Edit Dwell Time**) and
- Change the status of the pump for each zone between Auto and Off (**Edit Pump**).

Edit Active Zones			
Zone	Status	Dwell time(sec)	Pump
Zone 1	Active	90	Auto
Zone 2	Active	90	Auto
Zone 3	Active	90	Auto
Zone 4	Active	90	Auto
Edit Status		Edit Dwell Time	
Edit Pump		Return	

## Zones Sequence Setup

With Zones Sequence Setup, you can determine a sequence of zone analysis. Up to 32 items can be programmed in the sequence, and any active zone can be included in the sequence. The dwell time for each zone in the sequence is determined by the dwell time set in the Edit Active Zones menu. Use of the Zones Sequence is optional. If all entries are set to "Not Used", then the MZA will cycle through all active zones in numerical order.

Sequence	Zone
1	Zone 2
2	Zone 3
3	Zone 1
4	Zone 4
5	Not Used
6	Not Used
7	Not Used
8	Not Used
9	Not Used
10	Not Used
11	Not Used
12	Not Used
13	Not Used
14	Not Used
15	Not Used
16	Not Used
17	Not Used
18	Not Used
19	Not Used
20	Not Used

Set Clear Return

The **Set** button allows you to select which zone is applied to the selected step number (1 through 28). The **Clear** button will clear any zone from the selected step.

To illustrate how this works, assume an example where Zones 1, 2, 3, and 4 are active. You can determine multiple sequences including those zones. In the example below, three example sequences are shown. Each sequence has eight steps. In Sequence 1, Zones 1, 2, 3, and 4 are analyzed in order, followed by Zone 3, 2, 4, and 1. This sequence will repeat itself after Step 8. In Sequence 2, Zones 3 and 4 are analyzed, one after the other, three times. In Steps 7 and 8, Zones 1 and 2 are analyzed, respectively. Finally, in Sequence 3, the zones are analyzed in an inverted order (4, 3, 2, 1) in the first four steps, and then they are analyzed in standard numerical order (1, 2, 3, 4) in Steps 5 through 8.

Examples of Possible Sequences in a Four-Zone Setup			
Step Number	Sequence 1	Sequence 2	Sequence 3
1	Zone 1	Zone 3	Zone 4
2	Zone 2	Zone 4	Zone 3
3	Zone 3	Zone 3	Zone 2
4	Zone 4	Zone 4	Zone 1
5	Zone 3	Zone 3	Zone 1
6	Zone 2	Zone 4	Zone 2
7	Zone 4	Zone 1	Zone 3
8	Zone 1	Zone 2	Zone 4

**Zones Inhibited**

This menu contains information on which zones are inhibited and which zones are not inhibited. If a zone is inhibited, the screen will indicate a reason for the inhibiting of that zone. No settings can be changed. This is an informational screen.

Zones Inhibited	
Zone 1	Not Inhibited (setup)
Zone 2	Not Inhibited (setup)
Zone 3	Not Inhibited
Zone 4	Not Inhibited (setup)
Zone 5	Zone not active
Zone 6	Zone not active
Zone 7	Zone not active
Zone 8	Zone not active
Return	

Reasons for a zone being inhibited include the following:

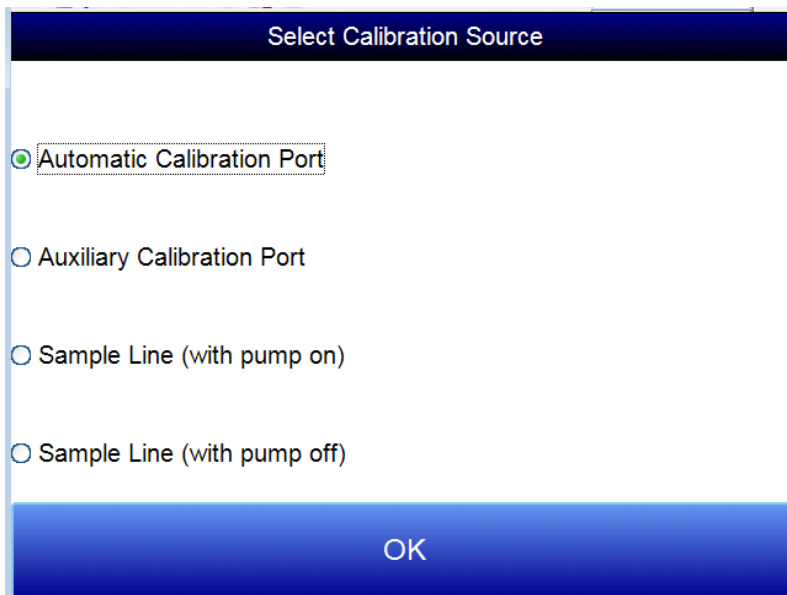
- Pump off
- Digital input blocking sample
- Zone off
- Minimum TC not satisfied
- Minimum mV not satisfied
- Calibration active
- Autocal active
- Sample inhibited
- Zone off or adjust delayed
- Digital input blocking adjustment

**Carbon Calculation**

Please see the Carbon Calculation section starting on page 13.

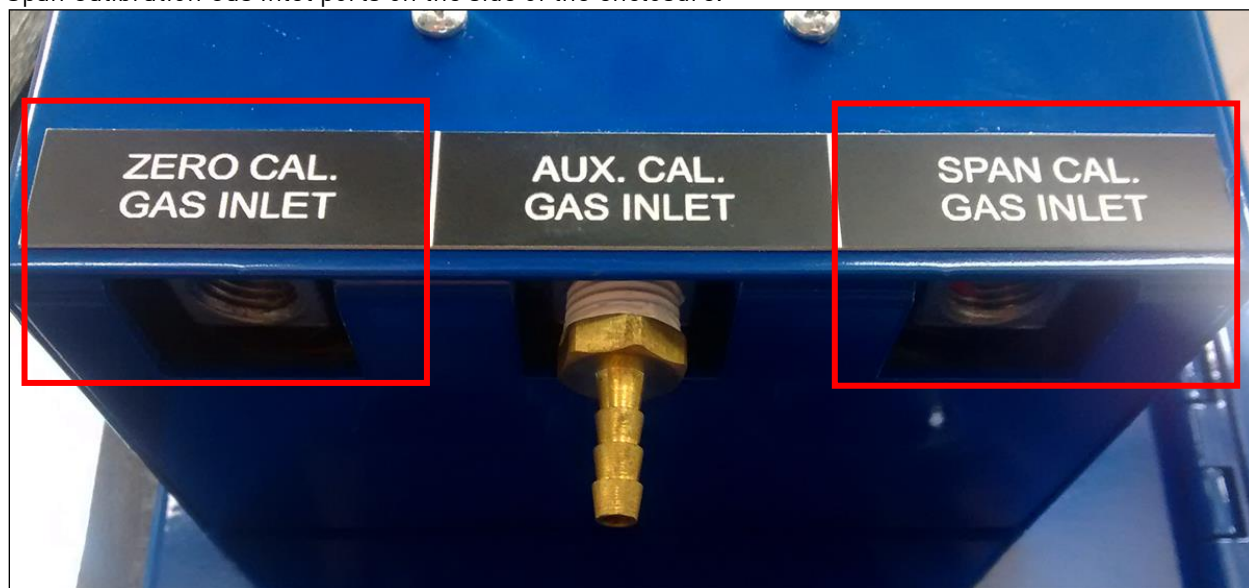
## Sensor Calibration

On the MZA 6010, you can perform a sensor calibration with one of four calibration sources. These sources are displayed when **Sensor Calibration** is first selected: **Automatic Calibration Port**, **Auxiliary Calibration Port**, **Sample Line (with pump on)**, and **Sample Line (with pump off)**.



You will be required to select one of the four sources.

With the **Automatic Calibration Port**, calibration is performed using the Zero Calibration Gas Inlet and Span Calibration Gas Inlet ports on the side of the enclosure.



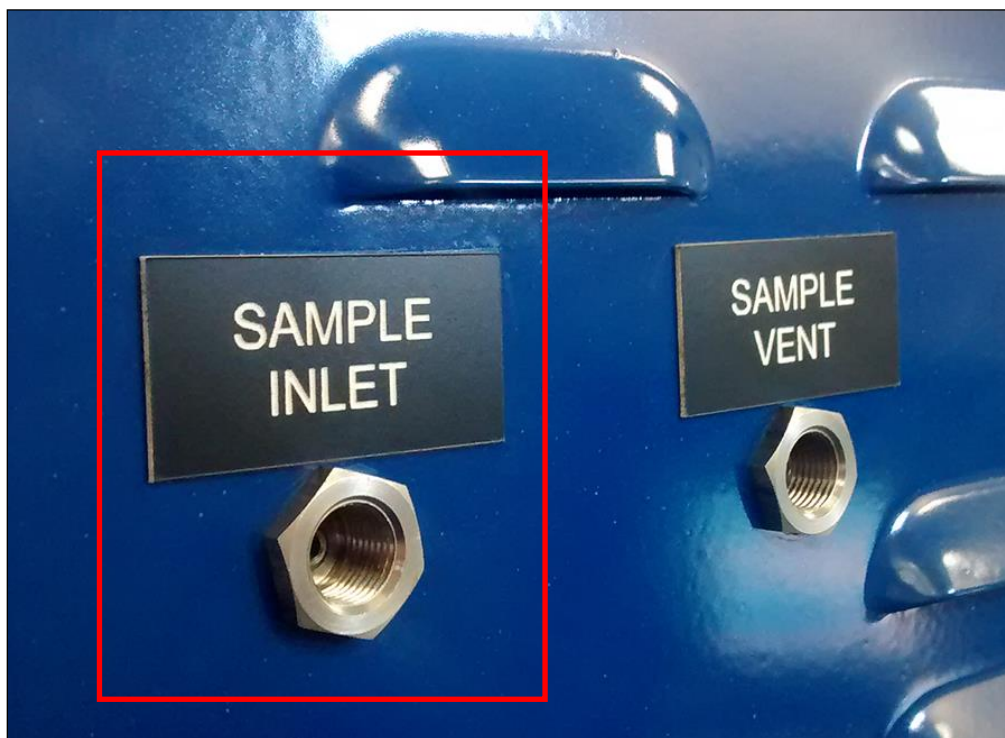
Gas Inlet Ports for Automatic Calibration

The **Auxiliary Calibration Port** makes use of the Auxiliary Calibration Gas Inlet, located on the side of the enclosure and in the middle of the gas inlets for Zero Calibration and Span Calibration. A single gas line is run to the Auxiliary Calibration Gas Inlet port for zero and span calibration.



Gas Inlet Port for Auxiliary Calibration

Calibration with a **Sample Line** makes use of the Sample Inlet Port located on the side of the enclosure opposite the ports used for Automatic Calibration and Auxiliary Calibration. The option selected will depend on whether the pump is running [Sample Line (with pump on)] or not running [Sample Line (with pump off)].



Sample Inlet Port Used for Sample Line Calibration

Once you have attached the gas line as needed and selected the desired calibration source, tap OK. A screen similar to the one shown below will be displayed.

Gas	Target	Actual	Status
<input checked="" type="checkbox"/> CO	0.00%	-0.02%	OK
<input checked="" type="checkbox"/> CO <sub>2</sub>	0.000%	0.050%	OK
<input checked="" type="checkbox"/> CH <sub>4</sub>	0.00%	0.07%	OK

Last Zero Calibration: 6/16/2014 (12 days, 12 minutes)  
 Last Span Calibration: 6/16/2014 (12 days, 6 minutes)

Pump should be off when using pressurized cylinders of gas

0.0 scfh

Enter Cal Mode      Return

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<sub>2</sub>: 0.5%
- CH<sub>4</sub>: 5.0%
- H<sub>2</sub>: 40%
- N<sub>2</sub>: 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<sub>2</sub> 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).

### 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.

### Automatic Sampling Parameters



**NOTE:** This option requires zone selection.

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 MZA 6010 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
Minimum Temperature for sampling	1490°F
Minimum Millivolts for sampling	1030 mV
Minimum Millivolt condition...	also stops pump

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.

Minimum Temperature for sampling (0 = disabled)

This value is the lowest temperature that the instrument will sample from. When the temperature drops below this value, the COF/PF adjustment will stop and the sample pump will turn off *only if the pump is set to "Auto" mode*. To use this feature, the instrument should be communicating with an instrument that can provide real-time temperature data. The purpose of this function is to prevent the instrument from pulling a bad sample, which could potentially damage the sensors. The minimum temperature should always be slightly higher than the lowest possible process temperature.

Minimum Millivolts for sampling (0 = disabled)

This value is the lowest number of millivolts at which sampling will take place. When the number of millivolts drops below this value, the COF/PF adjustment will stop; the sample pump will turn off *only if the pump is set to "Auto" mode* and the Minimum Millivolt Condition is set to "Also stops pump" (see below). To use this feature, the instrument should be communicating with an instrument that can provide real-time probe millivolt data. The purpose of this function is to prevent the instrument from pulling a bad sample, which could potentially damage the sensors. This will prevent adjustments from being made when the proper conditions are not met. The minimum millivolts set point should be slightly higher than the minimum millivoltage that is expected.

Minimum Millivolt condition (0 = disabled)

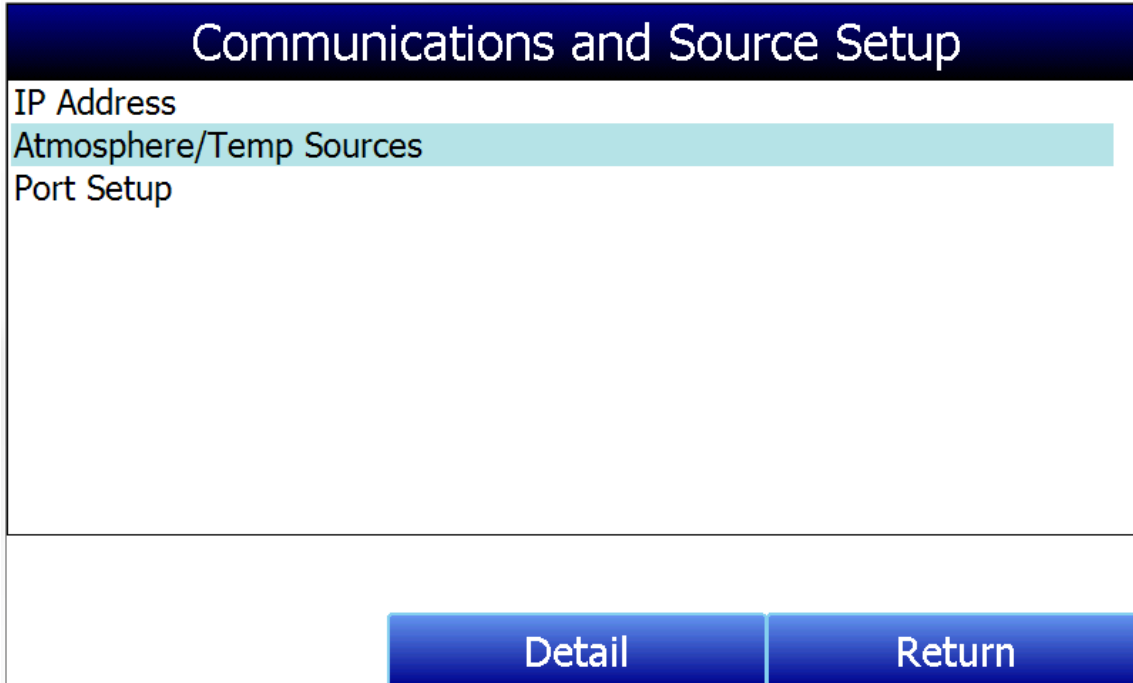
This determines the behavior of the MZA 6010 when the minimum millivolts value is reached. Two settings are available:

- **Also stops pump.** When this setting is selected, the sample pump will be stopped *if the pump is set to "Auto" mode*, and COF/PF adjustment will be stopped.
- **Only inhibits adjust and control.** When this setting is selected, COF/PF adjustment will be stopped, and the sample pump will be allowed to run.

To use this feature, the instrument should be communicating with an instrument that can provide real-time probe millivolt data. This is another feature that is intended to prevent the analyzer from pulling a bad sample and potentially damaging the sensors.

## Communications and Source Setup

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



Communications and Source Setup

IP Address

Atmosphere/Temp Sources

Port Setup

Detail Return

### IP Address

This screen allows you to:

- View the current IP address of the touch screen (To change the IP address to a fixed address, see the Manually Setting the IP Address section below)
- View or change the IR cell IP address
- View or change the IR cell net mask
- View or change the IR cell IP gateway

The Touch Screen IP Address is set dynamically by default. For the IR Cell, its IP Address, Net Mask, and IP Gateway are set to defaults, as follows:

- IR Cell IP Address: 192.168.0.221
- IR Cell Net Mask: 255.255.248.0
- IR Cell IP Gateway: 192.168.1.101

Using the IP Address menu options, these default values can be changed.

Communications and Source Setup-IP Address	
Touch screen IP Address	192.168.1.111
IR Cell IP Address	192.168.1.29
IR Cell Net Mask	255.255.255.0
IR Cell IP Gateway	192.168.1.101
<div style="border: 1px solid black; height: 150px; margin-top: 10px;"></div>	
<div style="display: flex; justify-content: space-between; align-items: center;"> <span>&lt;</span> <input style="width: 80%; border: 1px solid black;" type="text"/> <span>&gt;</span> </div>	
Edit	Return

The IR Cell IP Address option allows you to view the current IP address of the IR cell. To change the IP address of the IR cell, tap on the option line and select **Edit**.

The IR Cell Net Mask option allows you to view the current Net Mask of the IR cell. To change the Net Mask of the IR cell, tap on the option line and select **Edit**.

The IR Cell Gateway option allows you to view the current Gateway of the IR cell. To change the Gateway of the IR cell, tap on the option line and select **Edit**.

In order to detect the IR cell on the network when it is connected via Ethernet, it must be on the same subnet as the device (for example, the computer).

### *Manually Setting the IP Address*

When connected to a network, the MZA 6010 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.

1. Log in to the MZA 6010 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



**NOTE:** This option requires zone selection.

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.

**NOTE:** Use Terminals 1560 and 1570 on the main enclosure to wire external instruments to the MZA.

Atm/Temp sources: Zone 1	
Port Usage	Modbus Master
Port Baud Rate	19200
Probe Temp/mV Instru...	SSI AC20
Probe Temp/mV Instru...	0
Status	Not configured
Furnace Temp Instrum...	SSI 7EK
Furnace Temp Instrum...	0
Status	Not configured
<div> <div>Edit</div> <div>Return</div> </div>	

#### *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:

- |                         |                   |
|-------------------------|-------------------|
| • Internal, Probe mV, K | • Eur 2404        |
| • Internal, Probe mV, S | • Eur 2500        |
| • SSi AC20              | • CP V3.5         |
| • Yokogawa 750          | • CP V3.0         |
| • Honeywell UDC3300     | • CarbPC          |
| • Dualpro 1 Mod         | • SSi 9200 loop 1 |
| • Dualpro 2 Mod         | • IR Base         |
| • DP 1 MMI              | • MGA             |
| • DP 2 MMI              | • 9010            |

*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:

- |                       |                     |
|-----------------------|---------------------|
| Internal, S           | VC Base 3           |
| Internal, K           | VC Base 4           |
| SSi 7EK/804/808/816   | AIPC                |
| Yokogawa 750          | SSi 7SL             |
| Honeywell UDC 3300    | Flow Meter          |
| Dualpro 1 Mod         | UMC800              |
| Dualpro 2 Mod         | SSi D00             |
| DP 1 MMI              | SSi D01             |
| DP 2 MMI              | SSi D02             |
| Eur 2404              | SSi D03             |
| Eur 2500              | Yokogawa UT350      |
| UP V3.5               | Yokogawa 750 loop 2 |
| UP V3.0               | Yokogawa UP350      |
| CP3.5 SL              | DCP551              |
| CP3.0 SL              | Ascon 08            |
| 10Pro                 | Ascon X5            |
| DP IN C               | Ascon M4L           |
| SSi 9200 loop 1       | Ascon X5 Timer      |
| SSi 9200 loop 2       | SPUD                |
| SSi 9200 loop 3       | SSi AIB 3           |
| SSi 9100 loop 2       | Hydrogen            |
| Eurotherm 2704 loop 1 | Flow                |
| Eurotherm 2704 loop 2 | O2 remote           |
| Eurotherm 2704 loop 3 | Dual monitor        |
| VC Base 1             | Wflow               |
| VC Base 2             | 9010                |

*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
<div><div>Edit</div><div>Return</div></div>	

## 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	
<b>IR Matrix Tables</b>	
General Setup	
Security Settings	
Analog Output Setup	
Factory Default Settings	
Other Settings	
Language Setup	

Detail	Return
--------	--------



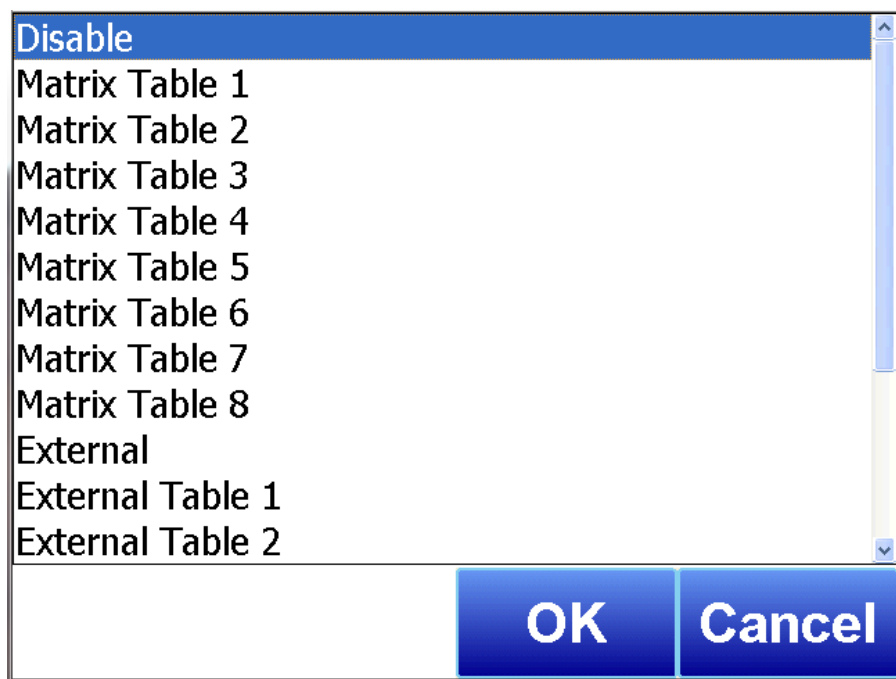


*CH<sub>4</sub> Factor*

This factor increases or decreases the significance of CH<sub>4</sub> in the calculation of carbon. CH<sub>4</sub> 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<sub>4</sub>, its role in the equation may become greater than it should be. In these cases the CH<sub>4</sub> factor should be reduced. In cases where the CH<sub>4</sub> is present in excess of 7 or 8%, this factor can be reduced to zero.

*Select IR Matrix*

This option allows you to choose a user-configured IR Matrix, or an external value or Matrix (written by an external source, such as a PLC).



Tap the desired source and then tap "OK" to select. Tap "Disable" to disable this feature.

*Set Setpoints based on IR Factor*

The MZA 6010 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 MZA 6010 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 MZA 6010 when this option is used. Note that **Use IRF Matrix** and **Use Furnace Temp for Furnace Setpoint** must both be set to "IR Temperature" for this option to work. In addition, the MGA 6010 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
<div> <div>Select Input</div> <div>Return</div> </div>	

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  $[0.25 \leq \text{Atm} < 0.4, \text{Temp} < 1200]$  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 MZA 6010 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!

This option will work only when the MZA 6010 is not communicating with any slave instruments. If you attempt to use this option by tapping it and then tapping "Edit" when the MZA 6010 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".

Communications and Source Setup-Atmosphere/Temp Sources	
Port Usage	Modbus Master
Port Baud Rate	19200
Probe Temp/mV Instrument	SST AC20
Probe Temp/mV Instrument Address	0
Status	Not configured
Furnace Temp Instrument	SST 7FK
Furnace Temp Instrument Address	0
Status	Not configured
<div> <div>Edit</div> <div>Return</div> </div>	

*Furnace Temperature Set Point Source*

This option allows you to choose the Probe Temperature or IR temperature as the set point source. Tap the desired option and then tap "OK" to select.

Furnace Temperature Set Point Source, Current Value:

☐ Probe Temperature

☒ IR Temperature

OK

Cancel

IR Matrix Tables

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. **NOTE:** Once an IR Matrix is set up, it must be selected under the "Calculation Factors" menu for the desired zone in order to become active.

Select a Matrix Table number edit and tap "OK"

Matrix Table 1
Matrix Table 2
Matrix Table 3
Matrix Table 4
Matrix Table 5
Matrix Table 6
Matrix Table 7
Matrix Table 8
<div>OK</div> <div>Cancel</div>

The following steps describe how to configure the IRF Matrix.

- 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).
- 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 ( $\text{Atm} < 0.25$ )
- 0.25 – 0.39 ( $0.25 \leq \text{Atm} < 0.4$ )
- 0.4 – 0.59 ( $0.4 \leq \text{Atm} < 0.6$ )
- 0.6 and higher ( $0.6 \leq \text{Atm}$ )

- 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.

IRF Adjustment Matrix	
IRF (Atm < 0.25, 1600 ≤ Temp)	125
IRF (0.25 ≤ Atm < 0.4, Temp < 1200)	105
IRF (0.25 ≤ Atm < 0.4, 1200 ≤ Temp < 1400)	125
IRF (0.25 ≤ Atm < 0.4, 1400 ≤ Temp < 1600)	0
IRF (0.25 ≤ Atm < 0.4, 1600 ≤ Temp)	0
IRF (0.4 ≤ Atm < 0.6, Temp < 1200)	105
IRF (0.4 ≤ Atm < 0.6, 1200 ≤ Temp < 1400)	0
IRF (0.4 ≤ Atm < 0.6, 1400 ≤ Temp < 1600)	0
IRF (0.4 ≤ Atm < 0.6, 1600 ≤ Temp)	0
IRF (0.6 ≤ Atm, Temp < 1200)	105
IRF (0.6 ≤ Atm, 1200 ≤ Temp < 1400)	0

Set IR Factor, Current Value: 0

135

7	8	9
4	5	6
1	2	3
0		

Esc

Clear

+/-

OK

Edit Return

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 MGA 6010 will set the current IR Shim Factor to 125.

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

### 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 MZA 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.

### Analog Output Setup

#### BOARD SELECTION

**NOTE:** This option requires **board** selection.

The MZA 6010 has four analog outputs per zone. These outputs can be configured for variable, zone number, Milliamps, zero value, and span value.

- The **Variable** is the process variable that applies to that analog output. Possible values are CO, CO<sub>2</sub>, CH<sub>4</sub>, High CO<sub>2</sub>, IR % carbon, H<sub>2</sub>, O<sub>2</sub>, and Probe %C.
- The **Zone Number** is the zone number to which each analog output applies.
- **MA** represents the Milliamp range used for each analog output signal. Options are 4-20mA and 0-20mA.
- The **Zero Value** is the value that corresponds to the lowest value on the Milliamp scale.
- The **Span Value** is the value that corresponds to the highest value on the Milliamp scale.

Analog Output Setup: Board1	
Analog Output 1 Zone Number	1
Analog Output 1 MA	4 - 20MA
Analog Output 1 Zero Value	0.00
Analog Output 1 Span Value	30.00
Analog Output 2 Variable	CO2
Analog Output 2 Zone Number	1
Analog Output 2 MA	4 - 20MA
Analog Output 2 Zero Value	0.00
Analog Output 2 Span Value	300.00
Analog Output 3 Variable	CH4
Analog Output 3 Zone Number	1

Edit
Return

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

**NOTE:** This option requires zone selection for enabling dew point calculation in particular zones.

This screen determines whether dew point calculations are enabled. 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.

Auto Calibration Setup

Auto Calibration Setup		
Auto Calibration	No	
Calibration Purge (sec)	90	
Zero Interval (hours)	48	
Calibration Interval (hours)	96	
Zero Calibration	Span Calibration	Zero and Span Calibration
Return		



The automatic calibration feature allows the instrument to calibrate itself using external supplies of zero and span calibration gases at pre-determined intervals or events as dictated by the user. The first step when setting up the automatic calibration feature on the MZA 6010 is to connect the Zero and Span calibration gases to the appropriate ports on the left side of the enclosure. There are blocking solenoids at each of these ports to only allow the flow of gas when it is called for and to prevent the flow when not needed. The pressure in the gas lines will need to be adjusted to maintain a flow rate similar to the sample flow rate, which should be between 20 and 50psi.

#### **Automatic calibrations based on timed intervals**

The interval between calibrations is determined on the Auto Calibration Setup screen. Auto Calibration must be set to "On". The calibration purge timer allows for the flow of calibration gas to purge the sample gas from the instrument before performing a calibration. If the sample lines are long the time can be increased from the default value of 90 seconds.

The zero and span intervals are measured in hours. The appropriate interval can be based on the process and the desired degree of accuracy. The standard values are 48 hours for a zero calibration and 96 hours for a span calibration.

### **Gas Alarm Setup**

## Z ONE SELECTION

NOTE: This option requires zone selection.

Gas Alarm Setup: Zone 1			
Parameter	Lower Limit	Upper Limit	Action
CO	0	100	None
CO2	0	1	None
CH4	0	100	None
High CO2	0	100	None
IR %C	0	100	None
H2	0	100	None
O2	0	1000	None
Furnace TC	0	10000	None
Probe TC	0	10000	None
Probe MV	0	10000	None
<div> <div>Edit LL</div> <div>Edit UL</div> <div>Edit Action</div> <div>Return</div> </div>			

The MZA 6010 allows the user to configure various alarms. For each parameter, there is a Lower Limit, Upper Limit, and Action. As default, no alarms are enabled on the MZA unless a special request was made to do so at the time of ordering. To modify a parameter's properties, select the item and press Edit with the appropriate option. When any parameter is in an alarm state, a notification banner will show at the top of the screen identifying the alarm, and the red light on the door will illuminate. If desired, one of the two relays (or both simultaneously) can be energized.

**Edit LL** is used to edit the lower limit for a selected parameter.

**Edit UL** is used to edit the upper limit for a selected parameter.

**Edit Action** is used to edit the action for a selected parameter.

There are four possible actions for the alarms:

- **None** – On screen notification of alarm condition. No relay actions.
- **A1** – On screen notification of alarm condition plus energizing of alarm relay #1.
- **A2** – On screen notification of alarm condition plus energizing of alarm relay #2.
- **A1AndA2** – On screen notification of alarm condition plus energizing of alarm relays #1 and #2.

The relays provide a contact that can be connected to external lights, horns, or other devices as desired. The rating for these relay contacts is maximum of 6 Amps / 250 Volts.

### Instrument Information

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

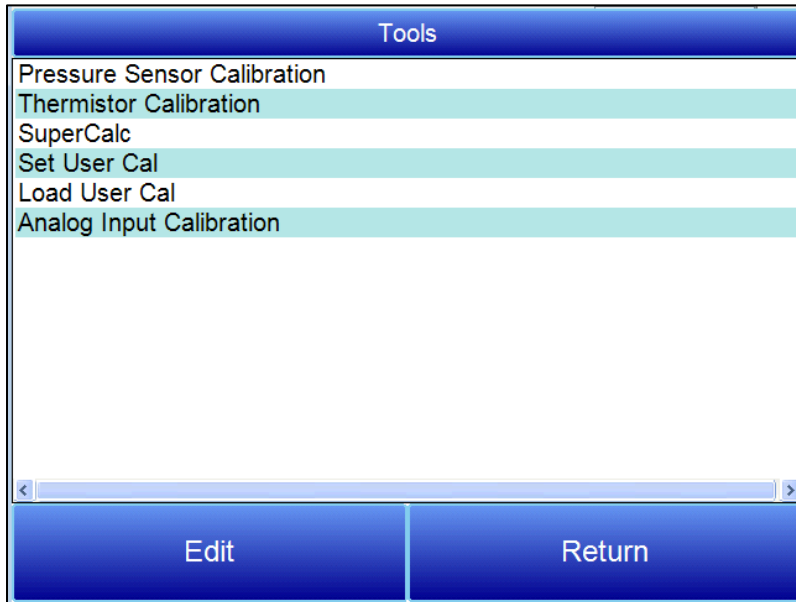
### General Information

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.

### Tools



### Thermister Calibration

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.

### SuperCalc



**NOTE:** This option requires zone selection.

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 MZA 6010, and it is only provided as a reference tool.

### Set User Cal / Load User Cal

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.

### **Shut Down Interface**

Use this option to shut down the touch screen interface for the MZA 6010. **It is recommended that you not shut down the screen interface unless you are following technical support instructions from SSi or you are preparing to power down the MZA 6010 system.**

### **Select Part Numbers and Internal Components**

The following items can be purchased as needed for the MZA 6010.

Part Number	Description
37051	Bowl Filter Element
20264	Ceramic Lined Sample Tubing Assembly with High Temperature Filter
13504	Span Gas Blend, 90 cubic feet, including cylinder and regulator assembly
13505	Zero Gas (Nitrogen), 90 cubic feet, including cylinder and regulator assembly
<b>Full MZA 6010 Units</b>	
13652	Standard 3-Gas MZA 6010 [CO, CO <sub>2</sub> , & CH <sub>4</sub> ]
13661	4-Gas MZA 6010 (Standard plus H <sub>2</sub> measurement)

## 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.

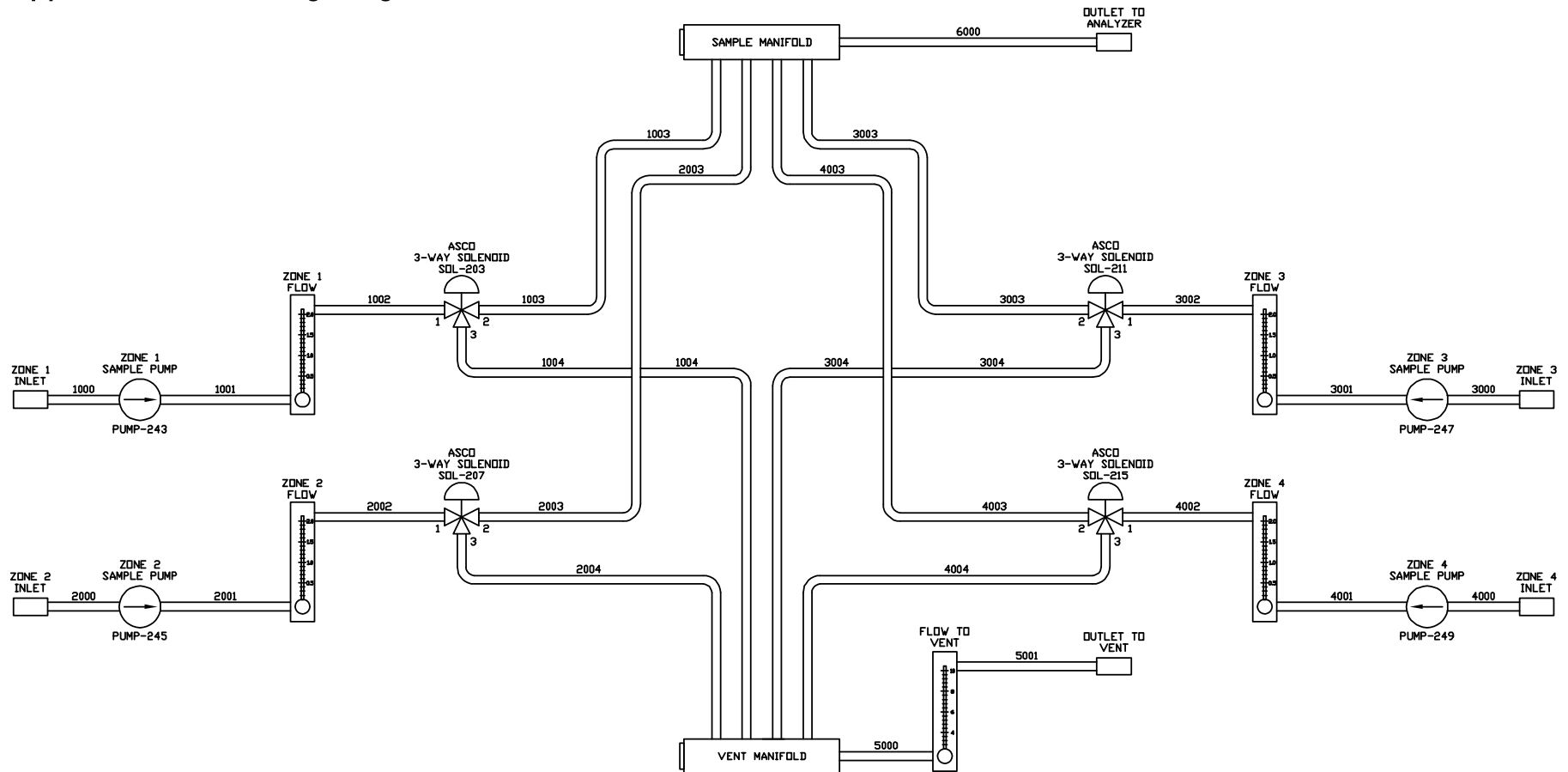
**CAUTION!**

Do not use an MZA 6010 for gas analysis with NH<sub>3</sub>-containing gas. Any use of an MZA 6010 with NH<sub>3</sub>-containing gas will void the product warranty.

## Revision History

Rev.	Description	Date	MCO#
New	First release	10-16-2015	2154
A	Added pump delay notification explanation	9-22-2016	2191
B	Added Digital and Analog Outputs to Appendix C.	10-20-2016	2199
C	Added time zone and daylight savings note to General Setup	5-26-2017	2217
D	Added Terminal information for wiring external instruments	6-1-2017	2219
E	Added Register Map and Config Parameters Appendices, removed electrical diagrams	10/20/2017	2224
F	Adjusted filter numbers on "Unpacking" section	4/9/2018	2232
G	Added IR Matrix Tables	1/11/2019	2250
H	added options to Furnace Temp and Probe Temp menus	4/25/2019	2263
I	Updated specifications	2-15-2022	2319
J	Updated wiring table, removed calibration based on digital inputs, updated terminal numbers	2-2-2023	2333
K	Updated Calculation Factors section to reflect correct Shim Factor	8/30/2023	2341

## Appendix A: Plumbing Diagram



## Appendix B: Inputs/Outputs on the MZA 6010

There are a number of Digital Inputs and Outputs in both the IR/interface enclosure and the pump enclosure on the MZA 6010. These are usually tied to external events or activated by an external PLC to perform various functions. The digital inputs are enabled by completing the electrical connection between each input and the ground terminal.

Digital I/O Board #1 in Main Enclosure	
Input 1	Zone 1 COF/PF Inhibit
Input 2	Zone 2 COF/PF Inhibit
Input 3	Zone 3 COF/PF Inhibit
Input 4	Zone 4 COF/PF Inhibit
Output 1	Not used
Output 2	Alarm 2
Output 3	Alarm 1
Output 4	Aux. Cal Gas Enable
Output 5	Sample Gas Enable
Output 6	Autocal Zero Gas Enable
Output 7	Autocal Span Gas Enable
Output 8	Not Used

Digital I/O Board in Zone 1-4 Pump Enclosure	
Input 1	Zone 1 Stop Sample
Input 2	Zone 2 Stop Sample
Input 3	Zone 3 Stop Sample
Input 4	Zone 4 Stop Sample
Output 1	Zone 1 Pump On/Off
Output 2	Zone 2 Pump On/Off
Output 3	Zone 3 Pump On/Off
Output 4	Zone 4 Pump On/Off
Output 5	Zone 1 Blocking Solenoid
Output 6	Zone 2 Blocking Solenoid
Output 7	Zone 3 Blocking Solenoid
Output 8	Zone 4 Blocking Solenoid

Digital I/O Board #2 in Main Enclosure	
Input 1	Zone 5 COF/PF Inhibit
Input 2	Zone 6 COF/PF Inhibit
Input 3	Zone 7 COF/PF Inhibit
Input 4	Zone 8 COF/PF Inhibit
Output 1	Zone 1 Alarm
Output 2	Zone 2 Alarm
Output 3	Zone 3 Alarm
Output 4	Zone 4 Alarm
Output 5	Zone 5 Alarm
Output 6	Zone 6 Alarm
Output 7	Zone 7 Alarm
Output 8	Zone 8 Alarm

Digital I/O Board in Zone 1-4 Pump Enclosure	
Input 1	Zone 5 Stop Sample
Input 2	Zone 6 Stop Sample
Input 3	Zone 7 Stop Sample
Input 4	Zone 8 Stop Sample
Output 1	Zone 5 Pump On/Off
Output 2	Zone 6 Pump On/Off
Output 3	Zone 7 Pump On/Off
Output 4	Zone 8 Pump On/Off
Output 5	Zone 5 Blocking Solenoid
Output 6	Zone 6 Blocking Solenoid
Output 7	Zone 7 Blocking Solenoid
Output 8	Zone 8 Blocking Solenoid

Shaded areas indicate internal functions of the MZA that are not available. They are included here for reference and troubleshooting purposes.

The MZA 6010 includes one Analog Output Board for zone 1. The outputs function as follows by default, but can be changed in the Analog Output Setup section. If more Analog Outputs are required, contact SSi sales for more information.

Analog Board (#)	
Output 1	Zone (#) %CO
Output 2	Zone (#) %CO <sub>2</sub>
Output 3	Zone (#) %CH <sub>4</sub>
Output 4	Zone (#) Carbon Potential (%C)



## Appendix C: Register Map

Register(s)	Description
file 0	
0	firmware version x 100
1	RS232 host port Baud (terms 1,2,& 3)
2	RS232 host port; Modbus slave = 1
3	RS485 Slave port Baud (0 to 13 for 1200 to 921600)
4	RS485 Slave port; 0 = MMI master, 1 = Modbus master
5	Not used reserved
6	Not used reserved
7	RS485 port Baud (0 to 13 for 1200 to 921600)
8	RS485 port; Modbus master = 1, host port = 9
9	PIC COMS baud
10	PIC coms mode (not used)
11	RS232 port baud (terms 4,5,& 6)
12	RS232 port mode: Modbus slave = 1, Modbus master = 9
13	forced to 1 for MGA
14	
15	0 = degree F; 1 = degree C
16	zone number
17	zone sequence
18	max number of zones (8 or less)
19	
20	Dwell Timer
21-25	
26	Instrument calculation enable and time per step. (ms) 10 MS min
27	start smart board detect routine
28 -32	
33	Baud set flag port F
34	if 1 enable pressure compensation
35	pressure trim value
36-42	
43	Startup pressure reading kPa * 100
44	elevation change from startup in feet * 10
45	Elevation from sea level in feet
46	pressure trim value
47	Local pressure entered for calibration
48	o2 calibration factor (10000 nom)
49	o2 zero offset
50	pressure reading in kPa * 100

Register(s)	Description
51	pressure difference due to elevation in kPa * 100
52	sea level (barometric) pressure
53	pressure in atmospheres * 1000
54	pressure in inHG * 100
55	upstream pressure reading in kPa * 100
56	upstream sea level (barometric) pressure
57	upstream pressure in atmospheres * 1000
58	upstream pressure in inHG * 100
59	pressure sensor and calculation select;
60	pressure diff upstream to downstream in kPa * 100
61	sample flow
62-63	
64	flow zero offset
65	flow span value
66	
67	Dualpro process factor register
68	LED D2 ON time in milliseconds
69	LED D2 OFF time in milliseconds
70	
71	must be 123 to accept cal request for cell
72-73	
74	Web change enable; 0 = disable, 1 = enable
75	
76	Sample/Pump ON delay same value all zones
77	Sample/Pump OFF delay same value all zones
78-79	
80	H2 zero gas % times 100 (xx.xx)
81	H2 span gas % times 100 (xx.xx)
82	hydrogen cell calibration request; 1 = zero, 2 = span
83	Low Dew point cell source; 0 = not used, 1 thru 40 = Smart AIB input number
84	Present reading from low dew point cell; xxx.x in deg C or def F
85 - 92	Zone low dew point data (reg 85 - 92)
93	
94	O2 data source: 0 = O2_blk, 1 thru 40 = Smart AIB input number
95	Est temperature of the lambda probe based on degree
96	pump run time
97	
98	

Register(s)	Description
99	
100	local cooler ON set point
101	local cooler OFF set point
102	local temperature x 10 in deg F or C based on degree
103	Auto cal interval in minutes 0 = OFF
104	Auto Zero interval in minutes 0 = OFF
105	Auto data display time at end of seq
106	purge time before cal or zero
107	if auto cal is avail this is 1
108	Zone alarm relays output desired states
109	relays output desired states:0 = pump, 1 = Alarm 2, 2 = Alarm 1, 3 = Aux cal gas, 4 = Sample, 5 = ACZ gas, 6 = ACZ span gas, 7 = AC/cooler on
110	bits 0 - 3 = sample relays zones 1 - 4; bits 4 - 7 = Zone ON zones 1 - 4
111	bits 0 - 3 = sample relays zones 5 - 8; bits 4 - 7 = Zone ON zones 5 - 8
112	
113	O2 data mantissa
114	O2 data exponent
115	HI range CO2 data xx.xx%
116	CO data xx.xx%
117	CO2 data x.xxxx% max 3.0000%
118	O2 data xx.x%
119	CH4 data xx.xx%
120	Ratio CO2/CO
128	IR Dew point if calculated
136	IR %C
144	IR suggested COF
152	IR suggested PF
160	IR equivalent millivolts
168	sample flow at calc time
176	Calculated new factor for COF/PF adjust
184	HI range CO2 data xx.xx%
192	CO data xx.xx%
200	CO2 data x.xxxx% max 3.0000%
208	O2 data xx.x%
216	CH4 data xx.xx%
224	sample temperature
232	sample pressure upstream
240	sample pressure downstream
248-249	
File 3	

Register(s)	Description
600-609	
610	IR cell seq flag
611	IR calibration requests
612	calibration mode
613	calibration timer for purge, etc
614	calibration counter
615	calibration enable CO
616	calibration enable CO2
617	calibration enable CH4
618	calibration enable CO2H
619	
620	calibration alarm bit map
621-639	
640	calibration span gas 1
641	calibration span gas 2
642	calibration span gas 3 x.xxxx
643	calibration span gas 4
644	calibration span gas 5
645	auto calibration span gas 2
646	auto calibration span gas 3 x.xxxx
647	auto calibration span gas 4
648	auto calibration span gas 5
649	aux calibration span gas 2
650	aux calibration span gas 3 x.xxxx
651	aux calibration span gas 4
652	aux calibration span gas 5
653	sample calibration span gas 2
654	sample calibration span gas 3 x.xxxx
655	sample calibration span gas 4
656	sample calibration span gas 5
657	calibration gas source; Forced to 0 for MZA
658-665	
666	
667	
668	ambient temperature trim; deg C * 100
669	gas (cell) temperature trim; deg C * 100
670	AIB board 1 input 1 type
671	AIB board 1 input 2 type
672	AIB board 1 input 3 type
673	AIB board 2 input 1 type
674	AIB board 2 input 2 type
675	AIB board 2 input 3 type

Register(s)	Description
676	AIB board 3 input 1 type
677	AIB board 3 input 2 type
678	AIB board 3 input 3 type
679	AIB board 4 input 1 type
680	AIB board 4 input 2 type
681	AIB board 4 input 3 type
682	AIB board 5 input 1 type
683	AIB board 5 input 2 type
684	AIB board 5 input 3 type
685	AIB board 6 input 1 type
686	AIB board 6 input 2 type
687	AIB board 6 input 3 type
688	AIB board 7 input 1 type
689	AIB board 7 input 2 type
690	AIB board 7 input 3 type
691	AIB board 8 input 1 type
692	AIB board 8 input 2 type
693	AIB board 8 input 3 type
694	Board number to calibrate 1 to 8
695	enables a calibration
696	CJ cal or zero/span voltage cal
697	Calibration Range register. Sets the voltage gain for a calibration.
698	bitmap of channels to be calibrated
699	Calibration value for all inputs
file 2	
700	alloy factor for calculation $10000 = 1.0000$
708	default Hydrogen to use if no H2 cell 40% = 40.00
716	0 = original sin, 1 = CarbCalc_Caf1, 2 = CarbCalc Caf, 3 = COCO2 Caf1, 4 = COCO2 Caf
724	IR shim factor
732	Pressure compensation factor; 0 = off, 10 = 1.0, max 2.0
740	CH4 factor
748	IR CO compensation factor
756	pump mode; 0 = off, 1 & 2 = auto
764	mode: 0 = monitor, 1 = COF/PF adjust base on %C
772	max adjust amount
780	maximum COF/PF
788	minimum COF/PF
796	Probe ATM instrument; -1 = internal (Input 1 for MV Input 2 for TC),

Register(s)	Description
	-2 = internal (Input 1 for MV Input 3 for TC), 0 to Probe ATM max for external,
	use -3 for manual
	-4 for data in external table
	Probe ATM inst number is type for inst setup [0][0];
804	Probe temperature instrument; -1 = internal (Input 3 for furn TC),
	-2 = internal (Input 2 for furn TC), 0 to Probe TC max for external,
	use -3 for manual
	-4 for data in external table
	Probe TC inst number + 256 is type for inst setup[1][0]
812	Dwell Times in seconds min 30 max 300
820	zone active; 0 = no, 1 = yes
828	Adjust/control update interval
836	Select CO2 for calculation: 0 = normal IR gas[2] , 1 = high range IR gas[4]
844	Enable IR Dew point calculation
852	IR dew point factor
860	Adjust minimum temperature
868	Adjust minimum millivolts
876	Minimum MV action; 0 = only inhibits adjust and control
884	sample control; 0 = off, 1 = on
892	
893	Ambient temperature Low alarm limit
894	Ambient temperature High alarm limit
895	Ambient temperature Low alarm limit
896	Ambient temperature High alarm limit
897	O2 cal span value 209 = 20.9%
898	O2 calibration req; 1 = zero, 2 = span
899	return code of UDPDL init()
file 4 [2][ ]	
	Dac assignx => gas number * 8 + zone number
	bit 12 sets output; 0 = 4 - 20MA, 1 = 0 - 20MA
9000	Brd 1 Dac 1 assignment
9001	Brd 1 Dac 2 assignment
9002	Brd 1 Dac 3 assignment
9003	Brd 1 Dac 4 assignment
9004	Brd 1 Dac 1 zero
9005	Brd 1 Dac 1 span
9006	Brd 1 Dac 2 zero
9007	Brd 1 Dac 2 span

Register(s)	Description
9008	Brd 1 Dac 3 zero
9009	Brd 1 Dac 3 span
9010	Brd 1 Dac 4 zero
9011	Brd 1 Dac 4 span
9012	Brd 2 Dac 1 assignment
9013	Brd 2 Dac 2 assignment
9014	Brd 2 Dac 3 assignment
9015	Brd 2 Dac 4 assignment
9016	Brd 2 Dac 1 zero
9017	Brd 2 Dac 1 span
9018	Brd 2 Dac 2 zero
9019	Brd 2 Dac 2 span
9020	Brd 2 Dac 3 zero
9021	Brd 2 Dac 3 span
9022	Brd 2 Dac 4 zero
9023	Brd 2 Dac 4 span
9024	Brd 3 Dac 1 assignment
9025	Brd 3 Dac 2 assignment
9026	Brd 3 Dac 3 assignment
9027	Brd 3 Dac 4 assignment
9028	Brd 3 Dac 1 zero
9029	Brd 3 Dac 1 span
9030	Brd 3 Dac 2 zero
9031	Brd 3 Dac 2 span
9032	Brd 3 Dac 3 zero
9033	Brd 3 Dac 3 span
9034	Brd 3 Dac 4 zero
9035	Brd 3 Dac 4 span
9036	Brd 4 Dac 1 assignment
9037	Brd 4 Dac 2 assignment
9038	Brd 4 Dac 3 assignment
9039	Brd 4 Dac 4 assignment
9040	Brd 4 Dac 1 zero
9041	Brd 4 Dac 1 span
9042	Brd 4 Dac 2 zero
9043	Brd 4 Dac 2 span
9044	Brd 4 Dac 3 zero
9045	Brd 4 Dac 3 span
9046	Brd 4 Dac 4 zero
9047	Brd 4 Dac 4 span
9048 -9095	

Register(s)	Description
file 4 [0]	
9100 - 9107	Bit map of states of each zone.
	Bits 0 to 8 why not sampling; 0 = OK, 1 = blocking sample.
	bit 0 = Zone activeX == 0, this clears all other bits.
	bit 1 = pump modeX == 0
	bit 2 = Digital input blocking sample
	bit 3 = base statusX = 0 (may be ON delay)
	bit 4 = Min TC (note if set Min MV is not tested)
	bit 5 = Min MV
	bit 6 = calibration
	bit 7 = Auto cal
	bit 8 = sample controlX == 0 (probably caused by one of the previous)
	Bits 9 to 11
	Bits 12 to 14 blocking COF/PF adjust
	bit 12 = IR modeX not 1 or 2
	bit 13 = base status not 4
	bit 14 = digital input blocking adjust.
	Bit 15 NU
9100 - 9147	
9148	Surface carbon activity
9149	Carbon with alloy factor = 1
9150	Carbon with specified alloy factor
9151	carbon calculated from only CO and CO2 with alloy factor = 1
9152	carbon calculated from only CO and CO2 with supplied alloy factor
9153	IR %C based on original 3 gas calculation
9154	Digital inputs from Dig I/O boards
	bits 0 to 3 from brd 1, 4 to 7 from brd 2, 8 to 11 from brd 3, and 12 to 15 from brd 4
	bits 0 to 7 are PF/COF inhibit for zones 0 thru 7
	bits 8 to 15 are stop sample for zones 0 thru 7
9155	Custom sequence pointer
9156 - 9187	first of 32 points for custom sequence
9188-9190	
9191	Que_[0] status
9192	Que_[1] status
9193	Que_[2] status
9194	Que_[3] status
9195	Que_[4] status



Register(s)	Description
9196	Que_[5] status
9197	generic que inst number
9198	generic que register
9199	generic que data
file 4 [1]	
8900	ambient temperature; deg F x 100
8901	gas (cell) temperature, deg F x 100
8902	cell abs pressure
8903	cell differential pressure
8904	gas 1 peak to peak
8909	gas 1 level at zero (N2)
8914	gas 1 gain constant from span
8919	gas 1 reading with compensation
8924	gas 1 value
8929	gas 1 positive
8934	gas 1 negative
8939	gas 1 value with TC adjust
8944	gas 1 value with press adjust
8949	gas 1 value with both
8954	temperature ratio Tcal/T
8959	pressure ratio P/Pcal
8964	filter time in MS
8969	Integer of calibration average
8974	Integer of gas read at ave
8989	Ambient temperature pre-trim
8990	Gas temperature pre-trim
8991	Normalized Absorbance (CH4)
8992	Normalized Absorbance (CO2)
8993	Normalized Absorbance (CO)
8994	Normalized Absorbance (CO2)
8995	gas 1 p2p raw.
file 5	
8500	probe MV
8508	probe COF
8516	probe temperature
8524	probe process factor
8532	probe %C
8540	probe carbon setpoint
8548	IR temperature
8556	H2 cell in % times 100 (xx.xx)

Register(s)	Description
8564-8567	
8568	test mode CO data xx.xx
8576	test mode CO2 data x.xxxx
8584	test mode CO data xx.xx
8592	test mode CO2 data xx.xx
8600	PC_compare mode 0 = probe %C setpoint, 1 = probe %C actual
8608	Compare IR %C to probe %C or Setpoint if 0 disable.
8616	alarm bit map
	bit 0 = low flow; bit 1 = slave communications
	bit 2 = max factor; bit 3 = min factor;
	bit 4 = PC_comp alarm
	bit 5 = auto cal alarm
	bit 6 = NU
	bit 7 thru 15 = gas alarms (see Note below)
8624	bit 0 = FC TC; Bit 1 = PB TC
	bit 2 = PB MV; bit 3 = PB COF/PF
	bit 4 = PB %C; bit 5 = ambient temperature
	bit 6 = gas temperature
	bit 7 thru 15 not assigned.
8632	alarm 1 assignment bit mask 0 = not assigned; 1 = assigned
8640	alarm 2 assignment bit mask 0 = not assigned; 1 = assigned
	bits 0 to 6 are alarm_bit_map1 bits (0 to 6)
	bits 7 to 15 are alarm_bit_map bits (7 to 15)
	alarm_bit_map bits 0 to 6 are always alarm 1
8648	Calculation flag 0 = COF, 1 = MMI PF
8656	Status of base (0 = OFF, 1 = pump delay ON, 2 = sample delay, 3 = measure delay, 4 = delay OFF, 5 = ON.)
8664	interval timer for COF/PF adjust
8672	sample ON delay timer
8680	sample OFF delay timer
8688	CO2 high alarm limit
8696	CO2 low alarm limit
8704	CO high alarm limit
8712	CO low alarm limit
8720	CH4 high alarm limit
8728	CH4 low alarm limit
8736	CO2H high alarm limit
8744	CO2H low alarm limit
8752	IR %C high alarm limit
8760	IR %C low alarm limit

Register(s)	Description
8768	H2 high alarm limit
8776	H2 low alarm limit
8784	O2 high alarm limit
8792	O2 low alarm limit
8800	furnace TC High alarm limit
8808	furnace TC Low alarm limit
8816	probe TC High alarm limit
8824	probe TC Low alarm limit
8832	probe MV High alarm limit
8840	probe MV Low alarm limit
8848	probe COF/PF High alarm limit
8856	probe COF/PF Low alarm limit
8864	probe %C High alarm limit
8872	probe %C Low alarm limit
8880	O2 data mantissa
8888	O2 data exponent
8896-8899	
file 9	
900	product ID code
901	reset logging
902	Dynamic C compiler version in hex
903	long date/time stamp in secs from
904	midnight Jan 1, 1980.
905	Hack attempts counter
906	Web access code, level 1
907	Web access code, level 2
908	SSI error handler return counts
909	Set factory defaults control, 23205 (0x5aa5) to set
910	Force user block write and read
911	Rabbit ID from ID block
912	Web CGI action
914	4 locations for IP address (14 - 17)
918	4 locations for netmask (18 - 21)
922	4 locations for gateway (22 - 25)
930	10 locations for port states
940	auto calibration interval timer
941	auto zero interval timer
942	auto cal/zero request; bit 0 = zero, bit 1 = span
943	auto cal/zero sequence

Register(s)	Description
944	sequence timer
945	auto cal/zero status
946	Flag to initiate log of Auto cal
947	Number of entries in Auto cal log file
980	4 locations for Time server IP address (120 - 123)
984	UTC time zone as a quarter hour offset from UTC must be +/- 100
	For EST with a -5 hour difference enter -20.
985	UTC update interval in days (0 to 399) 0 disables
986	UTC update flag
987	UTC result
988 - 989	
990	DAC board number. 1 thru 8
991	
992	
993	
994	
995	
996	
997	
998 - 999	
2600 - 2699	Four Quad DAC boards
2700 - 2799	Four Quad DAC boards
0 - 14	
0	DAC status = copy of COM_stat_X
1	DAC mode, 0 = counts, 1 = current
2	DAC 0 Value Current 0 to 20000
3	DAC 1 Value
4	DAC 2 Value
5	DAC 3 Value
6	DAC calibration channel
7	DAC calibration Enable
8	DAC calibration request
9	DAC calibration target value CH 1
10	DAC calibration target value CH 2
11	DAC calibration target value CH 3
12	DAC calibration target value CH 4
13	
14	

Register(s)	Description
15 to 19	
20	computed values to send to DAC
21	
22	
23	
24	
2800 - 2899	
0	Com status for message one of the PIC to rabbit comms.
1 - 3	
4	Com status for message two of the PIC to rabbit comms.
5 - 15	
16	A/D 1 status register (negative)
17	A/D 1 reading, ir led on
19	A/D 1 status register (positive)
20	A/D 1 reading, ir led off
22	A/D 2 status register (negative)
23	A/D 2 reading, ir led on
25	A/D 2 status register (positive)
26	A/D 2 reading, ir led off
28	A/D 3 status register (negative)
29	A/D 3 reading, ir led on
31	A/D 3 status register (positive)
32	A/D 3 reading, ir led off
34	A/D 4 status register (negative)
35	A/D 4 reading, ir led on
37	A/D 4 status register (positive)
38	A/D 4 reading, ir led off
40	IR LED trigger time
41	time from IRLED on/off to trigger AD7739 conv.
42	internal A/D channel selector
43	ambient temperature raw counts (10 bits resolution)
44	ambient temperature trim
45	gas temperature raw counts (10 bits resolution)
46	gas temperature trim
47	absolute pressure raw counts (10 bits resolution)
48	absolute pressure trim
49	differential pressure raw counts (10 bits resolution)
50	differential pressure trim
51	digital status word

Register(s)	Description
52	Baud Rate selection variable
53 - 99	
2900 - 2999	
2900-2903	
2904	Digital Output setpoint
2905	Digital Output actual
2906	Digital Input
2907-2913	
2914	Digital Output setpoint
2915	Digital Output actual
2916	Digital Input
2917-2923	
2924	Digital Output setpoint
2925	Digital Output actual
2926	// Digital Input
2927-2933	
2934	Digital Output setpoint
2935	Digital Output actual
2936	Digital Input
2937-2949	
2950	x curve point in MV
2951	y curve point in 10x MV (10000 = 1000.0)
2952-2999	more curve points.
2998	top curve point is forced to 3200 for x
2999	top curve point is forced to 32000 for y
3000 - 3099	
3100 - 3199	
3200 - 3299	
3300 - 3399	
1	version number of the firmware
2	0 = °F, 1 = °C, 2 = °R, 3 = K
3	Cold Junction Temperature
8	Input type
13	Process Variable
18	enables a calibration
19	CJ cal or zero/span voltage cal
20	Calibration Range register. Sets the voltage gain for a calibration

Register(s)	Description
21	
22	First of 5 Calibration value
27	First of 5 calibration timers
32	0 = no calibration, 1 = calibration in progress
33	First of 5 calibration error calculations
37	End of calibration registers
38	First of 5 Scaled VDC
3400 - 3499	
0 - 10	
11	
12 - 77	
78	
78 - 99	
3700 - 3799	
0 - 9	
10 - 17	8 registers for zone probe MV
18 - 25	8 registers for zone probe TC
26 - 33	8 registers for zone furnace TC
34 - 99	

**Note:****Gas Numbers      Gas alarm bits (for register 8616):**

0 = CO	7 = CO <sub>2</sub>
1 = CO <sub>2</sub>	8 = CO
2 = CH <sub>4</sub>	9 = CH <sub>4</sub>
3 = High CO <sub>2</sub>	10 = High CO <sub>2</sub>
4 = IR %C	11 = IR %C
5 = H <sub>2</sub>	12 = H <sub>2</sub>
6 = O <sub>2</sub>	13 = O <sub>2</sub>
7 = Probe %C	

## Appendix D: Configuration Parameters

<b><u>Communication and Source Setup / IP Address</u></b>	
IR Sensor IP Address	192.168.1.122
<b><u>Instrument Setup / General Setup</u></b>	
Temperature Units	°F
<b><u>Instrument Setup / Security Settings</u></b>	
Supervisor passcode	1
Configuration passcode	2
<b>Settings specific to each zone:</b>	
<b><u>Pump Control</u></b>	
Pump Status	Auto
Pump On Delay (seconds)	2
Pump Off Delay (seconds)	2
<b><u>Automatic Sampling Parameters</u></b>	
COF/PF Adjustment Increment	1
COF/PF Adjustment Interval	1
Minimum COF/PF Value	130
Maximum COF/PF Value	220
COF/PF Adjustment Mode	Monitor
Minimum Temperature for sampling	1490 °F
Minimum Millivolts for sampling	1030 mV
Minimum millivolt condition...	also stops pump
<b><u>Communication and Source Setup / Temp Sources</u></b>	
Port usage	Modbus Master
Port Baud Rate	19200
Probe Temp/mV Instrument	SSI AC20
Probe Temp/mV Instrument Address	0
Furnace Temp/mV Instrument	Ssi 7EK
Furnace Temp/mV Instrument Address	0
<b><u>Instrument Setup / Calculation Factors</u></b>	
IR Factor	CO Factor
IR Shim Factor	180
CH4 Factor	20
Use IRF Matrix	FALSE
Use Furnace Temp for Furnace Setpoint	FALSE
<b><u>Instrument Setup / Other Settings</u></b>	
Enable dew point calculation	Off
<b><u>Edit Active Zones</u></b>	
Zone 1 Status	Active
Zone 1 Dwell Time	90
Zone 1 Pump	Auto
Zone 2 Status	Active



Zone 2 Dwell Time	90
Zone 2 Pump	Auto
Zone 3 Status	Active
Zone 3 Dwell Time	90
Zone 3 Pump	Auto
Zone 4 Status	Active
Zone 4 Dwell Time	90
Zone 4 Pump	Auto
Zone 5 Status	Active
Zone 5 Dwell Time	90
Zone 5 Pump	Auto
Zone 6 Status	Active
Zone 6 Dwell Time	90
Zone 6 Pump	Auto
Zone 7 Status	Active
Zone 7 Dwell Time	90
Zone 7 Pump	Auto
Zone 8 Status	Active
Zone 8 Dwell Time	90
Zone 8 Pump	Auto
<b><u>Zone Sequence Setup</u></b>	
Default sequence is numerical by zone.	
<b><u>Zones Inhibited</u></b>	
Varies based on number of active zones.	
<b><u>IF NITRIDER CALCULATION IS ENABLED:</u></b>	
<b><u>Tools / Valve Setup</u></b>	
Valve 1 Maximum	
Valve 1 Decimal Place	
Valve 1 Gas	
Valve 2 Maximum	
Valve 2 Decimal Place	
Valve 2 Gas	
Valve 3 Maximum	
Valve 3 Decimal Place	
Valve 3 Gas	
Valve 4 Maximum	
Valve 4 Decimal Place	
Valve 4 Gas	
<b><u>Nitrider Calculation</u></b>	
N2 Flow	0
NH3 Flow	0
DA Flow	0
CO2 Flow	0

