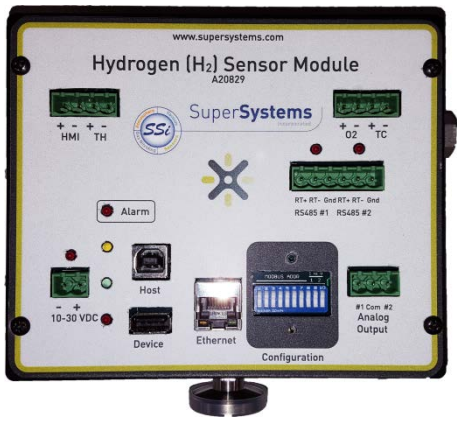
SuperSystems incorporated



PN: A20829

PN: A20830

Single Gas Sensor Modules

H_2 measurement with optional O_2 input

OPERATIONS MANUAL

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Table of Contents

Introduction

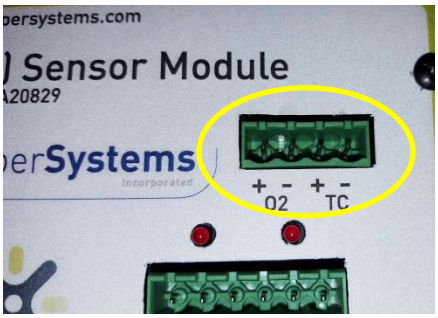
SSi provides single gas analysis technology for use in heat treating and other production environments. This manual covers the two H_2 versions of Single Gas Sensor Module (SGSM), SSi's compact single gas detection modules, which are preconfigured for use with a specific gas (see the Oxygen Measurement Option section below for details on O_2 detection).

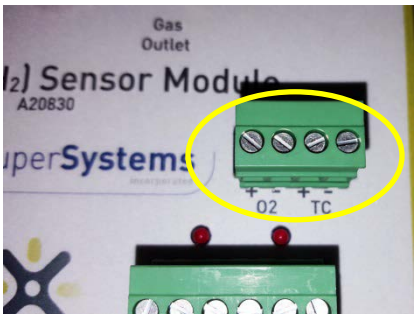
The in-situ H_2 sensor (A20829) is designed to mount directly to a vertical pipe on a furnace, while the flow-through sensor (A20830) contains an inlet and outlet, and is designed to be mounted on DIN rail.

An Ethernet-based web interface provides a broad range of control options. The SGSM also includes onboard datalogging and communications via serial connection, USB, or Ethernet.

Oxygen Measurement Option (with Additional Sensor)

The SGSM provides the option of O_2 detection and monitoring with the addition of an external O_2 sensor (PN 31435) wired into the unit in the locations pictured below:





Specifications

Specifications for gas measurement and SGSM operation are included below.

Gas Measurement Specifications

H_2 Sensors (A20829 and A20830)	
Range	0 – 100%
Accuracy	±0.1%
Resolution	±0.1%
Measurement Method	Thermal Conductivity
O_2 Sensor (PN 31435, Mounted Externally)	
Range	0 - 21%
Accuracy	±0.1%
Measurement Method	Lambda Zirconia

Single Gas Sensor Module (SGSM)

Response Time	0 - 6 seconds
Power Supply Input Voltage	10 - 30 VDC
Maximum Operating Temperature	122 °F (50 °C)

Analog Outputs	2 (4-20mA or 0-5 V)
Serial Communications	2 RS485 ports using Modbus RTU, configurable baud rate
Ethernet	1 port
USB	1 Type A port, 1 Type B port
Calibration	Field calibration via web interface

Connections Diagram

The following diagrams show the connections for the two versions of the SGSM.

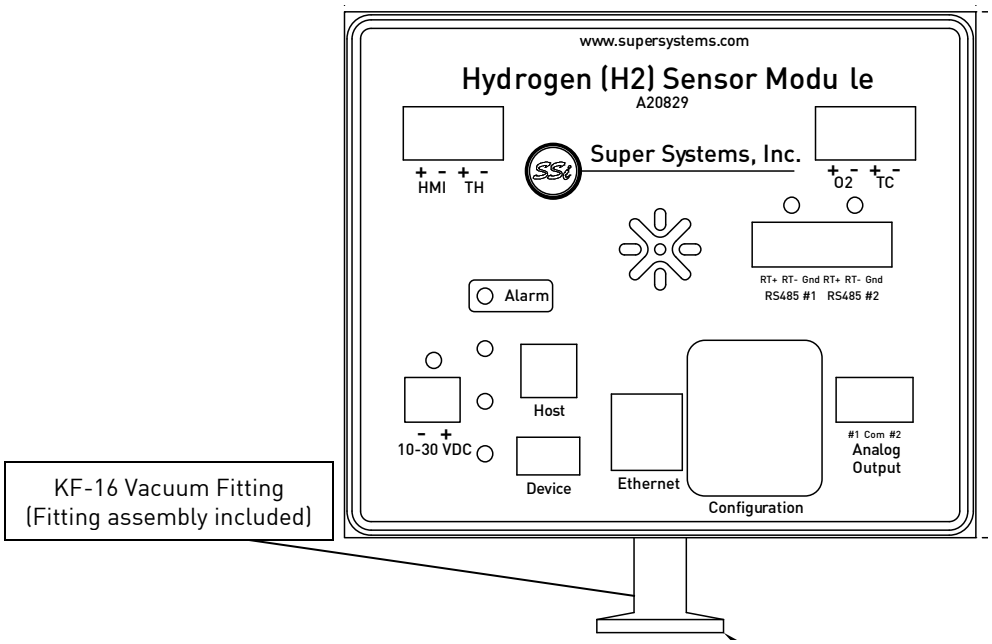


Figure 1 - Connections Diagram for A20829

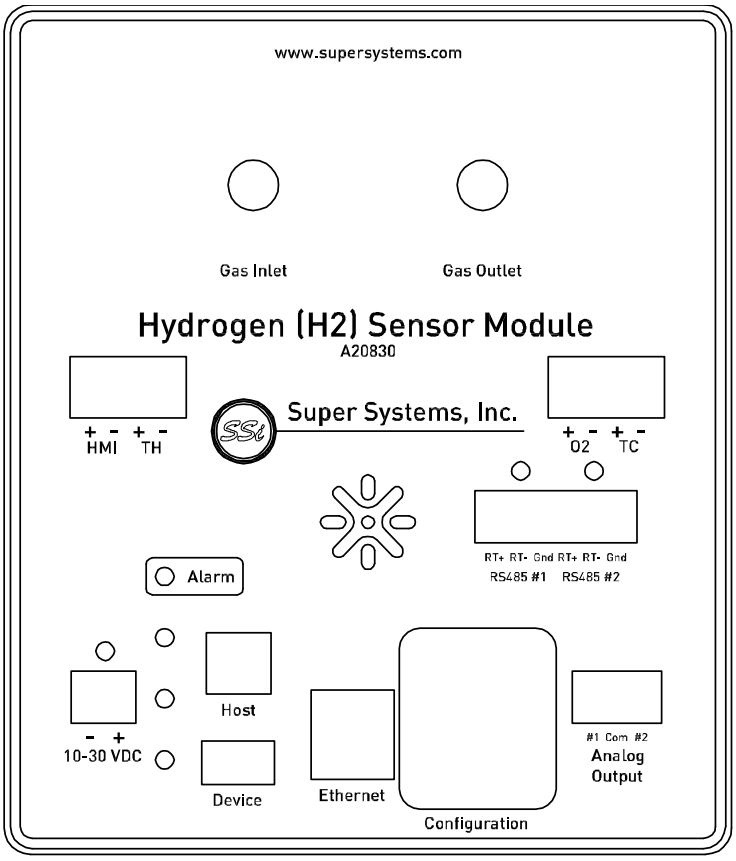


Figure 2 – Connections Diagram for A20830

Modbus Registers

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

Register Name	Register Location	Description
VERSION_NUMBER	0	current version number of the firmware
UART_1_MODE	1	0 = slave, 1 = Sensor Driver
UART_1_BAUD_RATE	2	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_2_MODE	3	0 = slave, 1 = Sensor Driver
UART_2_BAUD_RATE	4	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_3_MODE	5	0 = slave, 1 = Sensor Driver

Register Name	Register Location	Description
UART_3_BAUD_RATE	6	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_4_MODE	7	0 = slave, 1 = Sensor Driver
UART_4_BAUD_RATE	8	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_5_MODE	9	0 = slave, 1 = Sensor Driver
UART_5_BAUD_RATE	10	Baud Rate: 0=1200,...,5=19200,...10=115200.
PV_VARIABLE	11	Actual process variable.
BOARD_ADDR	14	Board modbus address (important for slave only)
MODEL_NUM	15	MODEL number Map as reg 900
SET_FACT_DEF	16	23205 = Full Defaults, 23206 = H_2 Defaults, 23207 = Loop 1 Defaults, 23208 = Loop 2 Defaults
DEGREE_REG	17	0 = °F, 1 = °C, 2 = °R, 3 = K
CUR_LOOP_CAL_REG	18	Calibration state. 0 = normal, 1 = prep zero, 2 = store zero, 3 = prep span, 4 = store span
CUR_LOOP_CAL_CHN	19	Calibration channel
CUR_LOOP_CAL_VAL	20	Cal value. 20.12 mA would be 20120
CUR_LOOP_TARGET_VALUE	22	Actual request value
CUR_LOOP_ZERO_TO_TWENTY	24	0-20 mA enable
CUR_LOOP_SOURCE	26	0 = H_2, 1 = DA, 2 = NH_3, 3 = K_N, 4 = External, 5 = Standard Kn, 6 = NDIR gas
CUR_LOOP_ZERO	28	Zero value. This value equates to either 4 mA or 0 mA
CUR_LOOP_SPAN	30	Span value. This value equates to either 20 mA
CUR_LOOP_MANUAL	32	If manual mode is set, then this register controls (0-20000)
INST_PV_MODE	34	0 = H_2, 1 = DA, 2 = NH_3, 3 = K_N, 4 = Standard Kn, 5 = NDIR single gas

Register Name	Register Location	Description
H2_SELECTION	36	0 = Single gas OEM, 1 = In-Situ Sensor
DISP_OPT	37	Display option bitmap: bit 0 = H_2, 1 = DA, 2 = NH_3, 3 = Super K_N, 4 = Standard K_N
SER_NUM_REG	444	actual mapping from Advantech
MB_SET_TIME_WRITE	506	1 = SNTP server write, 2 = manual write
MB_SET_TM_YEAR	507	set year
MB_SET_TM_MON	508	set month
MB_SET_TM_MDAY	509	set day of month
MB_SET_TM_WDAY	510	set day of week, 0 = Sunday
MB_SET_TM_HOUR	511	set hour
MB_SET_TM_MIN	512	set minute
MB_SET_TM_SEC	513	set second
MB_TM_YEAR	514	year
MB_TM_MON	515	month
MB_TM_MDAY	516	day of month
MB_TM_WDAY	517	day of week, 0 = Sunday
MB_TM_HOUR	518	hour
MB_TM_MIN	519	minute
MB_TM_SEC	520	second
MB_COMP_TIME_YEAR	580	compile year
MB_COMP_TIME_MON	581	compile month
MB_COMP_TIME_MDAY	582	compile day of month
MB_COMP_TIME_WDAY	583	compile day of week, 0 = Sunday
MB_COMP_TIME_HOUR	584	compile hour
MB_COMP_TIME_MIN	585	compile minute
MB_COMP_TIME_SEC	586	compile second
MODEL_NUM_OLD	900	MODEL number
RESET_FACT_DEFAULTS	909	Resets everything to factory settings

Register Name	Register Location	Description
MB_IP_ADDR	914	IP Address
MB_IP_MASK	918	Subnet Mask
MB_IP_GTWY	922	Gateway
SENSOR_COMM_STATUS_REG	1100	H_2O_2 comm status (0-16)
SENSOR_N2_FLOW	1101	N_2 flow
SENSOR_NH3_FLOW	1102	NH_3 flow
SENSOR_DA_FLOW	1103	DA flow
SENSOR_H2_FLOW	1104	H_2 Flow
SENSOR_PV_MODE	1105	Process variable (0 = H_2, 1 = DA, 2 = NH_3, 3 = Kn, 4 = Standard Kn)
SENSOR_INPUT_TYPE_REG	1106	Input for voltage inputs
SENSOR_MIN_H2	1108	minimum H_2 value
SENSOR_CO2_PRESENT	1109	concentration of CO_2 present. Important for H_2 measurement only
SENSOR_PV_REMOVE_NEGATIVE	1110	Makes any negative number zero
SENSOR_GEN_QUEUE_ENABLE	1150	Allows for a generic write
SENSOR_GEN_QUEUE_START	1151	Start of write. E.g., register 45.
SENSOR_GEN_QUEUE_ADDRESS	1152	Address of board to write to.
SENSOR_GEN_QUEUE_NUM_WORDS	1153	Number of words to write down up. Up to 30
SENSOR_GEN_QUEUE_BLOCK	1154	write up to 30 words
SENSOR_READ_REGISTERS	1200	just designates where to start writing
MB_READ_VERSION_NUMBER	1200	current version number of the firmware
MB_READ_PELLISTOR_AVDD	1201	A/D analog voltage supply
MB_READ_PELLISTOR_EXCV	1202	Pellistor bridge excitation voltage
MB_READ_PELLISTOR_VDC	1203	Pellistor voltage
MB_READ_PELLISTOR_NA	1204	Pellistor Normalized Absorbance
MB_READ_PERC_H2	1205	H_2 x 10000

Register Name	Register Location	Description
MB_READ_PER_H2_MANT	1206	H_2 mantissa
MB_READ_PER_H2_EXP	1207	H_2 exponent
MB_READ_PER_DA	1208	DA value
MB_READ_PER_NH3	1209	NH_3 value
MB_READ_PER_SUPER_KN	1210	Super Kn
MB_READ_STANDARD_KN	1211	Standard K_N
MB_READ_PROC_VAR	1212	Process variable
MB_READ_GAS_TEMP	1213	Gas temperature
MB_READ_BOARD_ADDR	1214	Board modbus address (important for slave only)
MB_READ_MODEL_NUM	1215	MODEL number Map as reg 900
MB_READ_SET_FACT_DEF	1216	23205 = Full Defaults
MB_READ_DEGREE_REG	1217	Sets the unit used to display temperature.
MB_READ_N2_FLOW	1218	N_2 flow
MB_READ_NH3_FLOW	1219	NH_3 flow
MB_READ_DA_FLOW	1220	DA flow
MB_READ_H2_FLOW	1221	H_2 Flow
MB_READ_PV_MODE	1222	Process variable (0 = H_2, 1 = DA, 2 = NH_3, 3 = Kn, 4 = Standard Kn)
MB_READ_INPUT_TYPE_REG	1223	Input for voltage inputs
MB_READ_MIN_H2	1225	minimum H_2 value
MB_READ_CO2_PRESENT	1226	Amount of CO_2 present up to 10%.
MB_READ_PV_REMOVE_NEG	1227	Remove negative number
MB_READ_SET_TAPS_REG	1228	Sets the digital trim pot
MB_READ_UART_1_BAUD_RATE	1229	Baud Rate: 0=1200,...,5=19200,...10=115200.
MB_READ_UART_2_BAUD_RATE	1230	Baud Rate: 0=1200,...,5=19200,...10=115200.
MB_READ_PV_FP	1231	Process variable in floating point
MB_READ_PELLISTOR_DIAG	1233	Pellistor Diagnostics

Register Name	Register Location	Description
MB_READ_AMBIENT_TEMP	1234	Ambient temperature
MB_READ_CJ_TEMP_REG	1235	Cold junction temperature
MB_READ_AD_RAW_VDC	1237	Raw VDC
MB_READ_GAIN_REG	1239	Gain
MB_READ_AD_SCALED_VDC	1241	Scaled VDC
MB_READ_TC_PROC_VAR	1243	TC process variable
MB_READ_PERC_O2	1245	Based on Nernst equation
MB_READ_PERC_O_DP	1246	decimal point for O2
MB_READ_PERC_O2_FP	1247	floating point value for O2 (w registers)
MB_READ_LAMBDA_TEMP	1249	Typically 800F
MB_READ_LAMBDA_CNV_MV_EN	1250	Convert mV to probe mV
MB_READ_AMB_PRESSURE_REG	1251	Ambient pressure (absolute)
MB_READ_GAS_PRESSURE_REG	1252	Gas pressure (absolute)
MB_READ_NDIR_GAS_SELECTION	1253	[0-7]. TBD
MB_READ_NDIR_GAS_VPP	1254	Peak-peak voltages
MB_READ_NDIR_GAS_VPP_SF	1258	Peak-peak voltages. No high/low values
MB_READ_NDIR_GAS_VPP_FIR	1262	Peak-peak voltages FIR filtered
MB_READ_NDIR_GAS_NA	1266	Gas Normalized absorbance
MB_READ_NDIR_GAS_NA_TC	1269	Gas Normalized absorbance, temperature compensated
MB_READ_NDIR_GAS_CONC	1272	Gas concentration
MB_READ_NDIR_GAS_CONC_DP	1275	Gas concentration decimal point
MB_READ_NDIR_GAS_CONC_FP	1278	Gas concentration floating point
MB_READ_CAL_ENABLE_REG	1284	enables a calibration
MB_READ_CAL_REQUEST_REG	1285	CJ cal or zero/span voltage cal
MB_READ_CAL_RANGE_REG	1286	Calibration Range register. Sets the voltage gain for a calibration.
MB_READ_CAL_CHANNELS_REG	1287	bitmap of channels to be calibrated

Register Name	Register Location	Description
MB_READ_CAL_VALUE_REG	1288	Calibration value
MB_READ_CAL_TIMER_REG	1293	First of 5 calibration timers
MB_READ_CAL_PROGRESS_REG	1294	0 = no calibration, 1 = calibration in progress
MB_READ_CAL_ERROR_REG	1295	First of 5 calibration error calculations
MB_DIGIO_OUTPUT_SET	1600	Bitmap that sets the output of a digital I/O card
MB_DIGIO_COMM_STATUS_REG	1601	Communication status for digital I/O card
MB_DIGIO_VERSION_NUMBER	1610	current version number of the firmware
MB_DIGIO_UART_1_MODE	1611	Determines mode: modbus slave = 0, modbus master = 1
MB_DIGIO_UART_1_BAUD_RATE	1612	Baud Rate.
MB_DIGIO_UART_2_MODE	1613	Determines mode: modbus slave = 0, modbus master = 1
MB_DIGIO_UART_2_BAUD_RATE	1614	Baud Rate.
MB_DIGIO_BOARD_ADDR	1615	Board modbus address (important for slave only)
MB_DIGIO_MODEL_NUM	1616	MODEL number Map as reg 900
MB_DIGIO_RESET_FACT_DEFAULTS	1618	SFD 23205 sets factory defaults Map as reg 909
MB_DIGIO_UART_3_MODE	1619	Determines mode: modbus slave = 0, modbus master = 1
MB_DIGIO_UART_3_BAUD_RATE	1620	Baud Rate. 0=1200 ,..., 10=115200
MB_DIGIO_SER_NUM_0	1621	Start of Serial number
MB_DIGIO_SER_NUM_1	1622	serial number 1
MB_DIGIO_SER_NUM_2	1623	serial number 2
MB_DIGIO_SER_NUM_3	1624	serial number 3
MB_DIGIO_SER_NUM_4	1625	serial number 4
MB_DIGIO_SER_NUM_5	1626	serial number 5
MB_DIGIO_SER_NUM_6	1627	serial number 6

Register Name	Register Location	Description
MB_DIGIO_SER_NUM_7	1628	serial number 7
MB_DIGIO_SER_NUM_8	1629	serial number 8
MB_DIGIO_SER_NUM_9	1630	serial number 9
MB_DIGIO_EVENT_IN_CP	1636	Copy of Event Input
MB_DIGIO_EVENT_OUT_ACT_CP	1637	Actual Output
MB_DIGIO_EVENT_OUT_SP_CP	1638	Copy of Output setpoint
SENSOR_SUB_SERIAL_NUM	1700	serial number of sensor board

Initial Network Configuration

This section is intended for use by persons familiar with Ethernet network setup.

In order to work correctly, the unit must be properly configured for the network to which it is connected. To locate the unit's IP address, first connect the unit to an Ethernet network using the appropriate cable.

If you already know the IP address of the web interface, skip to the Network Configuration section on page 21. The network configuration is described in this section.

If the unit is connected to a network that assigns IP addresses dynamically, it will acquire an IP address that is available. If it cannot acquire an IP address, it will use a default IP address of 192.168.1.200. If the unit is using the default IP address, that IP address can be used to access the web interface (for more information on the web interface, refer to the Control Interface via Web Browser section on page 14.

The IP address of the unit can be found by using SSi's *nLocateIP* software. This method is described in the following subsection.

nLocateIP Method

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

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

Figure 1 - Opening nLocateIP program

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

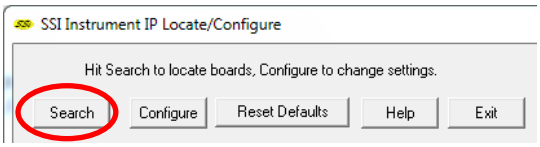


Figure 2 - Search button in nLocateIP

4. Look for identifying text in the list of instruments. The corresponding IP address is the IP address that you will want to use.

Once you have found the IP address, you should be able to complete any additional network configuration using the web interface. See the Network Configuration section on page 21.

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

Control Interface via Web Browser

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

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

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

Main

The main page displays the percentage composition of the gas for which the SGSM is configured. In the example below, the percentage composition of H_2 is displayed.

Figure 3 - Main Page (with H_2 Percentage Shown)

Instrument Information

The Instrument Information page provides a description of the SGSM, the part number, the serial number of the main board, the sub-serial number of the sensor board, the main board version number, and sensor board version number.

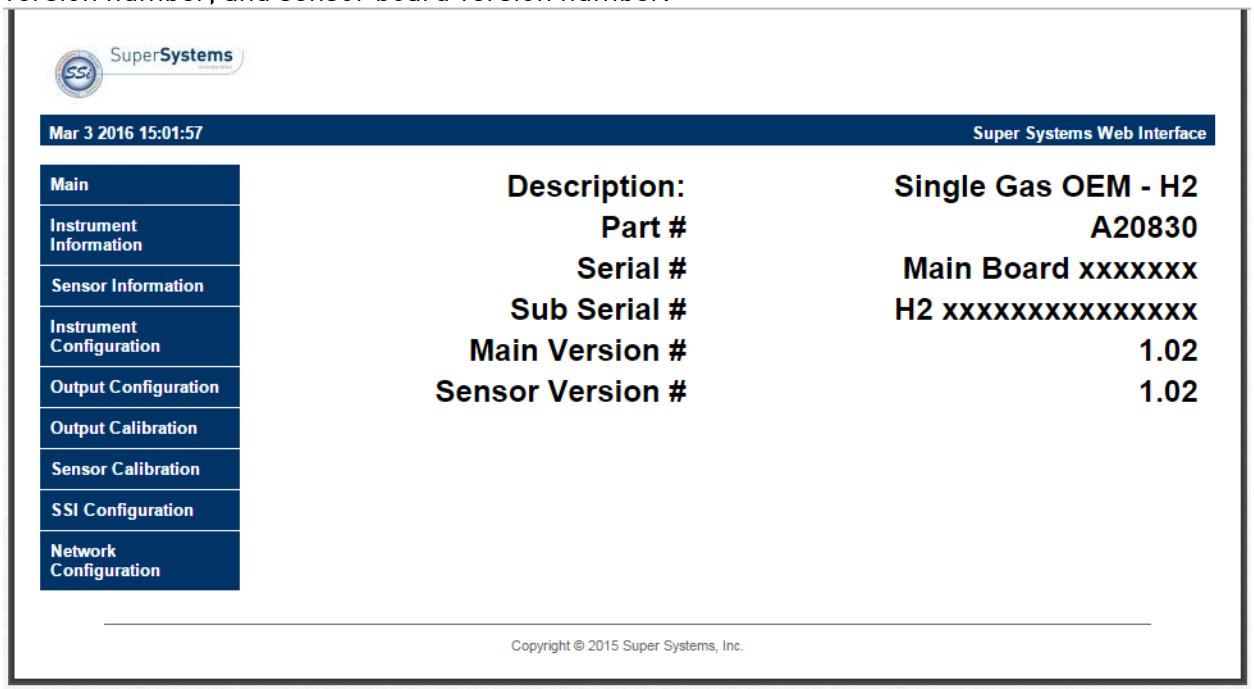


Figure 4 - Instrument Information Page

Sensor Information

The Sensor Information page displays information on the following:

- AVdd: This value is the supply voltage for the analog to digital converter that measures the pellistor voltage. This value is typically about 5V.
- Excitation Vdd: This value is the voltage seen across the pellistor bridge. This value should be approximately 0.9V.
- Pellistor Vdd: This value is the voltage present across the sensing pellistor. This voltage, in air, should be approximately half the excitation voltage.

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

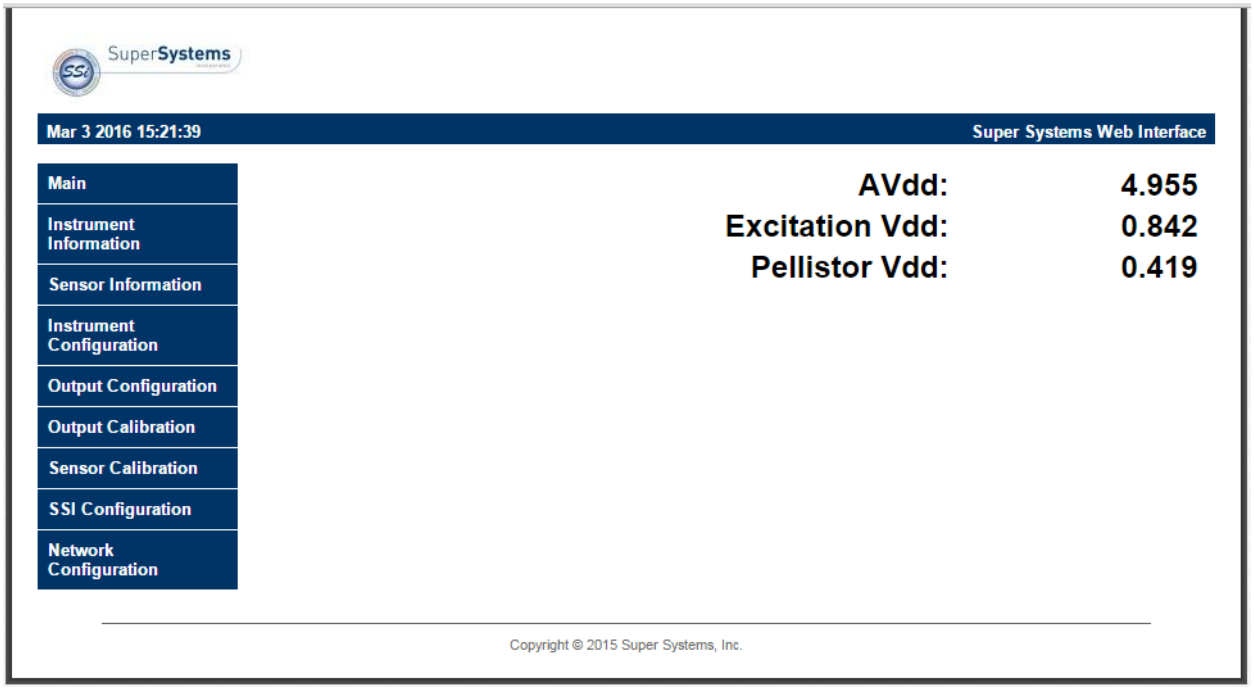


Figure 5 - Sensor Information Page

Instrument Configuration

The only option on this page that applies to the SGSM is RTCC.

- RTCC: This option, when pressed, will sync the current time of the main board to the computer on which the web interface is running.

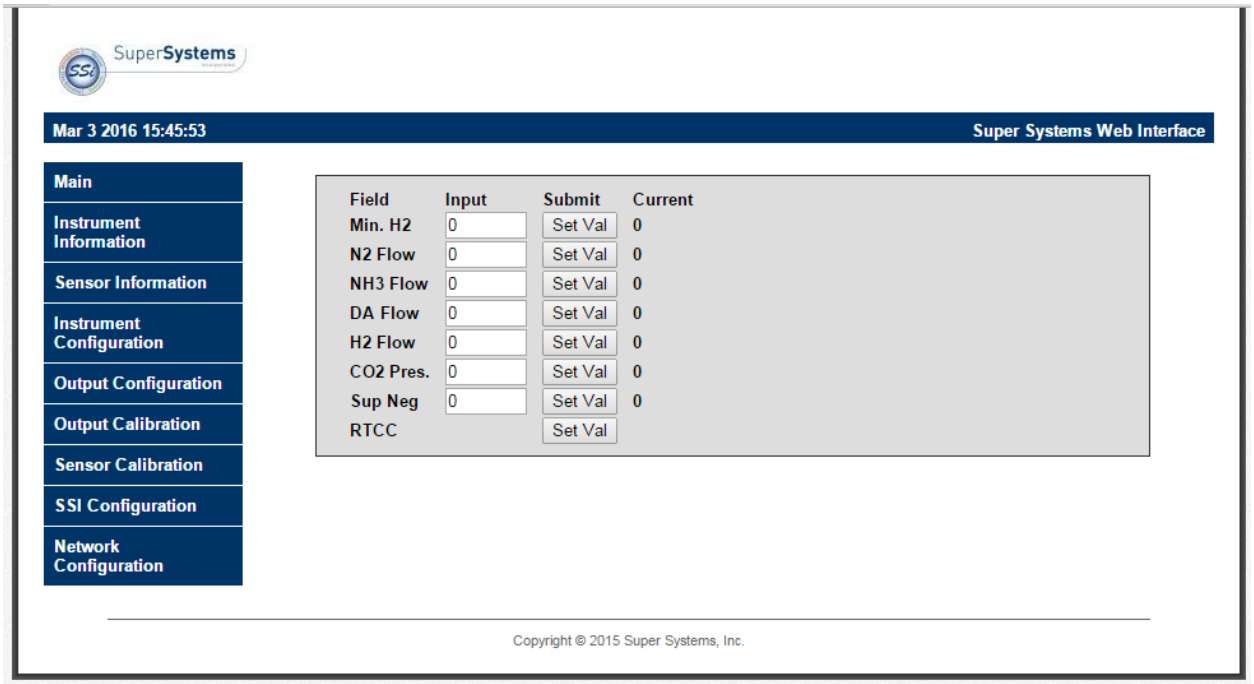


Figure 6 - Instrument Configuration Page

Output Configuration

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

For each loop, the following parameters can be adjusted:

- Source: A selected source: H_2, DA, NH_3, K_N, External, or Standard K_N.
- Zero (%): The % output at the lowest end of the applicable range.
- Span (%): The % output at the highest end of the applicable range.
- Range: The output mode: 4-20 mA or 0-20 mA.
- Manual (%): A %Output entered manually.

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

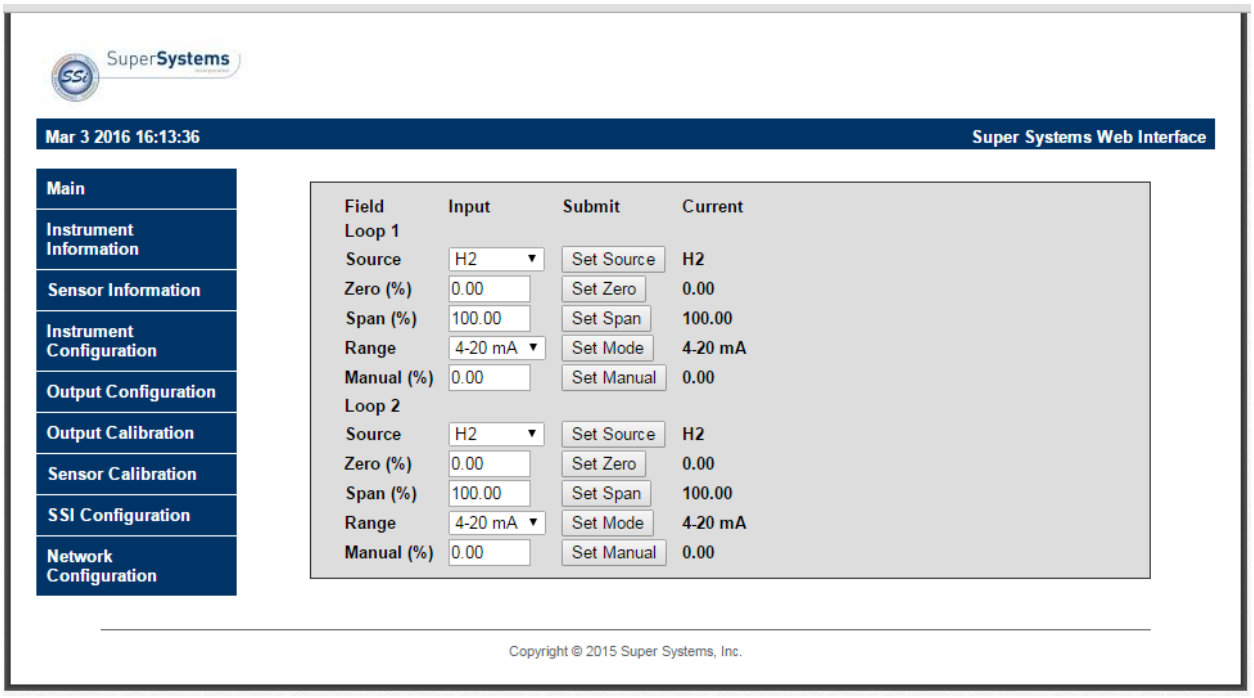


Figure 7 - Output Configuration Page

Output Calibration

The SGSM is equipped with two analog outputs. These outputs require calibration to ensure that the mA signal corresponds to a given output value (zero value for the lowest value and span value for the highest value). SSi recommends output calibration be performed on each output at least once per year, or as needed.

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

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

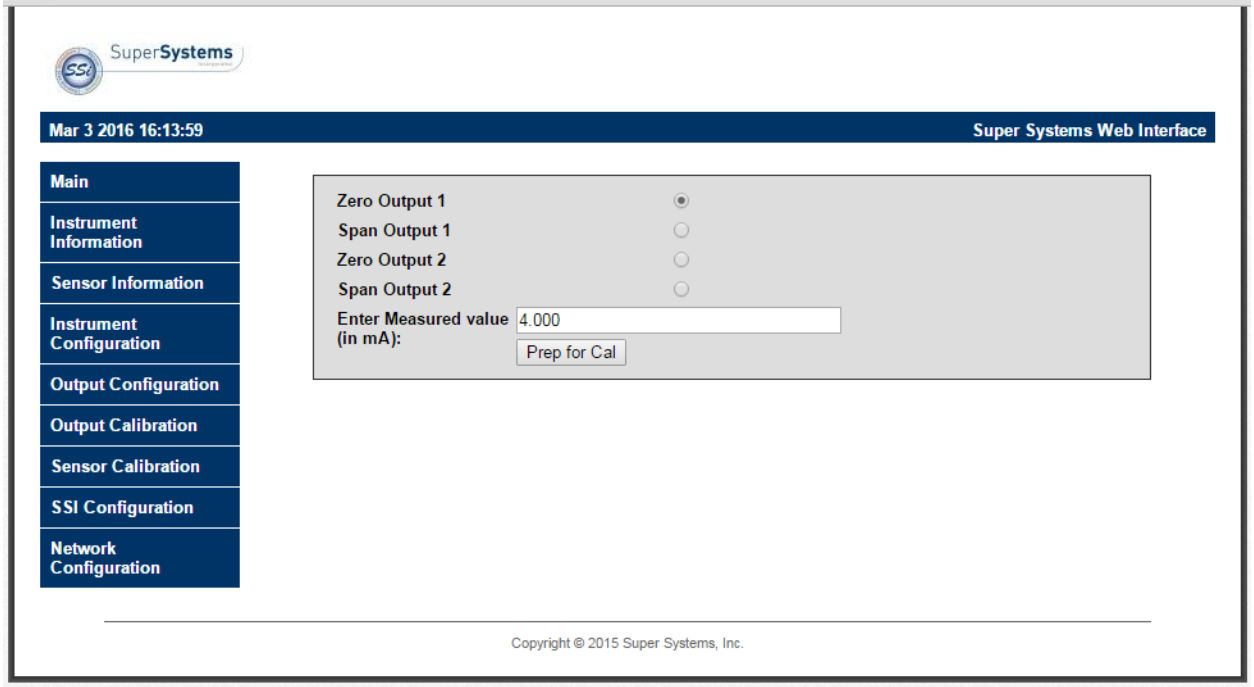


Figure 8 - Output Calibration Page

Sensor Calibration

To ensure accurate readings, the gas sensor must be calibrated at the low end and high end of the measured gas composition range. SSi recommends calibration be performed at least once per year, or as needed.

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

1. Note the percentages of the sensor gas in each gas source (zero and span).
2. Ensure that the system is purged of any latent gas.
3. Flow the zero gas. Wait two minutes, and then enter the target gas concentration in the "Enter gas concentration" field.
4. Press "Calibrate". A Calibration Timer will count down.
5. Once the Calibration Timer has counted down, the zero value will be calibrated.

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

6. Ensure that the system is purged of any latent gas.
7. Flow the span gas. Wait two minutes, and then enter the target gas concentration in the "Enter gas concentration" field.
8. Press "Calibrate". A Calibration Timer will count down.
9. Once the Calibration Timer has counted down, the span value will be calibrated.

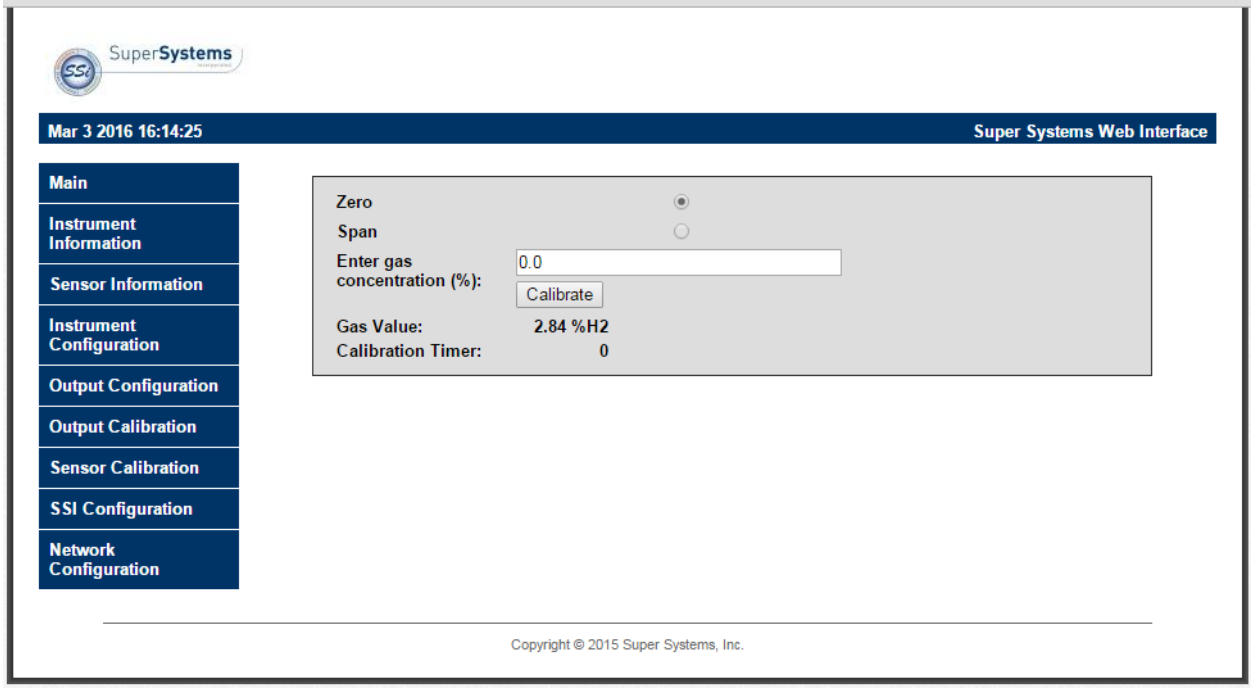


Figure 9 - Sensor Calibration Page

SSI Configuration

IMPORTANT!

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

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

- Main Serial: The serial number of the main board.
- Sub Serial: The serial number of the sensor board.
- En. Card: Enable Card. This option allows a digital I/O card to be added.
- Relay Input: This option allows a value to be written to enable relays. Possible values are 0 to 255, and they are binary values corresponding to one of the eight relays.
- Set FD: This option resets the sensor board to factory defaults.
- Set Reg: This option allows a value to be written to the main board. The first value is the
- H2 Sel.: This is a setting that should not be changed except in the factory.

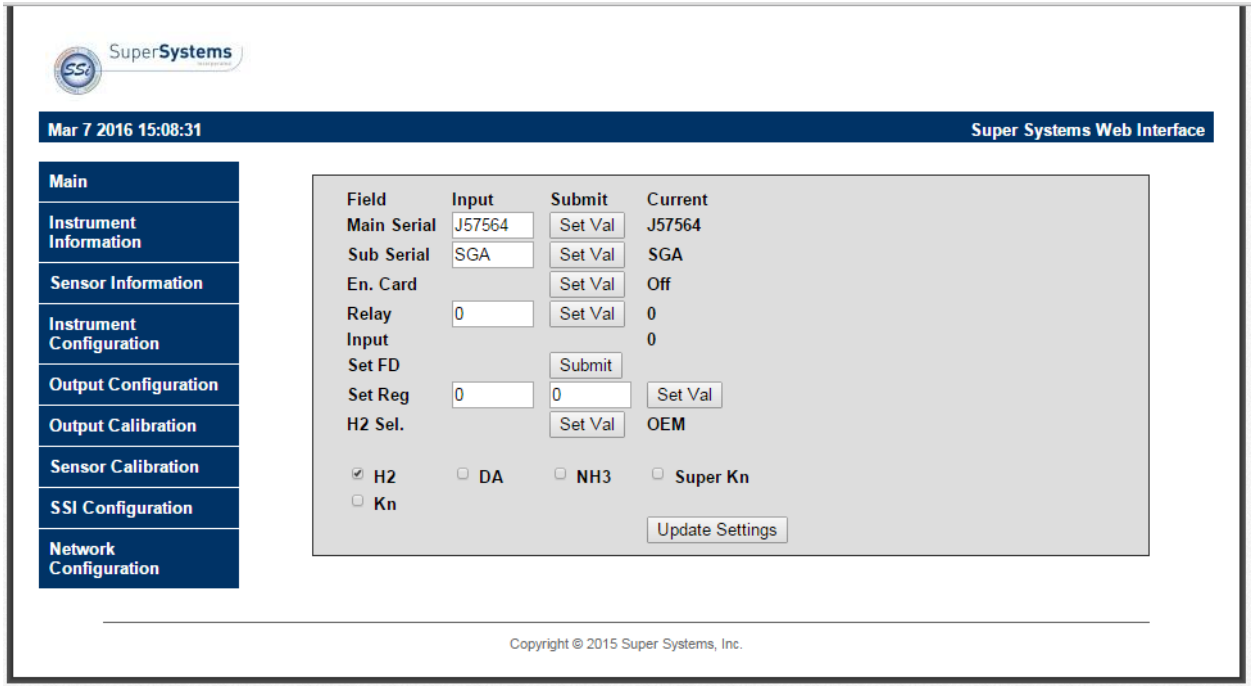


Figure 10 - SSI Configuration Page

Network Configuration

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

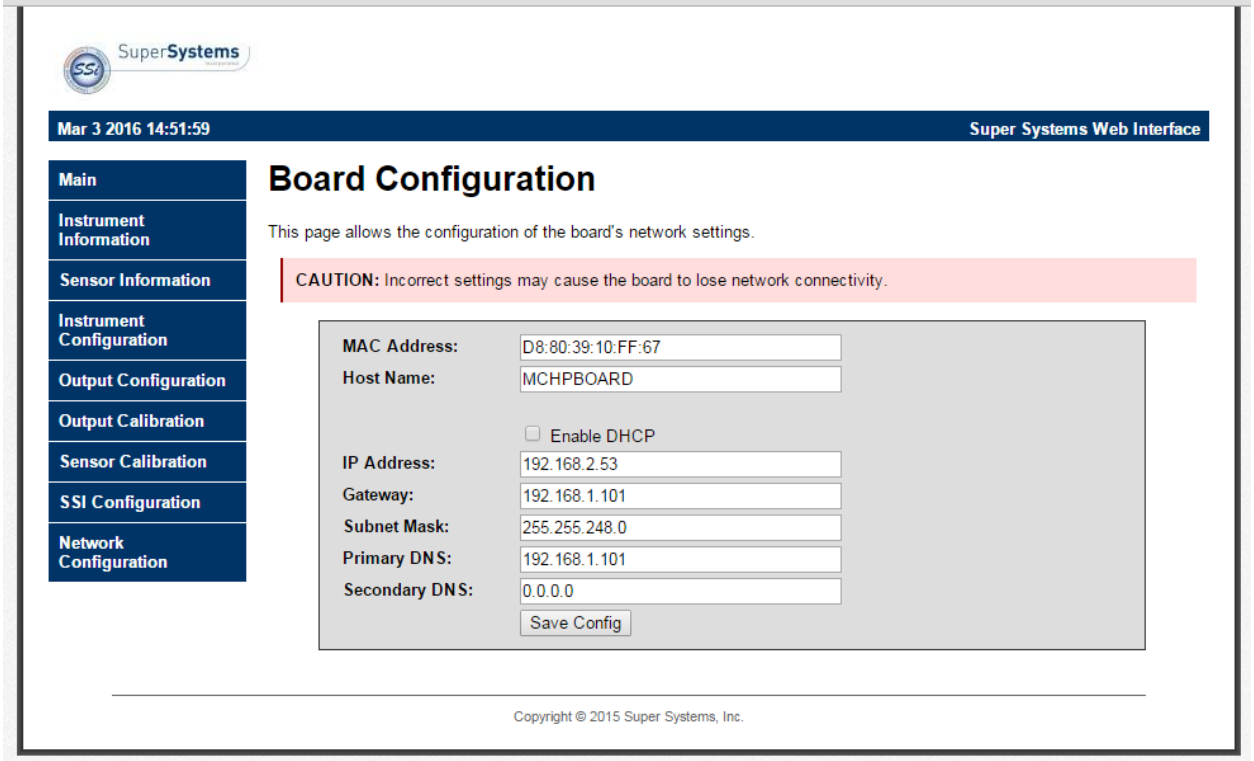


Figure 11 - Network/Board Configuration Page

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

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

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

Replacement Parts

Part	Part Number
Fitting, KF-16 Adapter, 1/8 Female NPT	34699
Fitting, KF-16 Adapter, Clamp Assembly	34700
Terminal Block, 2-Position	33312
Terminal Block, 6-Position	33305
Terminal Block. 4-Position	33353
Terminal Block, 3-Position	33310

Part	Part Number
Sensors	
Hydrogen Sensor, In-Situ	A20829
Hydrogen Sensor, Flow-through	A20830
Oxygen Sensor, 4-Wire Analog	31435
Oxygen Sensor Interface	13672-O2

Warranty

Limited Warranty for Super Systems Products:

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

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

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

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

Revision History

Rev.	Description	Date	MCO #
New	Initial release	10/4/2016	2196