SuperSystems
incorporated

PN: A20829

PN: A20830

Single Gas H_2 (Hydrogen) Sensor Modules

With Optional O_2 Input

OPERATIONS MANUAL

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Introduction

SSi provides hydrogen gas analysis technology for use in heat treating and other industrial environments. This manual covers the two H_2versions of Single Gas Sensor Module (SGSM). 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) is designed to be mounted on DIN rail. For compliance with electrical connection standards, the in-situ H_2 sensor functions are routed to a 10-Position plug and an included connection cable. The connections for the DIN mounted flow-through sensor are on terminal blocks located on the face of the sensor.

The primary function of each of these sensors is to measure H_2, but each of them has the ability to measure Oxygen (O_2) with the addition of an external O_2 sensor (see details below). Note that the Lambda O_2 sensor requires 12 VDC power.

Specifications

Specifications	In-Situ H2	Din Rail Mount H2
Part Number	A20829	A20830
24VDC (10-30VDC Acceptable) Power Input	Yes	Yes
Analog Outputs (4-20mA or 0-5VDC)	2	2
Ethernet	1	1
USB Host port	0	1
USB Client port	0	1
RS485 Communications Ports (modbus RTU)	1	2
Communications Port for HMI	0	1
Wiring Method	Cable (included)	Direct
Inputs for Optional Oxygen Sensor	Yes	Yes
Measurement Range	0 – 100% of gas concentration	
Accuracy	±1% of full scale (±0.1% of gas concentration, based on 100%)	
Resolution	0.1%	
Response Time (to 90% of Reading)	0 - 6 seconds	
Maximum Operating Temperature	122 °F (50 °C)	
Field Calibration	Via web interface	
Measurement Method	Thermal Conductivity	

Specifications	Optional Oxygen Sensor
Part Number	31435
Measurement Range	0 - 21%
Accuracy	±0.1%
Measurement Method	Lambda Zirconia

Connections Diagram

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

A20829

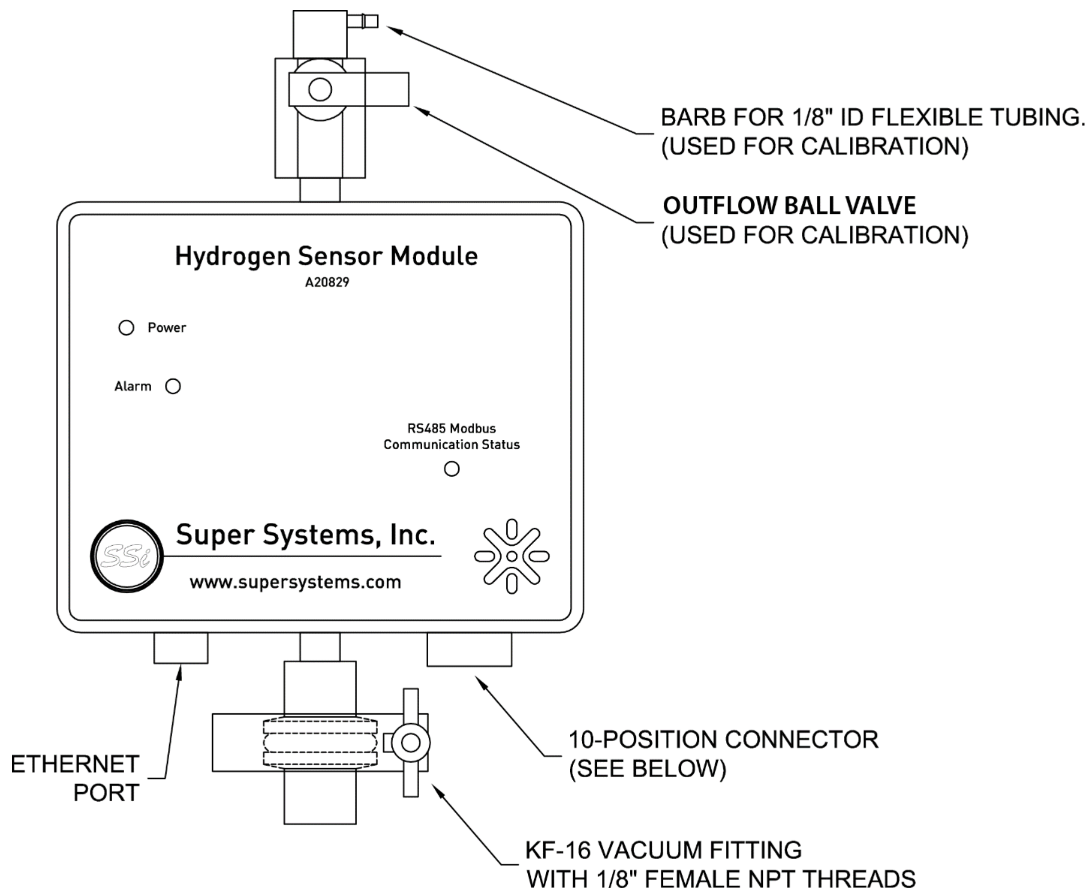
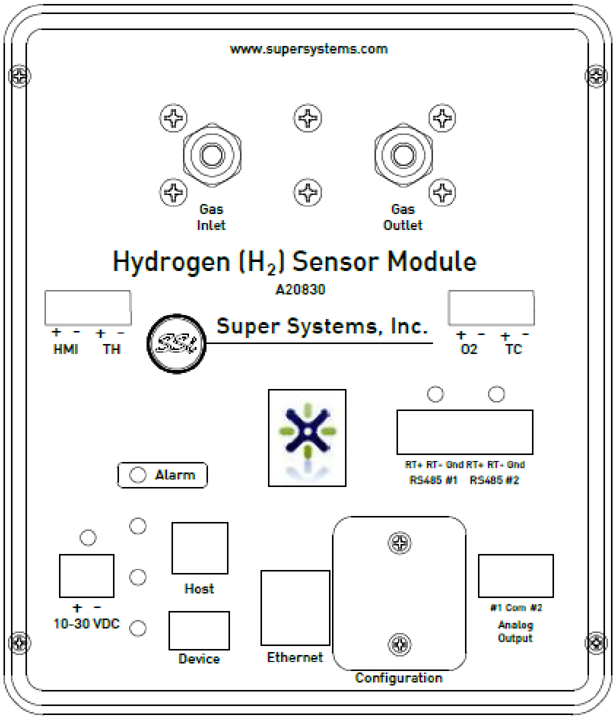


Figure 1 - Connections diagram for A20829

Wire Color	Function	
Red	+VDC	Power supply (24VDC @ 750 mA)**
Black	-VDC	
Green/Black Stripe	+RS485	Communications signal
Red/Black Stripe	-RS485	provided by modbus over serial
White/Black Stripe	+O2	O2 input for lambda probe
Orange/Black Strip	-O2	when used as H2/O2 sensor
Orange	+ mA	Analog output #1
Blue	- mA	(4-20 mA)
Green	+ mA	Analog Output #2
White	- mA	(4-20 mA)

A20830



All connection points are located on the front of the unit and labeled with the connection type and polarity.

Figure 2 - Connections diagram for A20830

**Note that both the A20829 and A20830 will accept 10 – 30 VDC power. They are commonly powered using a 24 VDC supply. When a Lambda O_2 sensor is required, consider using a 12 VDC supply for both the SGSM and the Lambda sensor. SSi offers a 12 VDC supply for this option.

Connection Ports & Function

HMI: This is the connection for an HMI.
TH: This connection port is N/A for this product.
O2: This is the port for the Lambda O_2 analog sensor.
TC: This connection port is N/A for this product.
RS485 #1: This is a communications port used for when this device is the Client.
RS485 #2: This is a communications port used for when this device is the Host to another device.
10-30 VDC: This is the port to supply power to the SGSM.
Host: This is the USB Host port.
Device: This is the USB Client port.
Ethernet: This is the Ethernet port.
Configuration: This is where dip switch settings can be changed for the Modbus communications address.
Analog Output: These ports are for analog output #1 and #2.

Mounting

<u>A20829</u>

SSi recommends that the in-situ H_2 sensor (A20829) be mounted to the exhaust piping as close to the furnace as possible. Many contaminants solidify when cooled and can cause irreversible damage to the sensor over time. Heat from the gases will help to prevent the formation of contaminants in the sensor.

The unit should be mounted right side up so that the lettering on the front of the unit can be read. The length of pipe between the main exhaust and the bottom of the KF fittings should be minimized and must be *less than 2"* or the unit's response and accuracy may be negatively affected. The best location on the exhaust piping is at an elbow where the exhaust line might be vertically plumbed out of the furnace lid. See illustrations.

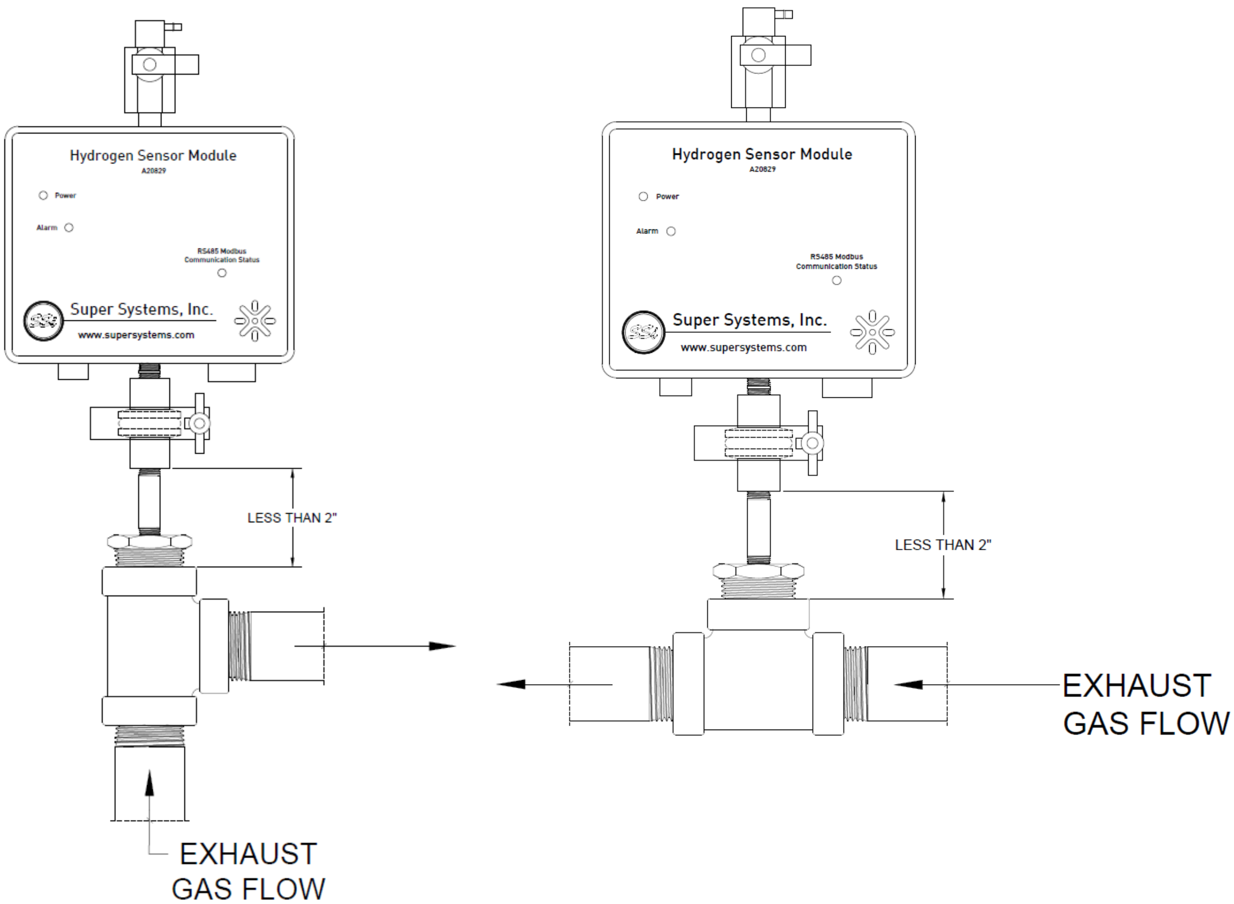


Figure 3–Mounting/Plumbingdiagram for A20829

Other mounting locations are possible, but must be tested and verified prior to using for measurement and control of the furnace atmosphere. Contact SSi if there are questions about the mounting location.

A20830

The flow-through sensor (A20830) requires gas flow past the sensor. The unit has specific inlet and outlet ports, which are labeled on the unit and shown in the figure below.

The unit comes with 1/8" FNPT threaded ports in which two stainless steel compression fittings have been plumbed. The compression fittings are sized to handle ¼" OD tubing.

This unit is designed to be mounted to 35 mm DIN rail.

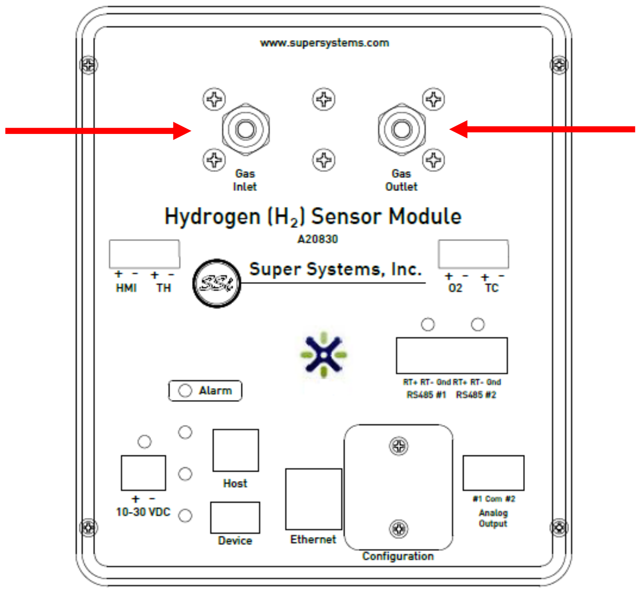


Figure 4 – Connections diagram for A20830

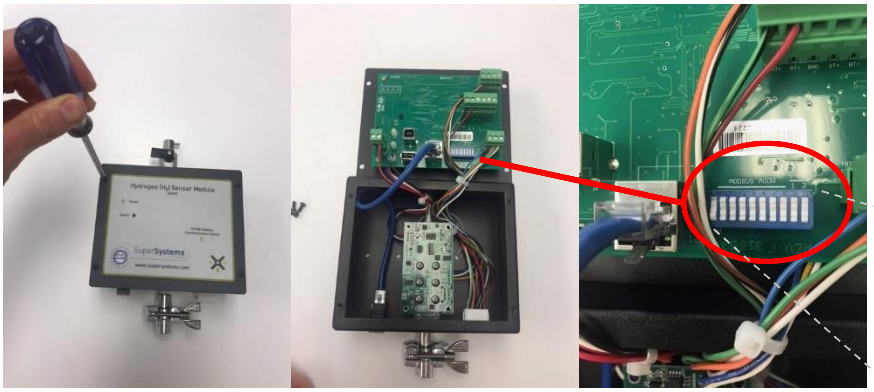
Modbus

A20829

The in-situ H_2 sensor has DIP switches located inside of the enclosure for setting the Modbus address. The Modbus address is set to 1 by default. Photos below show where the DIP switches are located inside of the enclosure. The DIP switch settings for each address are given in Appendix A.

To gain access to the DIP switches:

1. Verify that the unit is not powered. Unplug the power connector to remove power.
2. Remove the four (4) 6-32 screws to remove the front cover plate.
3. Carefully, pull the cover plate off of the enclosure. The cover plate has a circuit board attached to it, which is connected to the enclosure via several wires. Be careful not to damage the wires or circuit boards.
4. The DIP switches are located on the circuit board mounted to the back of the cover plate.
5. Move the DIP switches accordingly for the Modbus address listed in Appendix A.
6. When reassembling the unit, be careful of wire locations. Some wires may need to be positioned to the side or behind circuit boards in the enclosure in order to get the cover plate on the enclosure properly.



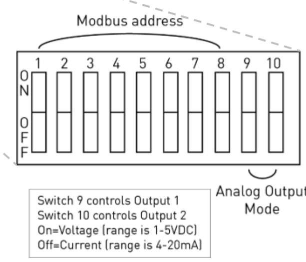
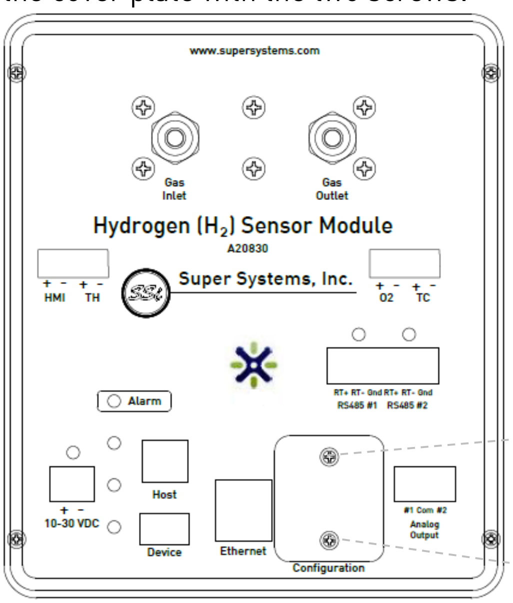


Figure 5 – Modbus DIP switch location for A20829

<u>A20830</u>

The DIP switches are accessible from the front of the unit without having to remove the cover plate.

1. Verify that the unit is not powered. Unplug the power connector to remove power.
2. Remove the two (2) 6-32 screws from the access plate labeled, "Configuration." This will expose the DIP switches.
3. Move the DIP switches accordingly for the Modbus address listed in Appendix A.
4. Secure the cover plate with the two screws.



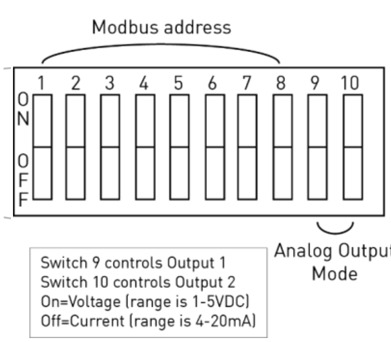


Figure 6–Modbus DIP switch location for A20830

Modbus Registers

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

NOTE: The gas percentage (multiplied by 10000) is located in register 1205.

Register Name	Register Location	Description
VERSION_NUMBER	0	current version number of the firmware
UART_1_MODE	1	0 = slave, 1 = Sensor Driver
VERSION_NUMBER	0	Current version number of the firmware
UART_1_MODE	1	0 = slave, 1 = Sensor Driver
UART_1_BAUD_RATE	2	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_2_MODE	3	0 = slave, 1 = Sensor Driver
UART_2_BAUD_RATE	4	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_3_MODE	5	0 = slave, 1 = Sensor Driver
UART_3_BAUD_RATE	6	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_4_MODE	7	0 = slave, 1 = Sensor Driver
UART_4_BAUD_RATE	8	Baud Rate: 0=1200,...,5=19200,...10=115200.
UART_5_MODE	9	0 = slave, 1 = Sensor Driver
UART_5_BAUD_RATE	10	Baud Rate: 0=1200,...,5=19200,...10=115200.
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 = H2 Defaults, 23207 = Loop 1 Defaults, 23208 = Loop 2 Defaults
DEGREE_REG	17	0 = °F, 1 = °C, 2 = °R, 3 = K

Register Name	Register Location	Description
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 = H2, 1 = DA, 2 = NH3, 3 = KN, 4 = External, 5 = Standard Kn, 6 = NDIR gas
CUR_LOOP_ZERO	28	Zero value. This value equates to either 4 mA or 0 mA
CUR_LOOP_SPAN	30	Span value. This value equates to either 20 mA
CUR_LOOP_MANUAL	32	If manual mode is set, then this register controls (0-20000)
INST_PV_MODE	34	0 = H2, 1 = DA, 2 = NH3, 3 = KN, 4 = Standard Kn, 5 = NDIR single gas
H2_SELECTION	36	0 = Single gas OEM, 1 = In-Situ Sensor
DISP_OPT	37	Display option bitmap: bit 0 = H2, 1 = DA, 2 = NH3, 3 = Super KN, 4 = Standard KN
EEPROM_WRITER_COUNT	38	Counts how many times the EEPROM has been written
CUR_LOOP_OUTPUT_CNTS	39	Counts being output for each current loop.
MB_LO_ALARM_BITMAP	96	First of two words containing the low threshold alarm bit map
MB_HI_ALARM_BITMAP	98	First of two words containing the high threshold alarm bit map
MB_ALARM_1_LOWER_LIMIT	100	Lower Limit for a given type (first of 30)

Register Name	Register Location	Description
MB_ALARM_1_UPPER_LIMIT	130	Upper Limit for a given type (first of 30)
MB_ALARM_1_ACTION	160	Action for a given type (first of 30)
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_TM_LEAP	521	1 = leap year, 0 = otherwise
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
WEBPAGE_ACCESS_CODE	910	Settable register that allows access to the webpages
SECOND_TIMER_VALUE	911	First of two bytes, memcpy'd 32 bit unsigned integer that increments every second forever
MB_IP_ADDR	914	IP Address
MB_IP_MASK	918	Subnet Mask
MB_IP_GTWY	922	Gateway
0	930	Max Round robin time (ms)
RESET_ROUND_ROBIN	931	Resets the round robin time
SENSOR_APP_RR_TIME	932	Round robin time (ms)
SENSOR_APP_RR_TIME_MAX	933	Max Round robin time (ms)
DIGIO_RR_TIME	934	Round robin time (ms)
DIGIO_RR_TIME_MAX	935	Max Round robin time (ms)
UART_1_PARITY	940	0 = 8N1, 1 = 8E1, 2 = 8N2
UART_2_PARITY	941	0 = 8N1, 1 = 8E1, 2 = 8N2
UART_3_PARITY	942	0 = 8N1, 1 = 8E1, 2 = 8N2
UART_4_PARITY	943	0 = 8N1, 1 = 8E1, 2 = 8N2
UART_5_PARITY	944	0 = 8N1, 1 = 8E1, 2 = 8N2
UART_1_MB_ADD_DELAY	955	Additional Intermessage delay
UART_2_MB_ADD_DELAY	956	Additional Intermessage delay
UART_3_MB_ADD_DELAY	957	Additional Intermessage delay
UART_4_MB_ADD_DELAY	958	Additional Intermessage delay
UART_5_MB_ADD_DELAY	959	Additional Intermessage delay
UART_1_MB_ADD_TO	960	Additional Timeout delay
UART_2_MB_ADD_TO	961	Additional Timeout delay
UART_3_MB_ADD_TO	962	Additional Timeout delay
UART_4_MB_ADD_TO	963	Additional Timeout delay
UART_5_MB_ADD_TO	964	Additional Timeout delay
SENSOR_COMM_STATUS_REG	1100	H2O2 comm status (0-16)
SENSOR_N2_FLOW	1101	N2 flow

Register Name	Register Location	Description
SENSOR_NH3_FLOW	1102	NH3 flow
SENSOR_DA_FLOW	1103	DA flow
SENSOR_H2_FLOW	1104	H2 Flow
SENSOR_PV_MODE	1105	Process variable (0 = H2, 1 = DA, 2 = NH3, 3 = Kn, 4 = Standard Kn)
SENSOR_INPUT_TYPE_REG	1106	Input for voltage inputs
SENSOR_MIN_H2	1108	minimum H2 value
SENSOR_CO2_PRESENT	1109	concentration of CO2 present. Important for H2 measurement only
SENSOR_PV_REMOVE_NEGATIVE	1110	Makes any negative number zero
SENSOR_GEN_QUEUE_ENABLE	1150	Allows for a generic write
SENSOR_GEN_QUEUE_START	1151	Start of write. E.g., register 45.
SENSOR_GEN_QUEUE_ADDRESS	1152	Address of board to write to.
SENSOR_GEN_QUEUE_NUM_WORDS	1153	Number of words to write down up. Up to 30
SENSOR_GEN_QUEUE_BLOCK	1154	write up to 30 words
SENSOR_READ_REGISTERS	1200	just designates where to start writing
MB_READ_VERSION_NUMBER	1200	current version number of the firmware
MB_READ_PELLISTOR_AVDD	1201	A/D analog voltage supply
MB_READ_PELLISTOR_EXCV	1202	Pellistor bridge excitation voltage
MB_READ_PELLISTOR_VDC	1203	Pellistor voltage
MB_READ_PELLISTOR_NA	1204	Pellistor Normalized Absorbance
MB_READ_PERC_H2	1205	H2 x 10000
MB_READ_PER_H2_MANT	1206	H2 mantissa
MB_READ_PER_H2_EXP	1207	H2 exponent
MB_READ_PER_DA	1208	DA value
MB_READ_PER_NH3	1209	NH3 value

Register Name	Register Location	Description
MB_READ_PER_SUPER_KN	1210	Super Kn
MB_READ_STANDARD_KN	1211	Standard KN
MB_READ_PROC_VAR	1212	Process variable
MB_READ_GAS_TEMP	1213	Gas temperature
MB_READ_BOARD_ADDR	1214	Board modbus address (important for slave only)
MB_READ_MODEL_NUM	1215	MODEL number Map as reg 900
MB_READ_SET_FACT_DEF	1216	23205 = Full Defaults
MB_READ_DEGREE_REG	1217	Sets the unit used to display temperature.
MB_READ_N2_FLOW	1218	N2 flow
MB_READ_NH3_FLOW	1219	NH3 flow
MB_READ_DA_FLOW	1220	DA flow
MB_READ_H2_FLOW	1221	H2 Flow
MB_READ_PV_MODE	1222	Process variable (0 = H2, 1 = DA, 2 = NH3, 3 = Kn, 4 = Standard Kn)
MB_READ_INPUT_TYPE_REG	1223	Input for voltage inputs
MB_READ_MIN_H2	1225	minimum H2 value
MB_READ_CO2_PRESENT	1226	Amount of CO2 present up to 10%.
MB_READ_PV_REMOVE_NEG	1227	Remove negative number
MB_READ_SET_TAPS_REG	1228	Sets the digital trim pot
MB_READ_UART_1_BAUD_RATE	1229	Baud Rate: 0=1200,...,5=19200,...10=115200.
MB_READ_UART_2_BAUD_RATE	1230	Baud Rate: 0=1200,...,5=19200,...10=115200.
MB_READ_PV_FP	1231	Process variable in floating point
MB_READ_PELLISTOR_DIAG	1233	Pellistor Diagnostics
MB_READ_AMBIENT_TEMP	1234	Ambient temperature
MB_READ_CJ_TEMP_REG	1235	Cold junction temperature
MB_READ_AD_RAW_VDC	1237	Raw VDC

Register Name	Register Location	Description
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
MB_READ_CAL_VALUE_REG	1288	Calibration value
MB_READ_CAL_TIMER_REG	1293	First of 5 calibration timers
MB_READ_CAL_PROGRESS_REG	1294	0 = no calibration, 1 = calibration in progress

Register Name	Register Location	Description
MB_READ_CAL_ERROR_REG	1295	First of 5 calibration error calculations
MB_READ_ZERO_VOLT_CAL	1300	volts at zero (for NDIR cell, 100 = ref, 101 gas)
MB_READ_ZERO_TEMP_CAL	1302	temperature at zero
MB_READ_SPAN_VOLT_CAL	1303	volts at span (for NDIR cell, 103 = ref, 104 gas)
MB_READ_SPAN_TEMP_CAL	1305	temperature at span
MB_READ_SPAN_TARG_CAL	1306	Target value at span
MB_READ_MAX_ROUND_ROBIN	1307	Max Round robin time (ms)
MB_READ_MAX_ROUND_ROBIN_US	1308	Max Round robin time (us)
MB_READ_EEPROM_WRITER_COUNT	1309	Counts the number of times EEPROM has been written (not saved)
MB_READ_SPAN_MULTIPLIER	1310	Shows the span multiplier
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

Register Name	Register Location	Description
MB_DIGIO_SER_NUM_0	1621	Start of Serial number
MB_DIGIO_SER_NUM_1	1622	serial number 1
MB_DIGIO_SER_NUM_2	1623	serial number 2
MB_DIGIO_SER_NUM_3	1624	serial number 3
MB_DIGIO_SER_NUM_4	1625	serial number 4
MB_DIGIO_SER_NUM_5	1626	serial number 5
MB_DIGIO_SER_NUM_6	1627	serial number 6
MB_DIGIO_SER_NUM_7	1628	serial number 7
MB_DIGIO_SER_NUM_8	1629	serial number 8
MB_DIGIO_SER_NUM_9	1630	serial number 9
MB_DIGIO_EVENT_IN_CP	1636	Copy of Event Input
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

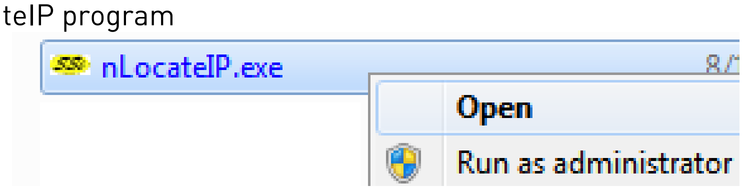
This section is intended for use by persons familiar with Ethernet network setup. The SGSM has a static IP Address so that the web interface can be accessed easily. The default IP Address of the sensor is 192.168.1.200.

If the default IP Address does not allow you to connect to this device through the web browser (see Control Interface via Web Browser section), the IP Address of the sensor can be found by using SSi's *nLocateIP* software. This method is described in the following subsection.

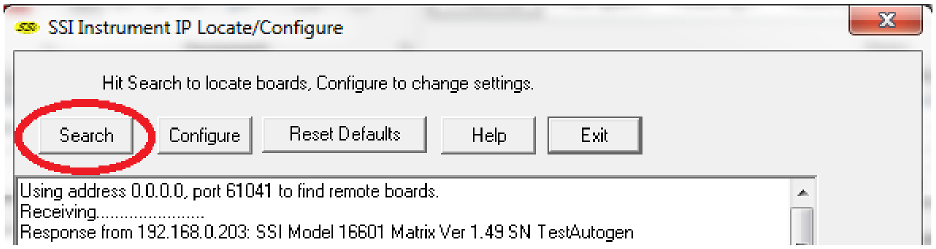
nLocateIP Method

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

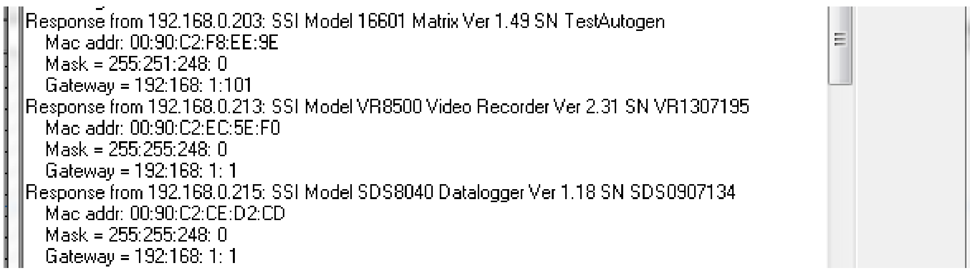
1. Ensure that the unit is connected to the network.
2. Open the nLocateIP program



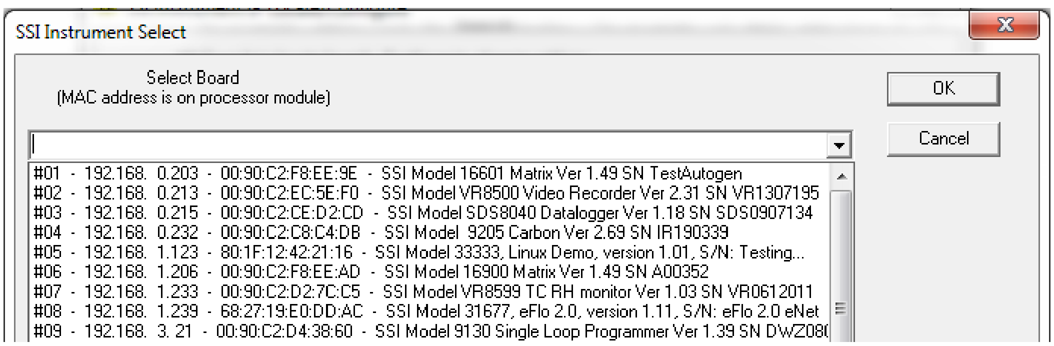
3. Once the program opens, click the **Search** button. The program will begin searching for SSi devices connected to the network.



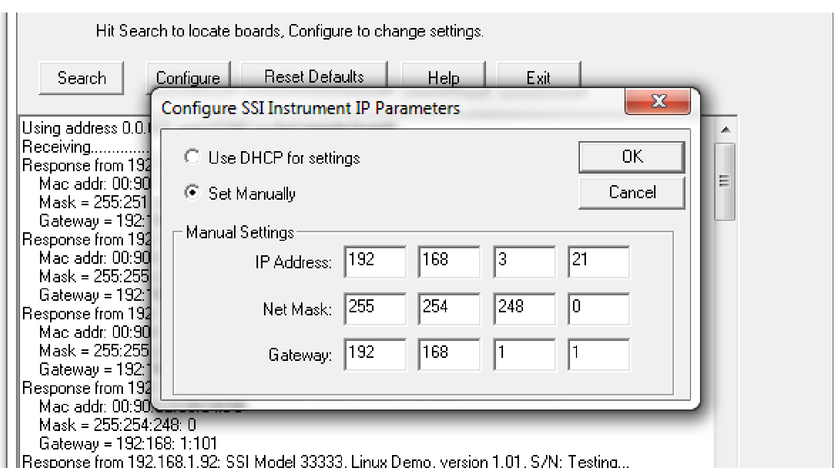
4. Look for identifying text in the list of instruments. It includes the type of instrument and serial number. It also provides the IP Address information for the sensor.



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



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

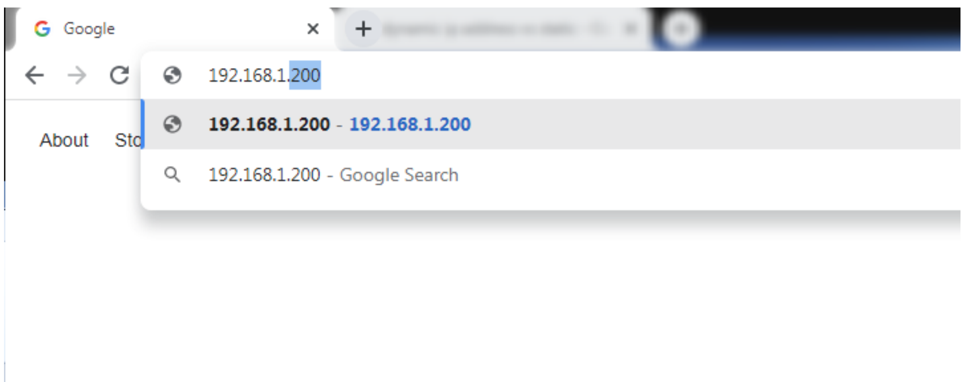


The sensor's IP Address settings will be changed immediately to allow it to communicate. If you are unable to find the unit in the list of devices, it is possible that a network setting (such as subnet mask) may be different, the unit may be connected to a different network, or the unit may not be powered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

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.

Enter the IP Address into the search bar of the web browser.



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. The oxygen measurement as well as other calculated values can be added to the display screen if desired. In the example below, the percentage composition of H_2 is displayed.

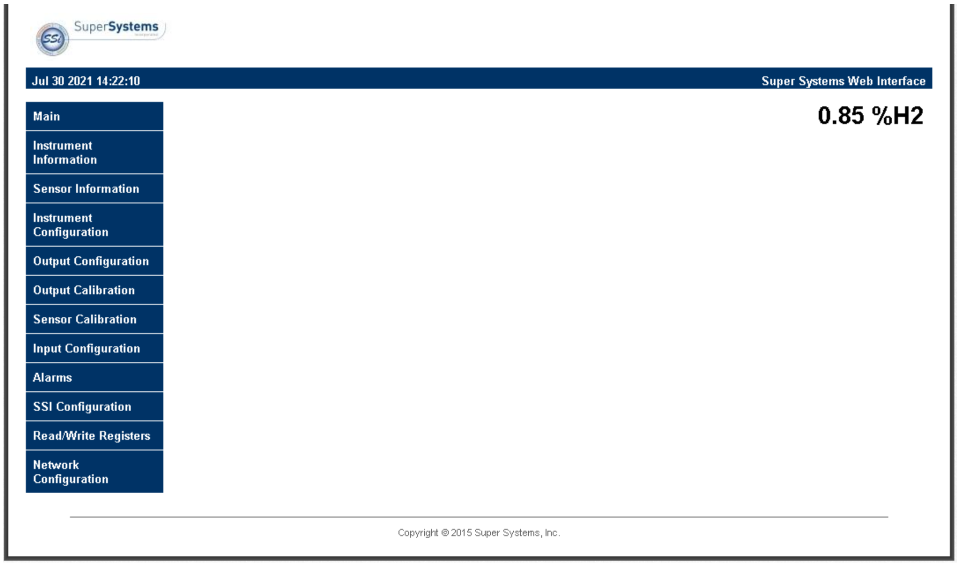


Figure 7- Main Page (with H_2 Percentage Shown)

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, sensor board version number, and webpage version number.

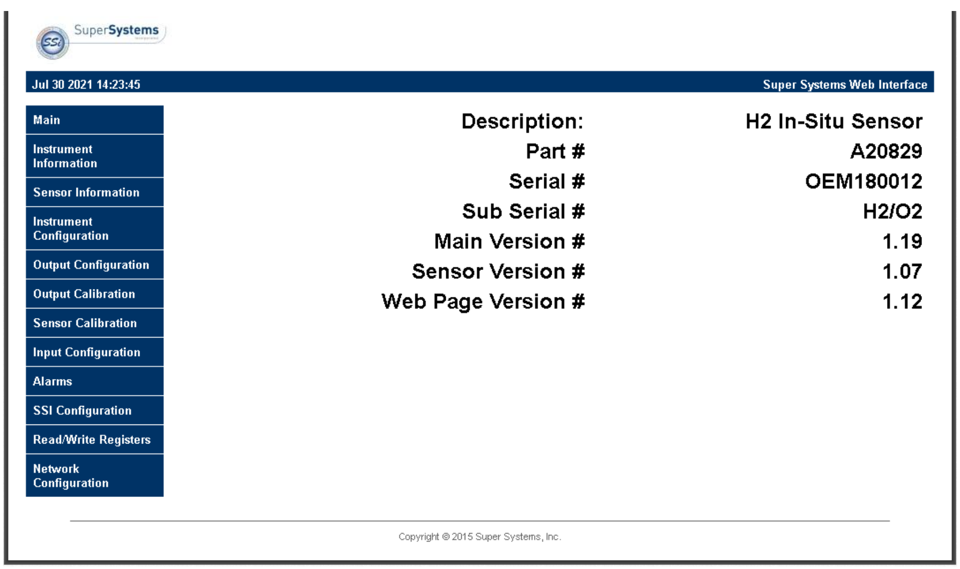


Figure 8- Instrument Information Page

Sensor Information

The Sensor Information page displays information that is useful for SSi technicians and engineers when troubleshooting.

- 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.
- PellistorVdd: This value is the voltage present across the sensing pellistor. This voltage, in air, should be approximately half the excitation voltage.
- Gas Temperature: The temperature of the measured gas.
- Amb. Temperature: The ambient temperature where the sensor is located. NOTE: The following options are intended primarily for SSi personnel to assist with troubleshooting procedures.
- Zero Vdc: (voltage direct current) A record of the zero vdc reading from the most recent calibration.
- Zero Gas Temperature: A record of the zero gas temperature reading from the most recent calibration.
- Span Vdc: (voltage direct current) A record of the span vdc reading from the most recent calibration.
- Span Gas Temperature: A record of the span gas temperature reading from the most recent calibration.
- Span Target %: A record of the span target % from the most recent calibration.

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

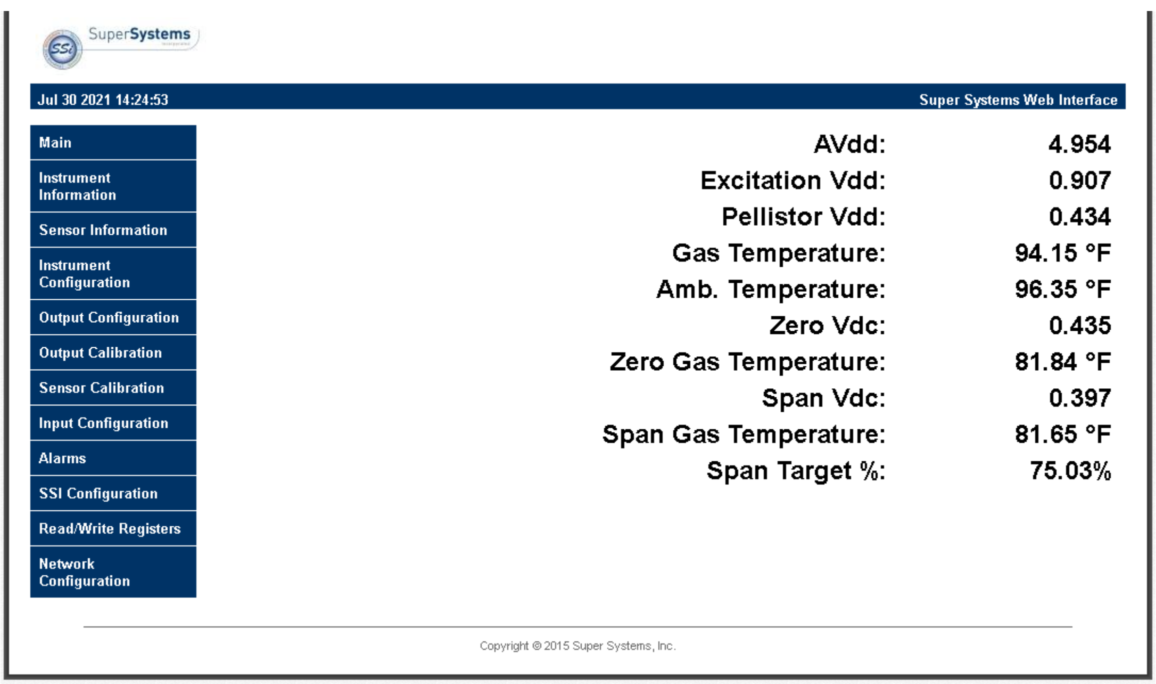


Figure 9- Sensor Information Page

Instrument Configuration

This webpage allows the user to make changes to the sensor's configuration. .

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

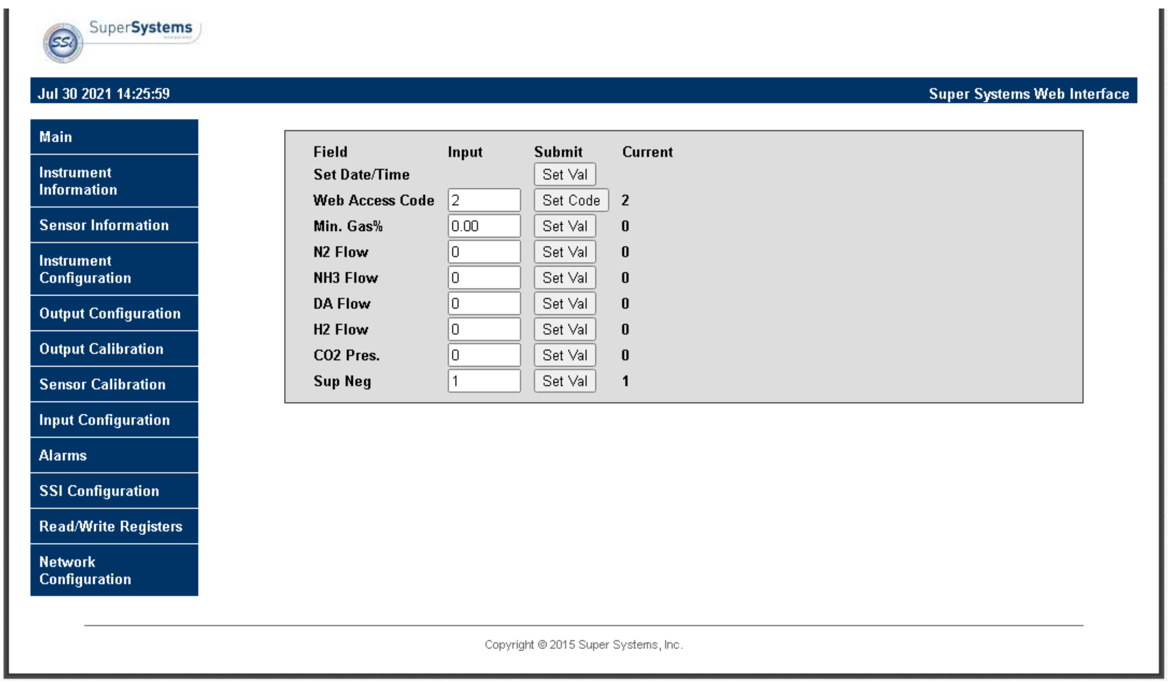


Figure 10- Instrument Configuration Page

Output Configuration

The Output Configuration options allow the user to set up an analog output milliamp signal from the SGSM to a chart recorder or other device for recording or controlling another process. There are two outputs that can be set up for the gas being measured or a calculated value based on the gas measurements. The options include:

- H2: Percent hydrogen reading from the sensor.

- DA: Calculated percent dissocation based on %H_2 reading and gas flows. Its full range scale is defined as 0 – 100.
- NH3: Percent ammonia calculation based on the %H_2 reading and gas flows. Its full range scale is defined as 0 – 100.
- KN: Calculated "super " nitriding potential based on the %H_2 reading and gas flows. Its calculated range shown on the Main webpage is 0 – 300, but the output range is limited to a range of 0 – 100 where 0/4 mA is 0 Kn and 20 mA is 100 Kn. It displayed as "Super KN" on the Main & SSi Configuration webpages.
- External: Used to verify the output and for special case scenarios – see below.
- Std. KN: Calculated nitriding potential based on the %H_2 reading and gas flows. Its calculated range shown on the Main webpage is 0 – 300, but the output range is limited to a range of 0 – 100 where 0/4 mA is 0 Kn and 20 mA is 100 Kn. It displayed as "Std. KN" on the Main & SSi Configuration webpages.
- O2: Percent oxygen reading for the sensor.

When an option is selected, the user can choose a 0 – 20 mA or 4 – 20 mA output range for that option's calibration range.

The "External" option is for special cases where an additional analog output is required from an external source. Contact SSi for additional details about this option.

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: H2, DA, NH3, KN, External, or Standard KN.
- Zero (%): Is the selected source's minimum calibrated zero value that corresponds to 4 mA on a 4-20 mA scale.   (4-20 mA is the default Range setting. If Range is set to 0-20 mA, then the Zero % refers to 0 mA.).
- Span (%): Is the selected source's maximum calibrated span value that corresponds to 20 mA on a 4-20 mA scale. (4-20 mA is the default Range setting. If Range is set to 0-20 mA, then the Span % still refers to 20 mA.).
- Range: Allows the user to choose between an output signal of 4-20 mA (default) and 0-20 mA.
- Manual (%): Allows the user to enter an output value to test the analog output. In order for this option to function, Source must be set to *External*.

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

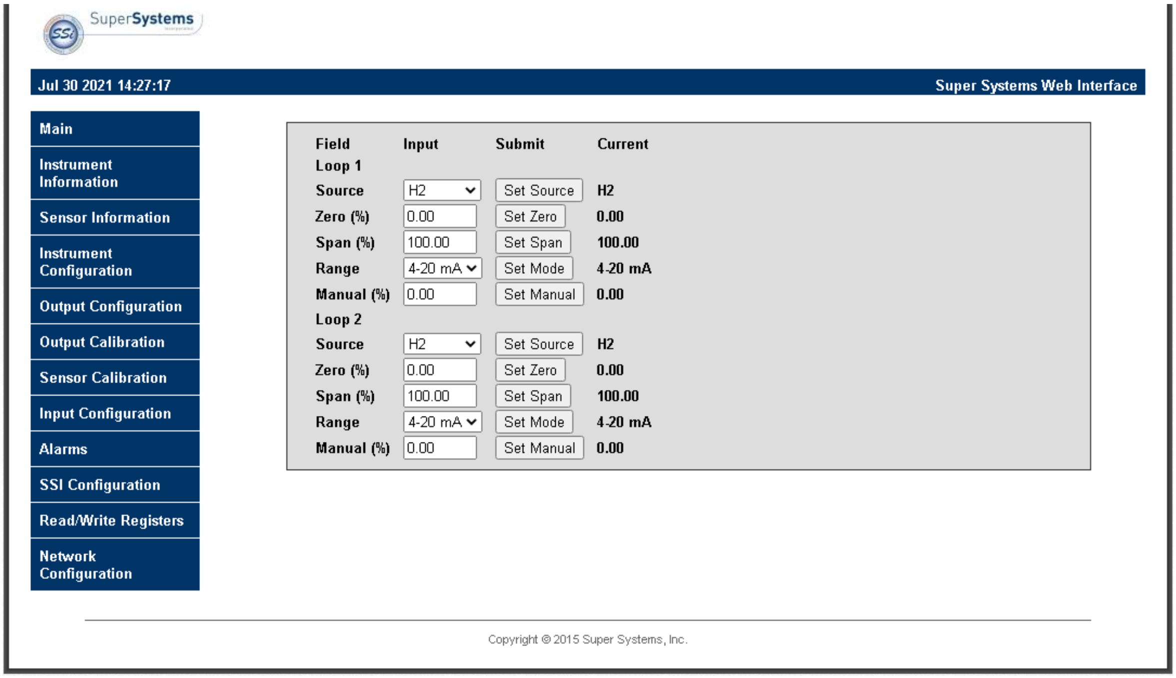


Figure 11- Output Configuration Page

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 suggests that this device should be calibrated on a routine basis, such as once a year or as prescribed by the user's quality system requirements.

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

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".

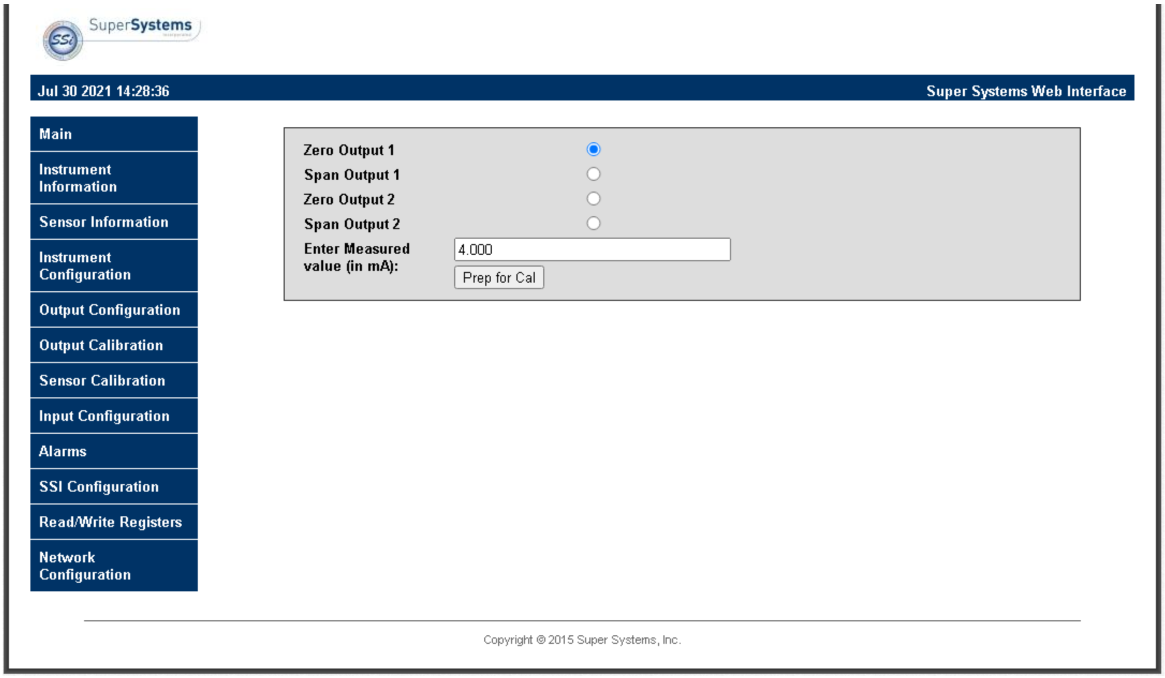


Figure 12- Output Calibration Page

Sensor Calibration

Calibration procedures for the in-situ H_2 analyzer (A20829) and flow-through analyzer (A20830) have differences and similarities due to the design of each unit. Because the H_2 sensors use thermal conductivity to quantify the %H_2 in the gas sample, how the gas is presented to the sensor affects its calibration and resulting accuracy. The in-situ H_2 analyzer does not allow sample gases to flow past the H_2 sensor. Therefore, the calibration must be performed in a similar way. The flow-through H_2 analyzer requires that flows past the H_2 sensor be similar to flows during normal operation to maximize accuracy of the sensor. The setup and calibration methods are detailed below.

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

A20829

Connect the gas as illustrated below. It is recommended to let everything (gas and SGA) sit for approximately thirty minutes to allow the temperature to achieve equilibrium.

To perform a sensor calibration, first make sure that the system is set up to flow both zero gas (with 0% H_2 in this case) and span gas when needed. The span gas should contain a minimum %H_2 that the sensor could be exposed to during normal operations. For example, if the sensor might see up to 75% H_2, the span gas should contain at least 75% H_2 in its chemistry. 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 <u>until the gas reading on the web page stabilizes</u>. For the zero calibration, the zero gas can flow directly through the sensor as shown in the illustration below. Flow should be 1 to 2 cfh.

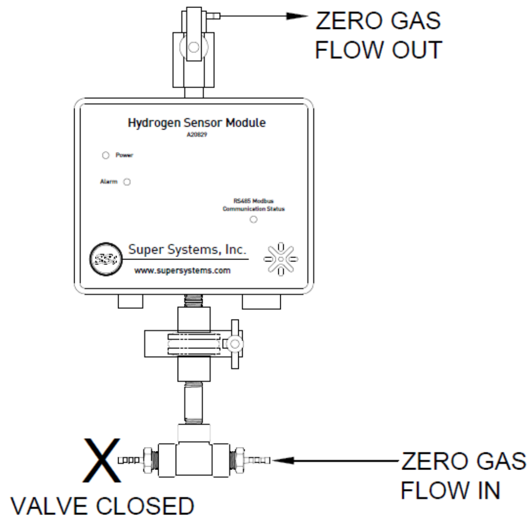


Figure 13 – Zero Calibration Gas Flow

4. Enter the target gas concentration in the "Enter gas concentration (%)" field.
5. Press the "Calibrate" button. A Calibration Timer will count down.
6. Once the Calibration Timer has counted down, the zero value will be calibrated.

NOTE:The remaining steps for the span gas require a different flow setup so please read the instructions carefully.

7. Ensure that the system is purged of any latent gas.
8. Start by flowing the span gas through the sensor similar to the zero gas calibration (see illustration below). <u>Wait until the gas reading on the web page stabilizes</u>.

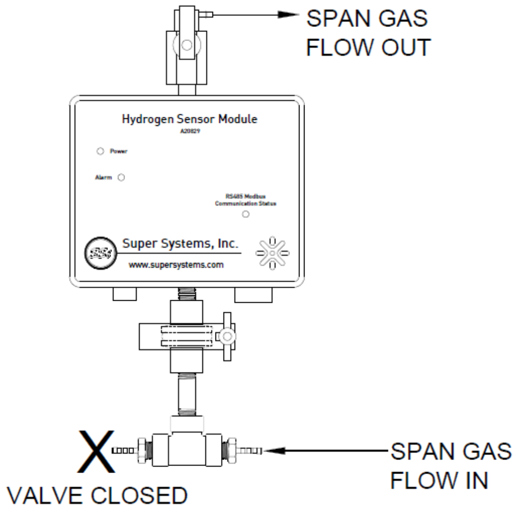


Figure 14 – Span Calibration Gas Initial Purge

9. Redirect gas flow through the tee fitting and close the calibration port at the top of the sensor (see illustration below). <u>Wait for the gas reading to stabilize for a minimum of 5 minutes **and** until the gas reading on the web page has stabilized</u>.

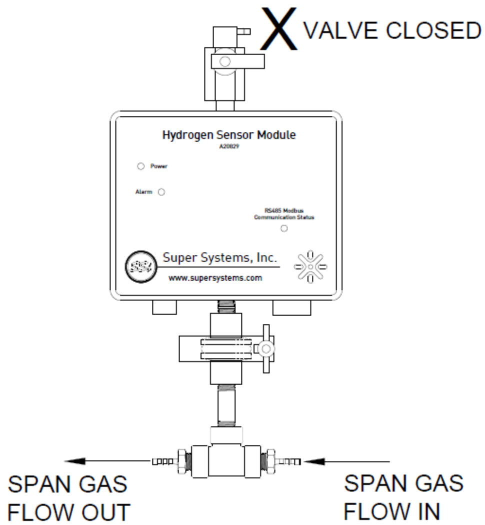


Figure 15 – Span Calibration Gas Flow Stabilization

10. Enter the target gas concentration in the "Enter gas concentration (%)" field.
11. Press the "Calibrate" button. A Calibration Timer will count down.
12. Once the Calibration Timer has counted down, the span value will be calibrated.

A20830

To ensure accurate readings, the gas sensor must be calibrated at both the low end and high end of the measured gas composition range. Performing only a zero or span calibration will cause the sensor to give an erroneous reading. The gas flow through the sensor must be carefully controlled in order to maximize the accuracy of the sensor. The flow of gas during calibration needs to be the same as the sample gas flow during normal operation. That flow is generally 1 to 2 cfh, but may be different for each application. SSi suggests that this device should be calibrated on a routine basis, such as once a year or as prescribed by the user's quality system requirements.

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

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

1. Note the percentages of the sensor gas in each gas source (zero and span).
2. Ensure that the system is purged of any latent gas.
3. Flow the zero gas until the gas reading on the web page stabilizes.
4. Enter the target gas concentration in the "Enter gas concentration (%)" field.
5. Press the "Calibrate" button. A Calibration Timer will count down.
6. Once the Calibration Timer has counted down, the zero value will be calibrated.

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

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

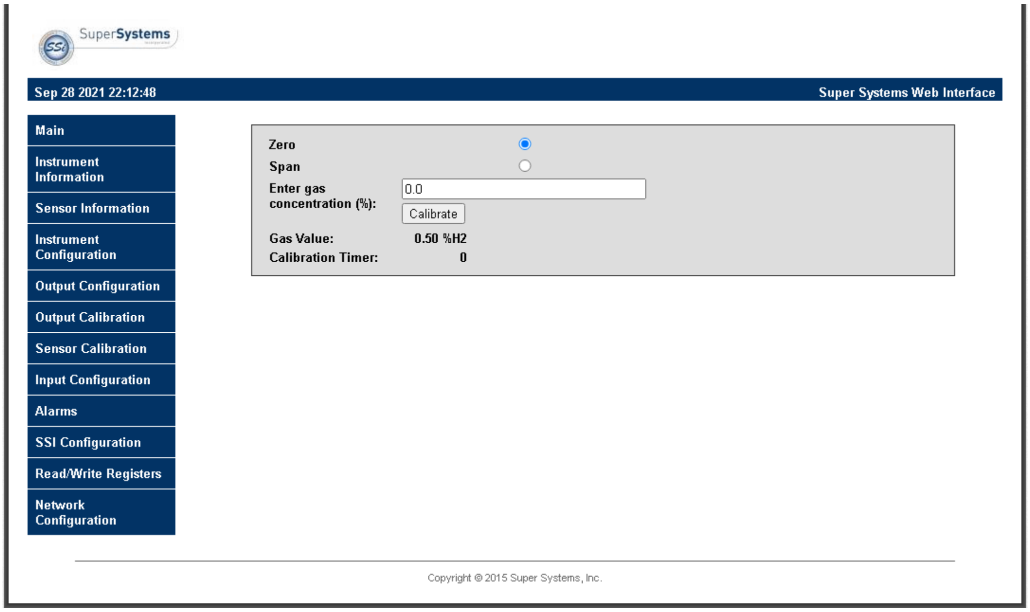


Figure 16 - Sensor Calibration Page

Input Configuration

The use of the Lambda analog O_2 probe requires that its input be configured and calibrated accordingly for measurement. The input labeled, "TC" is not applicable for this product and is not used. The O2 input (when used) must be calibrated at the low and high ends of input voltage range to ensure accurate readings. SSi suggests that this device should be calibrated on a routine basis, such as once a year or as prescribed by the user's quality system requirements.

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

Zero & Span Calibration:

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

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

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

Input 2 is not applicable for this product and can be disregarded.

TC Trim

The TC Trim **Calibration Type** is not applicable for this product.

CJ Trim

The CJ Trim **Calibration Type** is not applicable for this product.

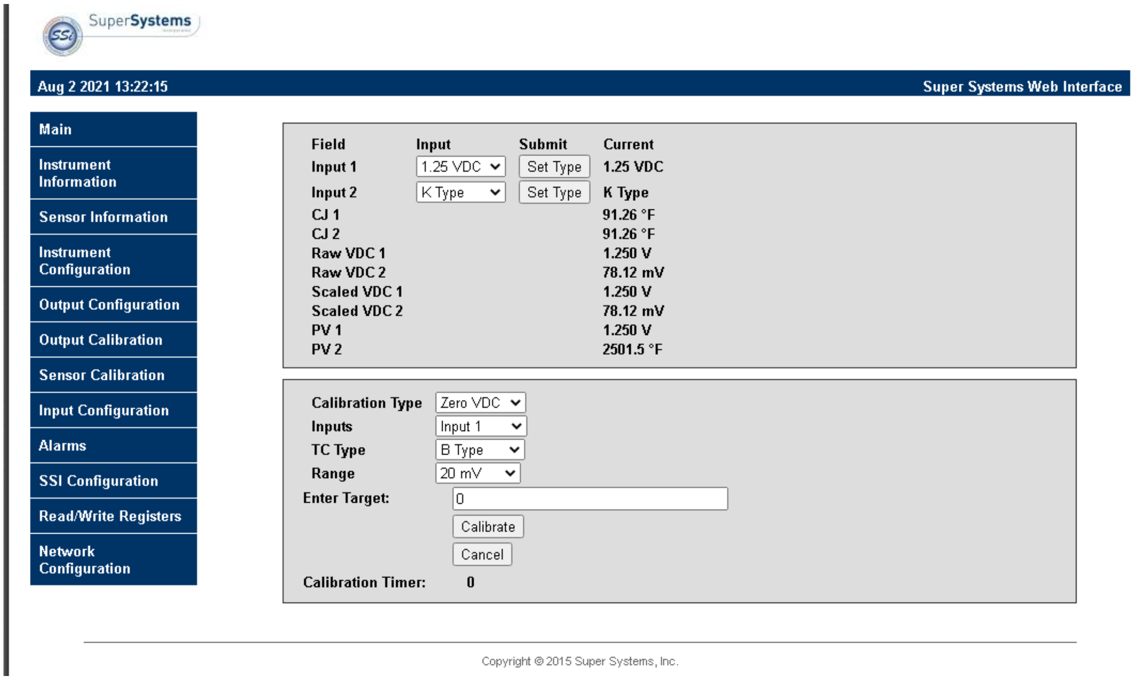


Figure 17 – Input Configuration Page

Alarms

The Alarms page allows the user to set lower and upper limits to create an alarm condition that can be setup and communicated through a Modbus register.

For the desired gas type, enter a Lower Limit and/or an Upper Limit for an alarm condition. Select an Action from the dropdown menu and click the Submit button to save that information.

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

- "None" will not use any of the alarm features (i.e. no alarms are used).
- "AL1" will activate the first set of Modbus registers associated with Alarm 1.
- "AL2" will activate the second set of Modbus registers associated with Alarm 2.
- "Both" will activate both sets of Modbus registers associated with the alarms.

Additionally, a red indicator light illuminates on the front of the enclosure when any alarm condition is met. Contact SSi for additional information on the alarm feature for this product.

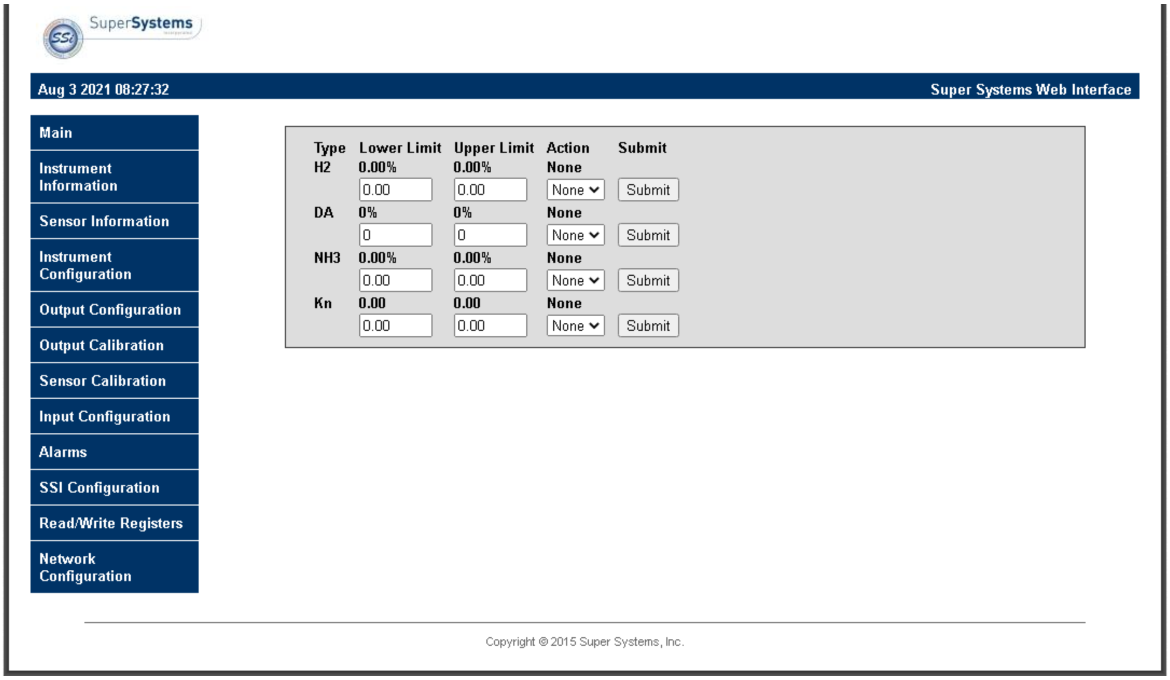


Figure 18 – Alarms Page

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. Accessing this page requires a special code to prevent unwanted changes to critical settings.

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

- Additional Settings: This unit allows for additional calculation displays associated with gas nitriding. (Note that Super Kn is labeled as KN in the Output Configuration webpage and Kn is labeled as Std. KN in the Output Configuration webpage.)

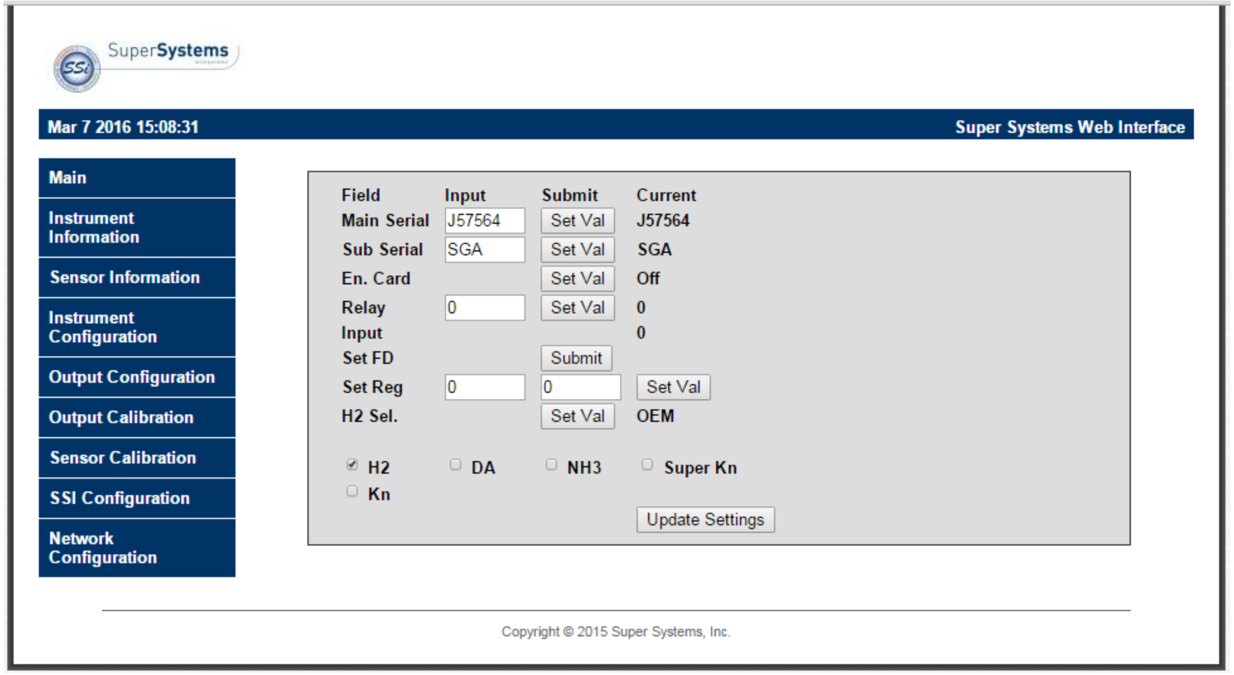


Figure 19 - SSI Configuration Page

Read/Write Registers

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

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

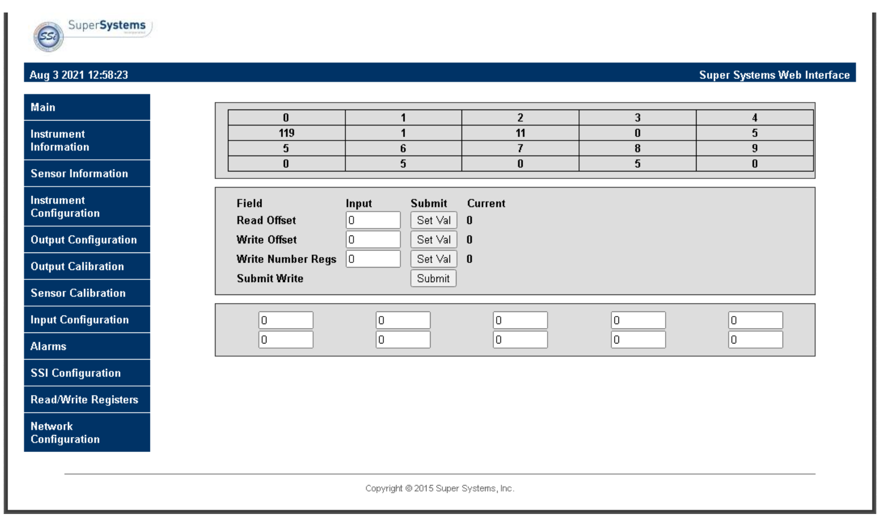


Figure 20 – Read/Write Registers Page

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.**

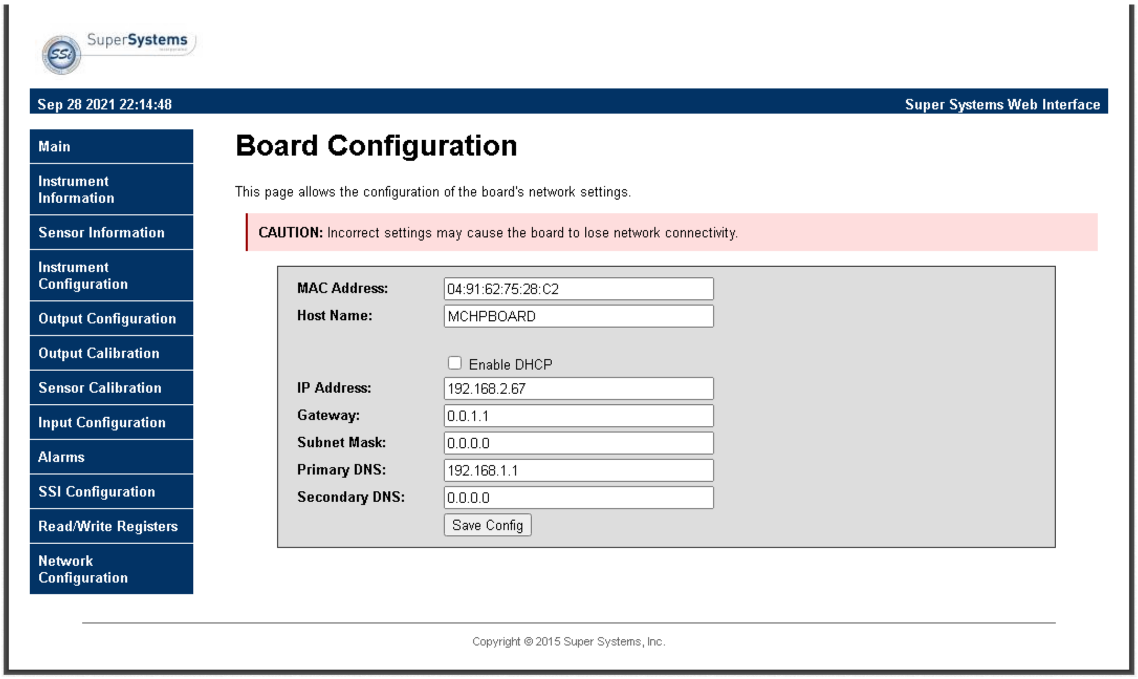


Figure 21 - Network Configuration Page

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
12 VDC Power Supply, 75 W	31709
24 VDC Power Supply, 75 W	31135
Lambda Oxygen Sensor, 4-Wire Analog (12 VDC)	31435
Terminal Block, 6-Position	33305
Terminal Block, 3-Position	33310
Terminal Block, 2-Position	33311
Terminal Block, 2-Position	33312
Fitting, 1/4 OD comp x 1/8 mpt 316 SS	34547
Fitting, KF-16 Adapter, 1/8 Female NPT	34699
Fitting, KF-16 Adapter, Clamp Assembly	34700
Fitting KF-16 Centering Ring, Silicone	34701

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.

Appendix A: DIP Switch Setting Examples

Address: 1

	1	2	3	4	5	6	7	8
ON	■							
OFF		■	■	■	■	■	■	■

Address: 2

	1	2	3	4	5	6	7	8
ON		■						
OFF	■		■	■	■	■	■	■

Address: 3

	1	2	3	4	5	6	7	8
ON	■	■						
OFF			■	■	■	■	■	■

Address: 4

	1	2	3	4	5	6	7	8
ON			■					
OFF	■	■		■	■	■	■	■

Address: 5

	1	2	3	4	5	6	7	8
ON	■		■					
OFF		■		■	■	■	■	■

Address: 6

	1	2	3	4	5	6	7	8
ON		■	■					
OFF	■			■	■	■	■	■

Address: 7

	1	2	3	4	5	6	7	8
ON	■	■	■					
OFF				■	■	■	■	■

Address: 8

	1	2	3	4	5	6	7	8
ON				■				
OFF	■	■	■		■	■	■	■

Address: 9

	1	2	3	4	5	6	7	8
ON	■			■				
OFF		■	■		■	■	■	■

Address: 10

	1	2	3	4	5	6	7	8
ON		■		■				
OFF	■		■		■	■	■	■

Address: 11

	1	2	3	4	5	6	7	8
ON	■	■		■				
OFF			■		■	■	■	■

Address: 12

	1	2	3	4	5	6	7	8
ON			■	■				
OFF	■	■			■	■	■	■

Address: 13

	1	2	3	4	5	6	7	8
ON	■		■	■				
OFF		■			■	■	■	■

Address: 14

	1	2	3	4	5	6	7	8
ON		■	■	■				
OFF	■				■	■	■	■

Address: 15

	1	2	3	4	5	6	7	8
ON	■	■	■	■				
OFF					■	■	■	■

Address: 16

	1	2	3	4	5	6	7	8
ON					■			
OFF	■	■	■	■	■	■	■	■

Address: 17

	1	2	3	4	5	6	7	8
ON	■				■			
OFF		■	■	■		■	■	■

Address: 18

	1	2	3	4	5	6	7	8
ON		■			■			
OFF	■		■	■		■	■	■

Address: 19

	1	2	3	4	5	6	7	8
ON	■	■			■			
OFF			■	■		■	■	■

Address: 20

	1	2	3	4	5	6	7	8
ON			■		■			
OFF	■	■		■		■	■	■

Address: 21

	1	2	3	4	5	6	7	8
ON	■		■		■			
OFF		■		■		■	■	■

Address: 22

	1	2	3	4	5	6	7	8
ON		■	■		■			
OFF	■			■		■	■	■

Address: 23

	1	2	3	4	5	6	7	8
ON	■	■	■		■			
OFF				■		■	■	■

Address: 24

	1	2	3	4	5	6	7	8
ON				■	■			
OFF	■	■	■			■	■	■

Revision History

Rev.	Description	Date	MCO #
New	Initial release	10/4/2016	2196
A	Added Configuration Board Diagram and DIP Switch Example Appendix	6/1/2017	2218
B	Replaced A20829 diagram, replaced A20829 photo, updated specs table, added wire color/function info to connection diagram	5/3/2019	2264
C	Corrected O2 Sensor Part Number	4/6/2021	2310
D	Added Mounting Instructions	7/30/2021	2313
E	Added Calibration instructions and information on new web pages, updated Modbus chart, added lambda probe info, various other corrections and additions	1/19/2022	2317
F	Updated specifications	2-15-2022	2319