PH$_2$

(PART NUMBER 13536)

Portable Hydrogen Analyzer 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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Basic Operating Description:

This instrument uses the measurement of Hydrogen to display % Hydrogen (H_2), % Dissociation (DA), and % Ammonia (NH_3). When the flow rates of Nitrogen, Ammonia, and Dissociated Ammonia are manually entered, the instrument can also calculate Nitriding potential (Kn). When the instrument is turned on, it will display % H_2 and %DA on the screen. To display additional values (%NH_3 or Kn), see the "Instrument Configuration" screen. The 4-20mA output on the side of the case can be set up to retransmit the any of these measurements in whatever range is appropriate for the application.
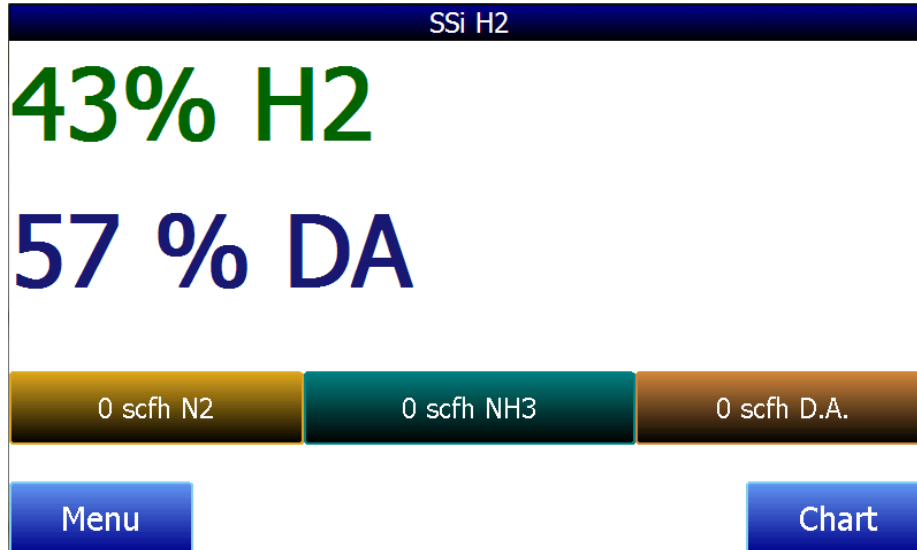

The home screen also displays the flow of N_2, NH_3, and D.A. These values can be entered by the operator when the instrument is in the mode to evaluate Kn or %DA. This is discussed further under the Instrument Configuration section. The **Menu** button in the bottom left-hand corner will take the operator to the configurable options within the controller. The **Chart** button in the bottom right-hand corner of the screen will display the data trend chart.

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Specifications

- Power Requirements: 100-240 VAC
- Current Draw: Max. 0.2 Amps
- Sensor Technology: Thermal Conductivity
- User Interface: 5.7" Color Touch Screen
- Measurement Range: 0-100% of gas concentration
- Hydrogen Measurement Accuracy: +/- 1% of full scale (+/-0.1% of gas concentration, based on 100%)
- Hydrogen Measurement Repeatability: +/- 1%
- Hydrogen Measurement Resolution: 0.1%
- Analog Outputs: Two Isolated 4-20mA (User Configurable)
- Analog Output Resolution: 0.005mA
- Analog Output Accuracy: +/- 0.01% of Range
- Analog Output Linearity: +/- 0.01%
- Analog Output Load Resistance: Minimum 0 Ohm, Maximum 500 Ohm
- Digital Communications: RS485 Modbus, Ethernet
- Recommended Flow Rate: 1.5 to 2.0 SCFH / 0.71 to 0.94 lpm
- Process Gas Fittings: Stainless Steel Compression for ¼" OD Tubing
- Calibration Gas Fitting: 1/8" Barb (can be removed for 1/8" Female NPT Port)
- Operating Environment: 10-90 %RH (Non-Condensing)
- Operating Temperature: 32 to 122°F / 0 to 50°C
- Sample Gas Temperature: 32 to 158°F / 0 to 70°C

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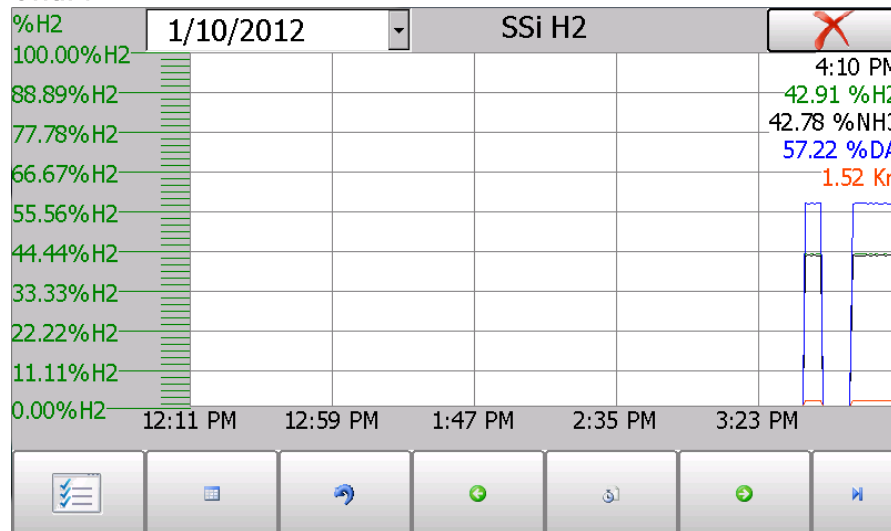
The Chart Display shows between 1 hour and 24 hours of process variable data on the screen and can be scrolled back to view all of the data stored on the hard drive. The vertical timelines change as the time changes on the screen.

The function buttons run along the bottom of the screen.

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

The blue arrow button - - will toggle real-time mode on and off. 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 pressing down for 1-2 seconds. The sub-menu will have the following options available: **Zoom**, **Restore**, **Add Note**, **Data**, and **Exit**.

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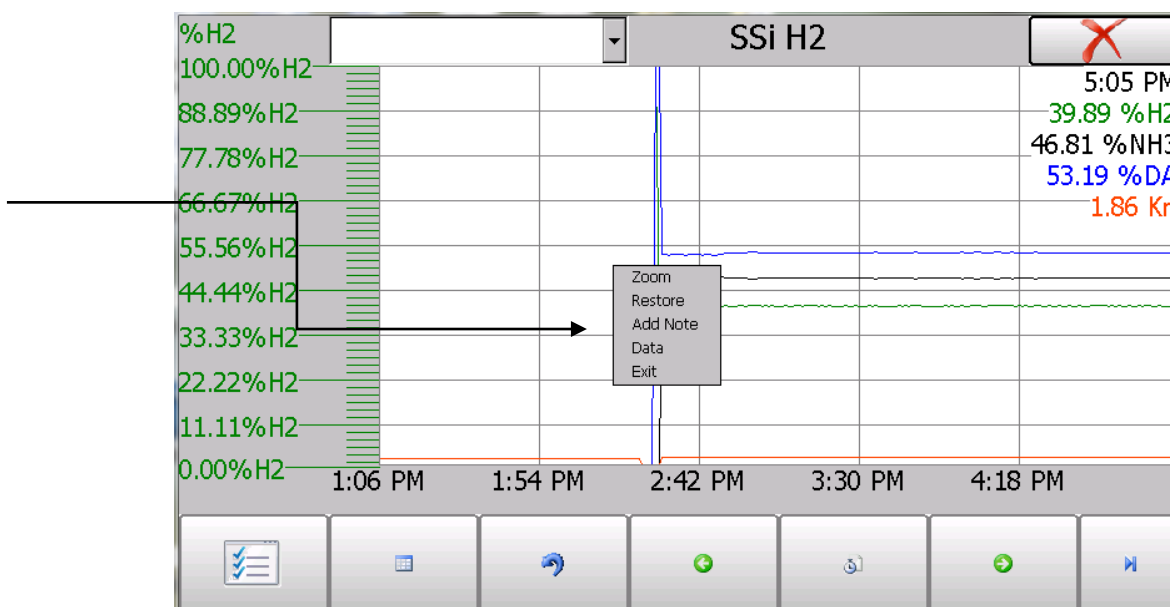
The **Zoom** option will allow the user to zoom in on a particular part of the screen. Once this has been selected, the user can take a stylus or a finger and create a box around the desired data. Once the user releases the stylus or finger, a zoom is no longer possible, and the user will need to re-select the option from the sub-menu to zoom in again.
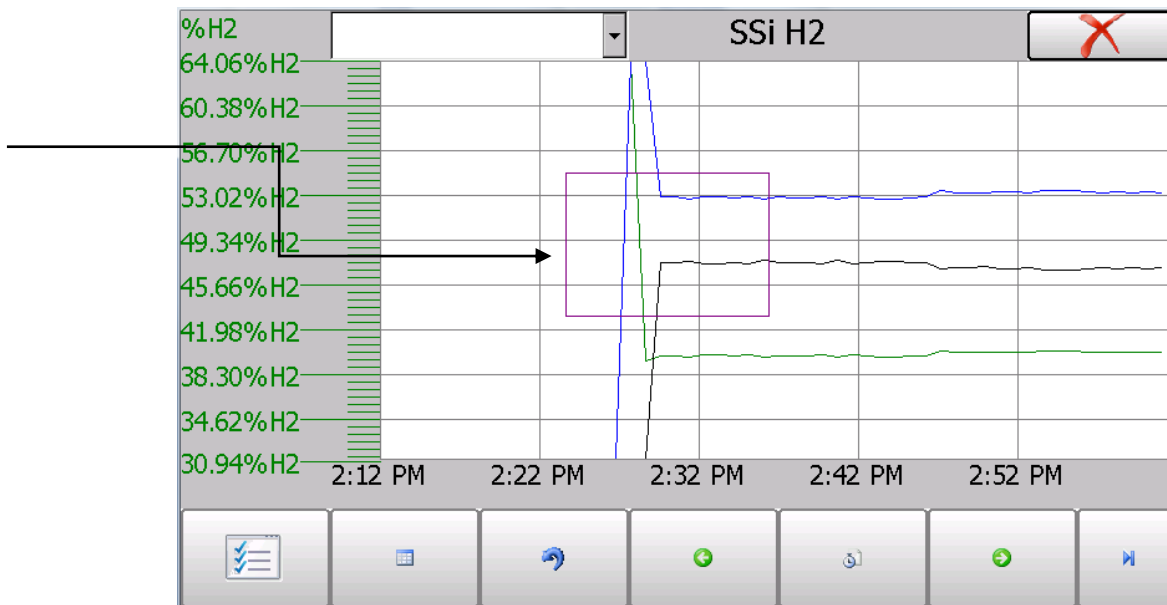
The **Restore** option will back out of any zoom options that have been performed and display the chart screen as it initially was.

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

The **Data** option will show the trend data as a data grid instead of the trend lines on a chart.

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

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

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

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Menu

Accessing the Menu screen will show two available options:

| Exit Program |
| Instrument Information |

| Login | Select | Go Back |
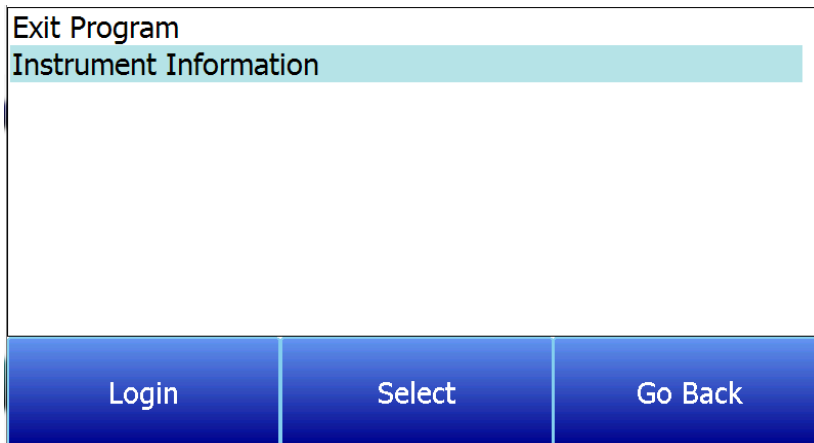
Additional menu items are available when an authorized user logs in using an appropriate Pass Code. When the Administrator Pass Code is entered (default = 2), the user will also be able to access the following options:

| Exit Program |
| Instrument Information |
| Pump Control |
| Communications Setup |
| Instrument Configuration |
| Output Configuration |
| Output Calibration |
| Sensor Calibration |

| Login | Select | Go Back |
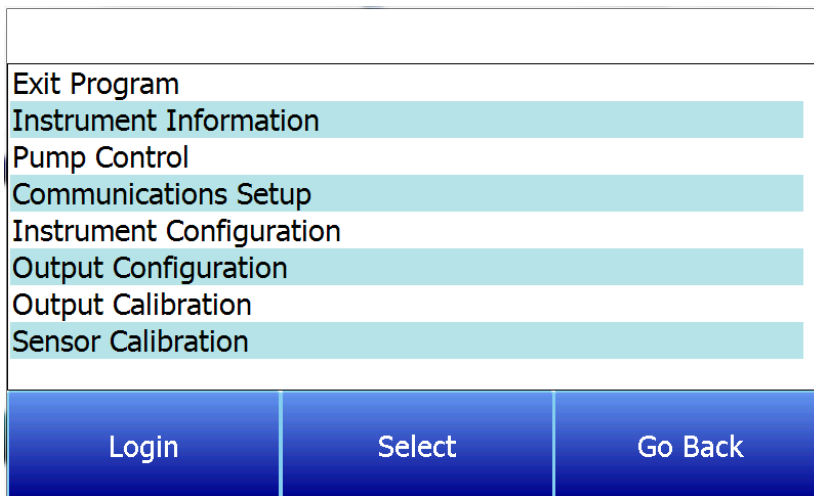
To access any items on the menu list, touch the item to highlight it and then press Select. A specific description of each item on the list follows:

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Exit Program

Exit Program

Instrument Information

Shut down interface

Shut down the user interface. Are you sure?

| Yes | No |

| Login | Select | Go Back |
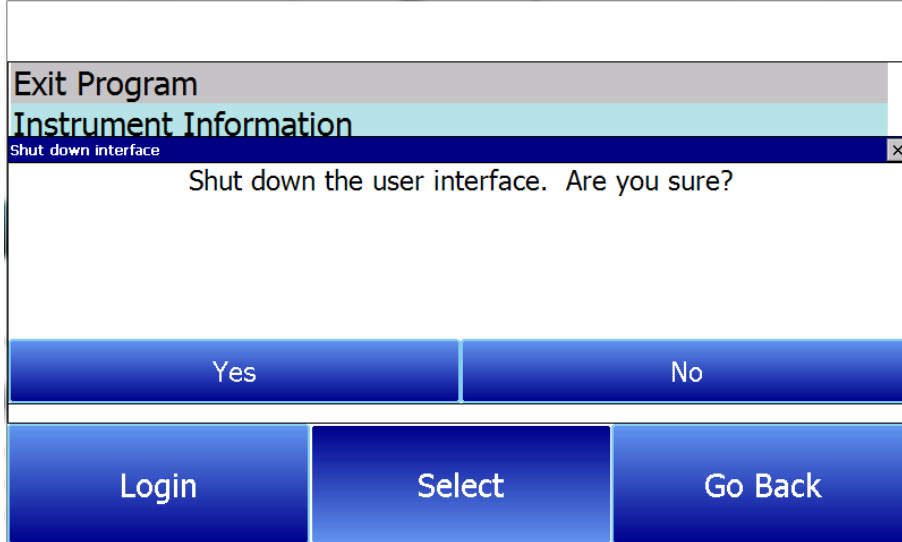
 Selecting Exit Program will allow the operator to shut down the user interface. This can be done by selecting **Yes** when prompted or **No** to return to the Menu list. If the user interface is shut down, it will restart automatically when the power to the instrument is cycled.

Instrument Information

Instrument Information	
MODEL	4100
Serial Number	DefaultSN
Data Log Status	Datalogging
Main Processor Ver	
HMI version	1.1.0.8

| | Go Back |

Instrument Information displays the default parameters of the Portable H_2. This screen provides information on any applicable revision levels and serial numbers. It also shows if the instrument is logging data. There are no functions that can be performed on this screen; it is for informational purposes only.
The **Go Back** button will return to the Menu list.

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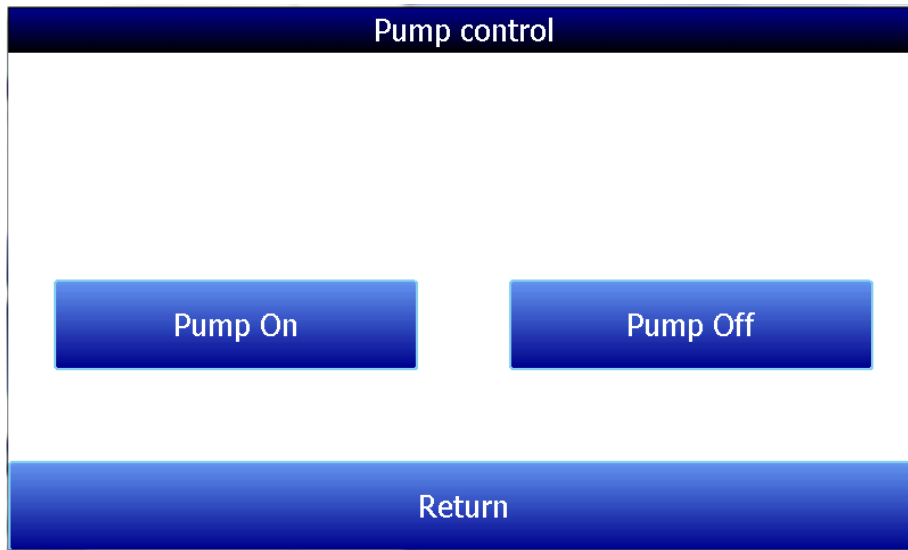
Pump Control

Pump Control will allow the operator to turn the pump on or off by selecting the corresponding button. Pressing **Return** will display the Menu list.

Communications Setup

The communication modes shown on this screen are for display only and should not be modified.

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Instrument Configuration

Instrument Configuration	
Mode	Dissociation
Minimum H2 for NH3 Display	0.00

| Edit | Go Back |

Instrument Configuration will modify the measured quantity display on the overview screen. This instrument will always display Percent Hydrogen (%H$_2$), and it is capable of displaying three additional different parameters if desired. These include:
- Percent Dissociation (DA)
- Percent Ammonia (NH$_3$)
- Nitriding Potential (Kn)

One additional parameter can be displayed along with Hydrogen by highlighting it and pressing **OK**.

Percent Hydrogen
The percent hydrogen is the amount of Hydrogen that is being detected by the thermal conductivity sensor inside the instrument. There are no additional calculations being performed to this value.

Percent Dissociation
Dissociation is derived from the amount of Hydrogen in the sample gas. Flow rates must be entered at the bottom of the screen to obtain a true %DA calculation.

Percent Ammonia
The amount of Ammonia can also be inferred from the Hydrogen value.

Nitriding Potential
The accurate calculation of Nitriding potential requires the flow rates of other gases that are being introduced into the process. All of the flow rates must be in the same units and scaling. Kn can only be calculated by entering the flow of Nitrogen (N$_2$), Ammonia (NH$_3$) and Dissociated

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Ammonia (DA). These values are entered at the bottom of the home screen when Kn is selected.

To change the display, click on **Mode** and press **Edit.** This will allow the operator to choose between Hydrogen, Dissociation, NH_3, and Kn for analysis and display. Select the appropriate mode and press **Ok** to modify this option.

Minimum H_2 for NH_3 display

There may be times when the process is not active. During these times, the measured Hydrogen value displayed on the screen will remain valid, but the calculated % NH_3 will not be valid since it is based on the assumption that the known process gases are involved. In these cases, it may be more desirable to hide the display of NH_3 instead of displaying a value that is known to be incorrect. This can be done by setting a minimum level of H_2 that will be present when the process is active. When the Hydrogen drops below this level, the instrument will know that the process is not active and the NH_3 readings are not valid so it will not display NH_3.

Output Configuration

Output Configuration	
Output 1 Source	NH3
Output 1 Zero	0.00
Output 1 Span	100.00
Edit	Go Back

There is one 4-20mA output that can be configured for any of the four parameters. The operator can select the Source (H_2, DA, NH_3, Kn), the zero value (the value to be represented by 4mA) and the span value (the value to be represented by 20mA).

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<u>Output Calibration</u>

The Portable H$_2$ has one 4-20 mA output. For optimal accuracy the output can be verified and if necessary calibrated.

Equipment needed:
A calibrator with the ability to measure Milliamps.

Zero Calibration - Outputs
To perform a zero calibration, click on the **Zero output** option. The circle will be filled in with a dot for the selected option. When ready to start the calibration, click on the **Prep for Cal** button.

The user will then measure the current at the appropriate output terminals and enter that value into the blue box by tapping on it once to bring up a number pad. Save this value by pressing **OK**.

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

Span Calibration – Outputs
To perform a span calibration, click on the **Span Output** option. The circle will be filled in with a dot for the selected option. When ready to start the calibration, click on the **Prep for Cal** button.

The user will then measure the current at the appropriate output terminals and enter that value into the blue box by tapping on it once to bring up a number pad. Save this value by pressing **OK**.

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

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Sensor Calibration

```
╔══════════════════════════════════════════════════════╗
║                    H2 Calibration                      ║
╟──────────────────────────────────────────────────────╢
║ ◉ Zero Hydrogen                                        ║
║ ○ Span Hydrogen                                        ║
║                                                        ║
║                                                        ║
║ Enter supplied target value:    ┌──────────────────┐   ║
║                                 │       0.00        │   ║
║                                 └──────────────────┘   ║
║                                                        ║
║                                                        ║
║                                                        ║
║ Measured H2 value: 429500 ppm H2                       ║
║                                 ┌──────────────────┐   ║
║                                 │     Go Back       │   ║
║                                 └──────────────────┘   ║
╚══════════════════════════════════════════════════════╝
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A proper calibration of the sensor requires two gases. The first gas should be pure Nitrogen or Argon. This contains no Hydrogen, and is therefore referred to as the Zero Gas. The second gas is the Span Gas. The Span Gas should ideally contain a quantity of Hydrogen similar to the amount of Hydrogen in the process to be measured. The Span Gas should also include any other gases that are present in the process gas in their respective percentages. The more similar to the process gas the calibration gas is, the more accurate the calibration will be.

Performing a Zero Calibration
On the Sensor Calibration page, select **Zero Hydrogen.** Begin the flow of gas through the analyzer using the flexible sample tubing assembly. The flow rate should be 1.5 to 2.0 SCFH as measured on the flow meter in the lid of the case. The gas should not be under any pressure other than the amount required to maintain the appropriate flow amount. The target Value is shown on the screen. For a Zero Calibration, this will be 0.00 (the amount of Hydrogen in the Zero Gas). The Measured H_2 Value can be seen at the bottom of the screen. When this value comes to equilibrium, it will not be showing any upward or downward trends, only the slight oscillation of the readings. This usually occurs in approximately 30 seconds. When the sensor is at equilibrium, press the green **Calibrate** button to perform the zero calibration. After the Zero Calibration is complete, turn off the flow of gas and disconnect it from the enclosure.

Performing a Span Calibration
To perform a span calibration, select **Span Hydrogen**, and flow the span gas in the same manner as the zero gas. The Target Value should be set to the exact amount of Hydrogen that is in the Span Gas cylinder. Then the same procedure should be followed as the Zero calibration, with the **Calibrate** button being pressed after the readings reach equilibrium. After the Span Gas calibration is complete, turn off the flow of gas, disconnect the cylinder from the enclosure.

Modifying Network Settings (Such as IP Address)

If using the PH_2 on a network, it may be necessary to modify network settings manually.One of the most common reasons for modifying network settings is to manually assign an IP address to the touch screen. If you are not familiar with IP addressing and network settings, it is recommended that you first speak to your network administrator.

To modify the network settings, first shut down the interface using the **Exit Program** option (as described in the Exit Program section).
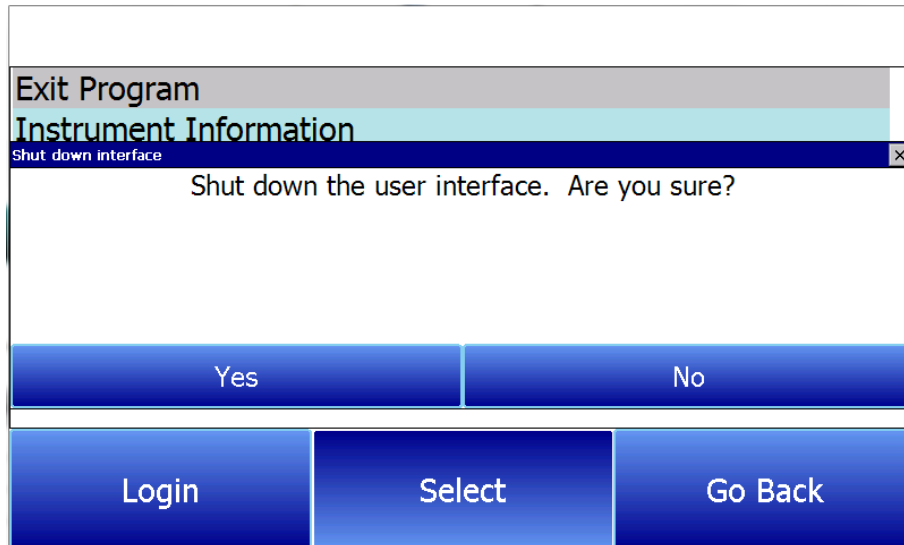
Once the PH_2 interface is shut down, you will see the operating system screen. The following procedure is typical for changing the IP address.

From the operating system screen, click Start, Settings, and Network and Dial-up Connections.
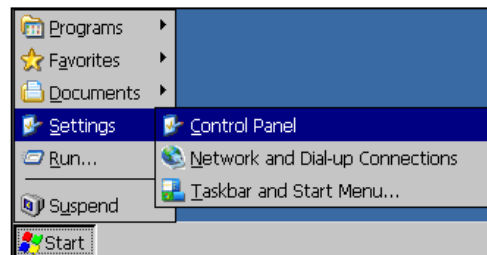

Double tap on the connection for the PH_2 touch screen (in the example, it is called "SMSC91181"). An Ethernet Driver settings window will appear, giving you the ability to specify an IP address. To do so, click the "Specify an IP address" radio button. Then enter an IP address manually.

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<u>Make sure that the IP address does not conflict with another IP address already assigned on the network.</u>

You will also need to add a Subnet Mask and a Default Gateway. The subnet mask is usually already determined for the network. A common subnet mask is 255.255.255.0; however, check with the network administrator to be sure. The default gateway is usually the address of the network router or other device that is responsible for routing network traffic.
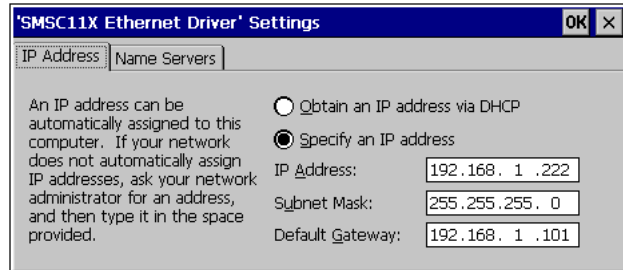
If you have questions about the specific network to which you are connecting the PH_2, please contact the network administrator.

Use with Touch Screen Manager

The PH_2 is compatible with SSi's Touch Screen Manager (TS Manager) software, which allows a Windows-based computer to connect to and access data from the PH_2 touch screen. In order to use TS Manager, the Windows-based computer must be connected to the PH_2 using an Ethernet connection or a USB connection with Active Sync or Mobile Device Center. For more information on using TS Manager, refer to the TS Manager manual available on the Super Systems Inc. website: http://www.supersystems.com ("Manuals" link).

TS Manager is typically supplied with any new purchase of the PH_2. If you need information on obtaining TS Manager, please contact Super Systems Inc. at (513) 772-0060.

Changing the System Date and Time

The time and date that the PH_2 screen software uses are based on the time and date of the touch screen operating system. To change the time and date, first shut down the software as shown in the picture below (also described in the Exit Program section). Once the software is shut down, double tap on the time shown in the task bar at the bottom of the screen on the operating system desktop. Change the date and time in the dialog box that appears.

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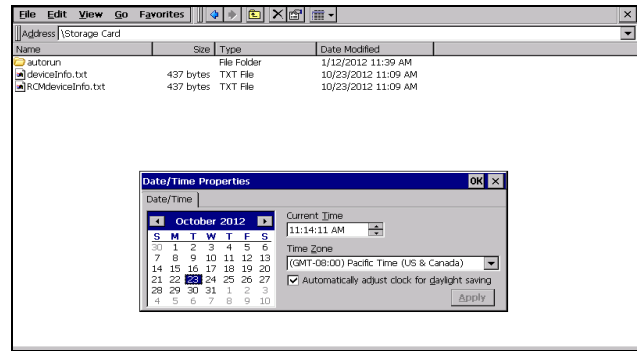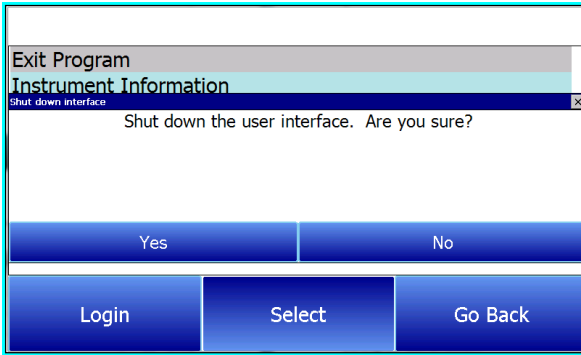
Once the date and time are changed, the system registry should be saved in order to ensure that any settings you changed are maintained when the touch screen is restarted or powered down and powered up again. To save the registry, follow these steps.

1. Click on the **Start** menu, and then select **Programs.** Determine whether an **Advantech** menu is present, such as the one shown in the figure below.
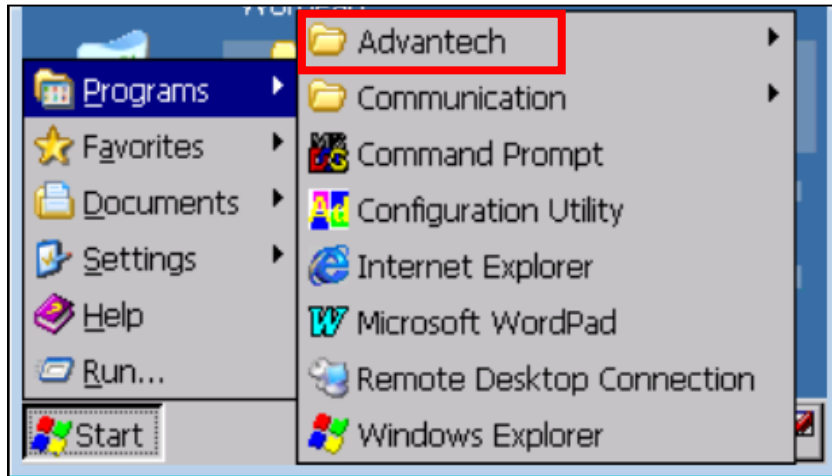
2. If an Advantech menu <u>IS</u> present: Select "Registry Saver" under the Advantech menu. A "SUCCESS" window similar to the one shown below should appear on the screen.

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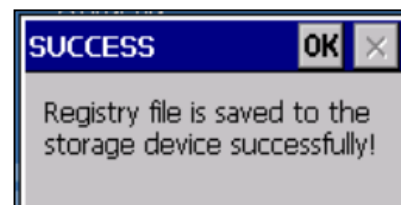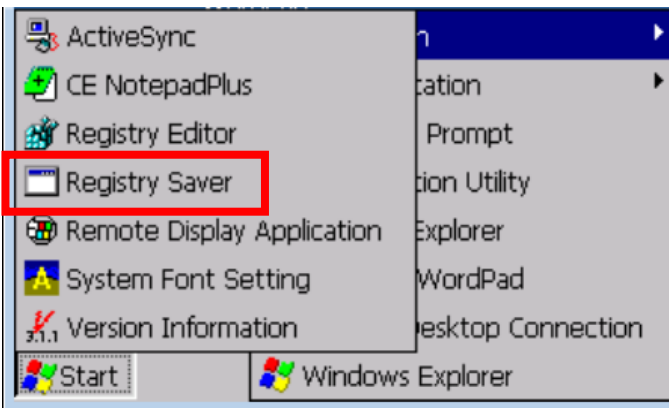
3. If an Advantech menu is <u>NOT</u> present: Open the "Run" dialog box by pressing the "Start" menu and selecting **Run**. In the dialog box, type *saveregs* and press **OK.** A "Registry Save complete" window similar to the one shown below should appear on the screen.
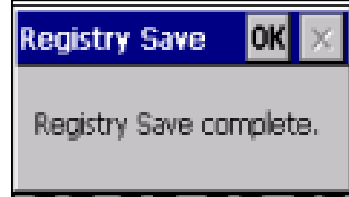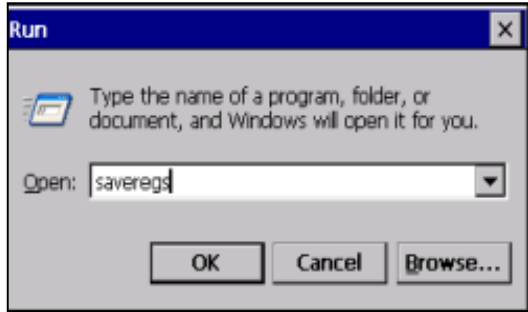
Spare Parts

The following items can be purchased as needed for the PH_2.

SSI P/N	DESCRIPTION
32012	Battery 12VDC
20624	H_2 Sensor
13550	Touch Screen Display
33018	Power Cord, AC
20634	Notepad, Universal portable instruments
36033	Flow scope, .2 to 2.0scfh
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 (40% H_2)
30054	Zero Gas Calibration Kit (including regulator)

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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.

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Revision History

Rev.	Description	Date	MCO #
-	Initial Release	2/1/2012	2093
A	Added information on Touch Screen Manager, modifying network settings, and changing system date and time	5/1/2013	2122
B	Revised specifications for hydrogen measurement.	9/23/2015	2167
C	Updated specifications	2-15-2022	2319

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