PROTON
THE LEADER IN ON SITE GAS GENERATION.

PD-0100-0001
REVISION M

HOGEN® S SERIES 2
HYDROGEN GENERATOR

Installation & Operation Instructions

Model Numbers:
54-0101-0000: HOGEN Hydrogen Generator
54-0101-0001: HOGEN 40 Load Following Hydrogen Generator
54-0101-0002: HOGEN 40 Tank Filling Hydrogen Generator
54-0101-0005: HOGEN 20 Load Following Hydrogen Generator
54-0101-0006: HOGEN 20 Tank Filling Hydrogen Generator
54-0101-0013: HOGEN 20 Tank Filling Hydrogen Generator

Serial Number _____

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SIC 3569-901	Gas Generating Equipment
NAICS 333-999-8556	Gas Generating Equipment

HOGEN S Series 2 Hydrogen Generator

INSTALLATION/OPERATION INSTRUCTIONS

CONTENTS

LISTS OF FIGURES

LISTS OF TABLES

1 INTRODUCTION

The HOGEN S Series 2 hydrogen generator is a fully automated Proton Exchange Membrane (PEM) based water electrolysis system. Depending on the mode, the HOGEN generator is designed to output up to 40 standard cubic feet per hour (SCFH) of 99.999 percent pure hydrogen. Hydrogen is delivered at a maximum of 200 psig (13.8 barg). The HOGEN generator's operation is continuous when supplied with power and deionized water. It is designed for indoor operation only.

Proton Energy Systems, Inc. (PROTON) has provided these instructions to guide the installation and operation of a HOGEN S Series 2 hydrogen generator. It provides technical product information. Installation requirements are also provided, along with detailed mechanical and electrical interface specifications. Important safety information is also included in this guide. Please take time to familiarize yourself with the system and the manual.

WARNING

DO NOT USE THE HOGEN S SERIES 2 HYDROGEN GENERATOR IN A MANNER NOT SPECIFIED BY THE MANUFACTURER.

WARNING

IT IS THE CUSTOMER RESPONSIBILITY TO CONSULT WITH THE LOCAL BUILDING INSPECTOR AND/OR FIRE MARSHALL REGARDING LOCAL CODE REQUIREMENTS FOR INSTALLATION AND OPERATION OF THIS EQUIPMENT.

Figure 1 HOGEN S Series 2 Hydrogen Generator

This manual attempts to answer most of the frequently asked questions with regards to installation and operation of the unit. However, should you have any questions, the PROTON technical staff stands ready to answer them and support the successful deployment of this equipment. Please call **(203) 949-8697** and ask for field service technical support or email **customerservice@protonenergy.com**. Please have the part number and serial number of your unit available.

1.1 General Description

The HOGEN S Series 2 hydrogen generator is a fully integrated system that produces hydrogen from water and electricity. The system includes an electrolyzer cell stack, as well as all the auxiliary equipment necessary for regulating electrolyzing operations and pressurizing hydrogen. The auxiliary equipment is used to aid in the functions of the system: circulating water, drying hydrogen, pressurizing hydrogen, and shutting down the system. The unit contains sensors and a control board to aid in monitoring system performance and to automate operation.

Figure 2 shows the HOGEN S Series 2 hydrogen generator schematic. The design also shows the system's boundaries and important interface connections. Water is introduced into the system. Hydrogen, water, and oxygen are emitted.

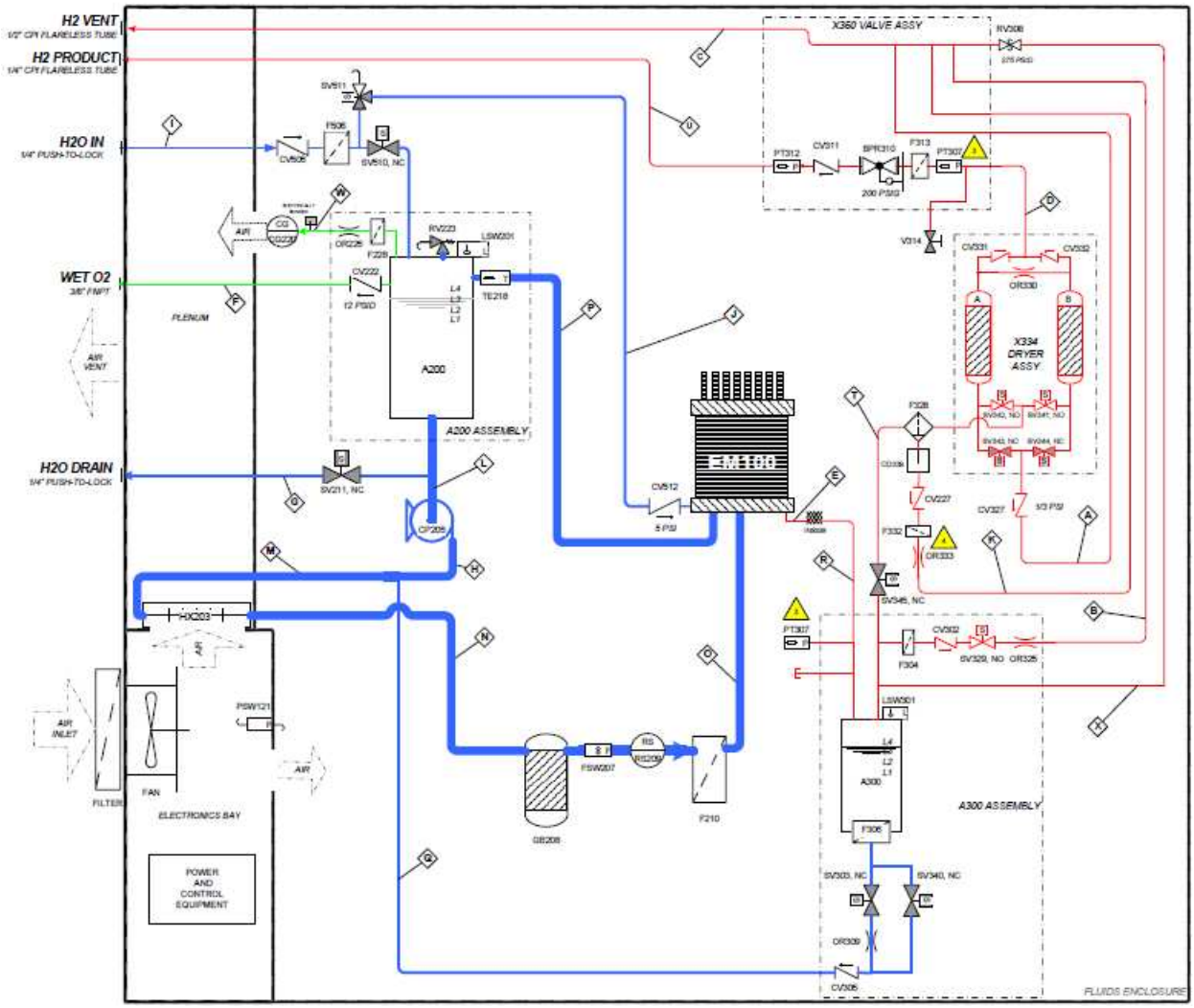


Figure 2 HOGEN S Series 2 Hydrogen Generator Schematic

1.2 Product Specification

Description			
On-site hydrogen generator in integrated, automated, site-ready enclosure. Load following operation automatically adjusts output to match demand.			
Electrolyte			
Proton Exchange Membrane (PEM) – Caustic-Free			
Hydrogen Production			
Requirement	**S10**	**S20**	**S40**
Net Production Rate	10 SCFH (0.26 Nm^3/h) 4.7 SLPM 0.56 kg/24hr	20 SCFH (0.53 Nm^3/h) 9.4 SLPM 1.14 kg/24hr	40 SCFH (1.05 Nm^3/h) 18.8 SLPM 2.27 kg/24hr
Delivery Pressure – Nominal	200 PSIG (13.8 barg)		
Power Consumed/Volume of Hydrogen Gas Produced (Est at EOL)	9.4 kWh/Nm^3 24.6 kWh/100 ft^3	9.0 kWh/Nm^3 23.7 kWh/100 ft^3	8.3 kWh/Nm^3 21.9 kWh/100 ft^3
Purity (Concentration of Impurities)	99.9995% Water Vapor < 5 PPM Water (-65°C/-85°F Dewpoint) N_2 < 2 PPM, O_2 < 1 PPM, All Others Undetectable		
Turndown Range	0 to 100% Net Product Delivery		
Upgradeability	N/A		
DI Water Requirement			
Requirement	**S10**	**S20**	**S40**
Rate at Max Consumption Rate	0.08gal/hr (0.26 L/hr)	0.13 gal/hr (0.47 L/hr)	0.25 gal/hr (0.94 L/hr)
Temperature	41° F to 95° F (5° C to 35° C)		
Pressure	21.8 to 58 PSIG (1.5 to 4 barg)		
Input Water Quality	ASTM Type II Deionized Water Required (< 1 micro Siemen/cm, > 1 megOhm-cm), ASTM Type I Deionized Water Preferred (< 0.1 micro Siemen/cm, >10 megOhm-cm)		
Heat Load and Coolant Requirement			
Requirement	**S10**	**S20**	**S40**
Cooling	Air-Cooled		
Heat Load from System	1.3 kW Max	2.2 kW Max	4.3 kW Max
Coolant	Ambient Air 41° F to 104° F (5° C to 40° C)		
Electrical Specifications			
Requirement	**S10**	**S20**	**S40**
Recommended Breaker Rating (Base Configuration)	6 kVA	8 kVA	12 kVA
Electrical Specification	205-240 VAC, Single Phase, 50 or 60 Hz		
Interface Connections			
Requirement	**S10**	**S20**	**S40**
H_2 Product Port	¼" CPI Compression Tube Fitting, SS		
H_2/H_2O Vent Port	½" CPI Compression Tube Fitting, SS		
DI Water Port	¼" Tube, Push-to-Lock, Polypropylene		
Drain Port	¼" Tube, Push-to-Lock, Polypropylene		

Interface Connections			
Requirement	**S10**	**S20**	**S40**
Electrical	Connect to On-Board Circuit Breaker		
Communications	RS 232, Ethernet		
Control Systems			
Requirement	**S10**	**S20**	**S40**
Standard Features	Fully Automated, Push Button Start/Stop. E-Stop. On-board H2 detection. Automatic fault detection and system depressurization.		
Remote Alarm	Form C Relay (2A/30VDC rated switching)		
Remote Shutdown	Circuit Breaker Shunt Trip		
Enclosure Characteristics			
Requirement	**S10**	**S20**	**S40**
Dimensions (L x D x H)	31" x 38" x 42" (97 cm x 79 cm x 106 cm)		
Weight	475 lbs (215 kg)		
Rating	IP22		
Environmental Considerations			
Requirement	**S10**	**S20**	**S40**
Standard Siting Location	Indoor, Level ± 1°, 0 to 90% RH Non-condensing, Non-hazardous, Non-classified Environment		
Storage/Transport Temperature	41°F to 140°F (5°C to 60°C)		
Ambient Temperature Range	41°F to 104°F (5°C to 40°C)		
Altitude Range – Sea Level to:	5000 ft (Sea Level to 1520 m)		
Ventilation	Proper ventilation must be provided from non-hazardous area at a rate in accordance with IEC60079-10, Zone 2 NE		
Safety and Regulatory Conformity			
Requirement	**S10**	**S20**	**S40**
Cabinet Ventilation with Environment	NFPA 69 and EN 1127-1, Clause 6.2		
	Vent Fan Draws Fresh Air Up to 28 m^3/min 1000 ft^3/min		
Noise (dB(A) at 1 Meter)	< 70 dBa		
Approvals	cTUVus (UL and CSA equivalent), CE (PED, ATEX, LVD, Mach. Dir., EMC); NYFD Approval Received		

Table 1 HOGEN S Series 2 Hydrogen Generator Specifications

2 SAFETY

The safety guidelines below may not cover all situations. If there are concerns or questions, please call PROTON or check with local authorities.

2.1 General Information

This system produces hydrogen. It is important for users to be aware, understand, and comply with all local safety requirements related to the handling of hydrogen and compressed gases.

2.2 Using Hydrogen Gas

Hydrogen is odorless, tasteless, colorless, and highly flammable. It is highly combustible in the presence of oxygen and burns with a colorless flame.

Leaking gas may be hot and pose a burn danger. If you are not in danger, stop the flow of gas and use water to cool the area. The lower explosive limit of hydrogen is 4 percent by volume. If fire occurs, do not attempt to extinguish flames, allow the fire to burn out.

Prevent overexposure to hydrogen. Hydrogen is non-toxic but can act as a simple asphyxiant by displacing the oxygen in air. Effects of oxygen deficiency resulting from simple asphyxiants include: rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgment, depression off all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result.

FIRE OR EXPLOSION - KEEP ALL SOURCES OF IGNITION AWAY FROM HYDROGEN.

BYPASSING ANY OF THE HYDROGEN GENERATOR SHUTDOWN CIRCUITS IS NOT ADVISEABLE. OPERATION OF THE GENERATOR WITH BYPASSES INSTALLED COULD RESULT IN SERIOUS INJURY AND/OR DAMAGE TO THE GENERATOR.

3 INSTALLATION

The HOGEN S Series 2 hydrogen generator is a fully integrated system. To install the HOGEN generator, mechanical, electrical, communication, and packaging interface requirements must be met. This section describes the interface and installation requirements.
Figure 2 introduces the mechanical system boundaries and principle interfaces for integration. Figure 3 illustrates the hardware, mounting points and connections for system integration and packaging.

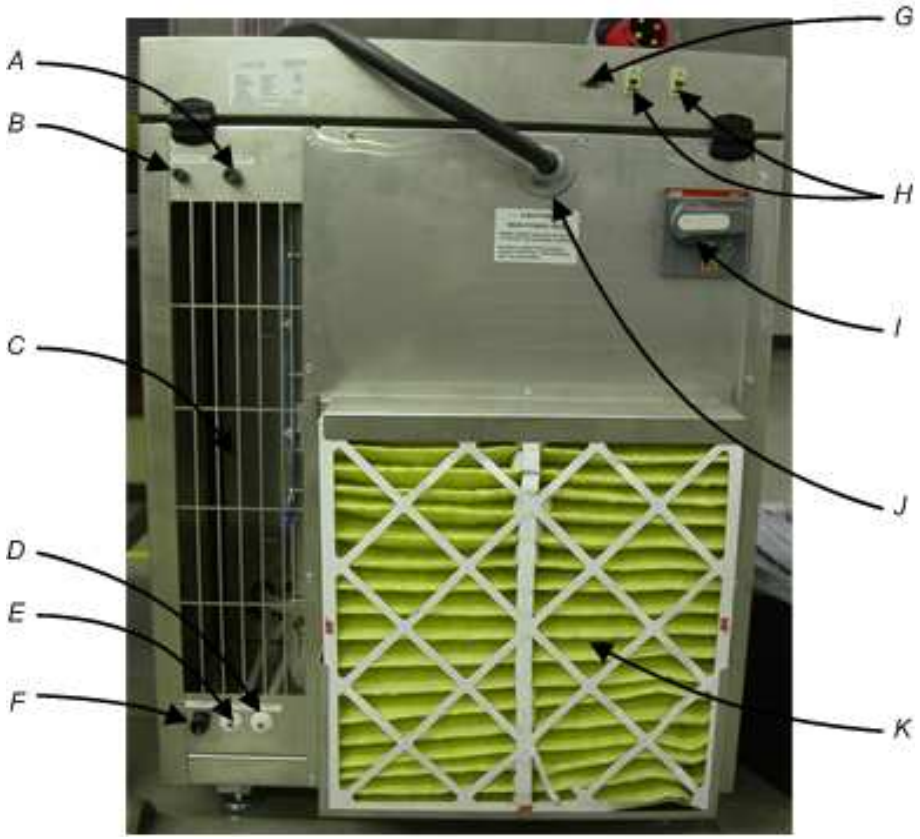


Figure 3 HOGEN S Series 2 Hydrogen Generator Interface Connections

Reference	Interface Connection	Reference	Interface Connection
A	H_2/H_2O Vent Port	G	Remote Shutdown Serial Port
B	Product Hydrogen Port	H	Modem/Ethernet Connections
C	Purge Air Exhaust	I	Main Power Disconnect Switch
D	Water Inlet Port	J	AC Power Feed
E	Water Drain Port	K	Purge Air Inlet
F	Oxygen Vent Port		

Table 2 HOGEN S Series 2 Hydrogen Generator Interface Connections

The top-level steps of installation are as follows:

1. Installing proper ventilating schemes within the area the HOGEN generator is to occupy.
2. Verifying the proper environmental conditions the HOGEN generator is to be exposed to.
3. Siting the unit.
4. Connecting electrical interfaces.
5. Connecting mechanical interfaces.
6. Calibrating the combustible gas detector.
7. Installing the cell stack.
8. Hydrating the cell stack.

Each of these steps is described in further detail in their sub-sections within this section.

3.1 Shipping Crate Removal Instructions

1. Using a Phillips screwdriver, remove 14 Phillips screws from the top cover of the crate.
2. Remove the top cover from the crate. (Refer to Figure 4.)

Figure 4 Removing Top Cover

3. Using a Phillips screwdriver, remove a total of 11 Phillips screws (five {5} on the right panel, five {5} on the left panel, and one {1} on the bottom of the front panel) to loosen the front panel of the crate. (Refer to Figure 5.)

NOTE

The front panel of the crate is marked with the words “Removable Panel.”

NOTE

The screws that need to be removed from the crate are marked with red for recognition purposes.

Figure 5 Removing the Front Panel Marked “Removable Panel”

4. Remove the front panel.

CAUTION

Ensure that trained personnel use the forklift to avoid serious injury and potential damage to the unit.

5. Using a forklift, slide the left fork underneath the left side of the unit and the right fork underneath the right side of the unit.
6. Using a forklift, lift the unit up 6 inches before backing the unit out of the crate. (Refer to Figure 6.)

Figure 6 Removing Unit from Crate with Forklift

CAUTION

Do not slide or push unit on its leveling feet. The leveling feet will break off. Leveling feet must be fully retracted and the unit must be lifted to be moved.

3.2 Facility Air Ventilation Requirements

The HOGEN generator design implements ventilation in accordance with EN60079-10, Zone 2, NE. In reference to NFPA 496, a Type Z pressurized ventilation scheme is implemented. A blower at the fresh air inlet forces an excess of 750 cubic feet per minute (CFM) of fresh purge air through the electrical compartment, through the HOGEN generator compartment, and then through the exhaust. The blower is of sufficient power to maintain an internal positive static air pressure in excess of 0.2 in. (50 mm) of water column. A pressure switch within the HOGEN generator cabinet detects any loss of ventilation pressure and will produce an automatic shutdown of the generator upon loss of pressure. Further, the air purge rate is such that it dilutes any internal hydrogen leakage to a concentration below the lower flammable limit (LFL) of hydrogen in air (4 percent). A combustible gas sensor is located at the exit of the air purge stream to detect the presence of hydrogen. This sensor will cause an alarm and an automatic shut down of the HOGEN generator when it detects the concentration of hydrogen within the purge air stream is in excess of 1.2 percent.

PROTON recommends an area air change rate of several hundred times the maximum generation rate of the HOGEN generator to preclude any possible build up of hydrogen concentration in the facility. In the event of internal equipment failure such that a brief hydrogen leak occurs, the HOGEN generator is equipped with an internal hydrogen detector safety circuit that will stop any further generation of hydrogen by automatically shutting down the HOGEN generator. Additionally, the system can be tied into facility fire detection systems, combustible gas sensors or other external facility alarms as required by the facility manager or local code compliance officials.

WARNING

THE HOGEN S SERIES 2 HYDROGEN GENERATORS ARE DESIGNED TO OPERATE IN NON-EXPLOSIVE ENVIRONMENTS. IT UTILIZES A FRESH AIR PURGE OF THE SEALED EQUIPMENT CABINET TO ESTABLISH A SAFE, NON-EXPLOSIVE INTERNAL OPERATING ENVIRONMENT (US PATENT 5980726).

CAUTION

Always refer to local code requirements to determine minimum facility ventilation requirements. A worksheet for estimating minimum ventilation at your facility is given below.

How to calculate the ventilation requirements for your site:

1. **Record net hydrogen generation rate (*P*) for your selected generator:**
   P* = _____ *Nm^3/h (SCFH)

NOTE

If there is a plan to have multiple hydrogen generators in the room, *P* must be the sum of all generators.

2. **Calculate the gross hydrogen generation rate (*G*). (Add 10 percent):**

$$G = P \times 1.1 = \_\_\_\_\_ \; Nm^3/h \; (SCFH)$$

3. **Calculate recommended ventilation rate *(F*). (Several hundred times gross generation rate):**

$$F \geq 100 \times G/60 = \_\_\_\_\_ \; Nm^3/min \; (SCFM)$$

4. **Confirm if actual room ventilation (F_A) is adequate, F_A =_____:**
   a. **Is actual room ventilation (F_A) greater than or equal to *F*? YES/NO**

CAUTION

If you answered YES for 4a, then you may install the unit(s) in the room. If you answered NO for 4a, then you may not site the unit in the room until improvements are made to the ventilation system.

Example Calculation:

1. **Record net hydrogen generation rate (*P*) for your selected generator:**

$$P = 40 \; (SCFH)$$

2. **Calculate the gross hydrogen generation rate (*G*). (Add 10 percent):**

$$G = 1.1 \times P = 44 \; (SCFH)$$

3. **Calculate recommended ventilation rate (*F*). (Several hundred times gross generation rate):**

$$F \geq 100 \times G/60 = 4400 \; (SCFH) / 60 = 73.3 \; SCFM$$

4. **Confirm if actual room ventilation (F_A) is adequate, F_A = 950 SCFM**
   a. **Is actual room ventilation (F_A) greater than or equal to *F*? YES**

3.3 Operating Environment

The HOGEN S Series 2 hydrogen generator has been designed for indoor use only. The HOGEN generator shall be situated on a grade of no more than ± 3 degrees. The area in which the system occupies shall have ventilation schemes described in Section 3.2.

The HOGEN generator is rated for ambient temperatures ranging from 41°F to 104°F (5°C to 40°C). The HOGEN generator is not designed for freezing conditions. If the system is introduced to freezing conditions, damage to the system may occur.

WARNING

IF FREEZING CONDITIONS EXIST AT YOUR SITE, PRECAUTIONS MUST BE TAKEN TO PREVENT THE UNIT FROM FREEZING.

The HOGEN generator contains a thermistor probe that measures the system water temperature. The maximum rated operating temperature for the HOGEN generator is 140°F (60°C). The system will shutdown automatically when the system temperature is over this rating. Temperatures above the maximum rating will damage the cell stack.

The HOGEN generator can be stored and transported in environments that range from 41°F to 140°F (5°C to 60°C) and 0 percent to 95 percent relative humidity, non-condensing. In the event that the unit is to be transported in a freezing environment, water must be drained from the system and the cell stack is to be taken out of the system and transported separately. Instructions for the decommissioning of the system are detailed in the Service Manual, PD-0300-0001.

CAUTION

If freezing conditions exist at your site, you must take measures to prevent condensation from freezing and obstructing the H_2 vent line and freezing the water supply and drain lines.

3.4 Site Preparation

The HOGEN S Series 2 hydrogen generator is designed for indoor installation on a level concrete pad. AC power and deionized water are the key utilities required. Ensure the generator is located so that it is safe from vehicle traffic and is in compliance with local safety regulations.

The HOGEN generator sits on four leveling feet and weighs about 500 lbs. (227 kg). To move the generator, use a fork truck to lift it from under its frame. Alternatively, straps can be used around the bottom and sides as a lift method. A level floor, ± 3 degrees, capable of supporting the generator is required. The minimum clearance requirements of the area around the generator are shown in Figure 7. It is the customers' responsibility to verify the local code requirements for this type of equipment are met when installing this equipment.

CAUTION

Not using a fork truck or pallet lift to move the HOGEN hydrogen generator may cause harm to the stabilizing structure of the unit.

WARNING

THE GENERATOR IS TYPICALLY SHIPPED WITH THE CELL STACK ALREADY INSTALLED. FOR THIS REASON, DO NOT EXPOSE THE STACK TO FREEZING CONDITIONS WHEN THE UNIT IS NOT RUNNING. PLEASE CONSULT THE FACTORY FOR SPECIAL STORAGE AND HANDLING INSTRUCTIONS IF THE UNIT WILL BE EXPOSED TO FREEZING CONDITIONS PRIOR TO INITIAL START UP.

All gas, water, electrical and communications connections are made from the rear of the system. Access to the rear panel is also required for routine air filter maintenance. Leave sufficient clearance to permit adequate air movement in and out of the generator at the rear of the unit.

The generator is controlled from the front control panel, which has start and stop switches, process status LED indicators, and a RS232 Service access port. Opening the two front doors will permit access for water filter replacement and routine maintenance.

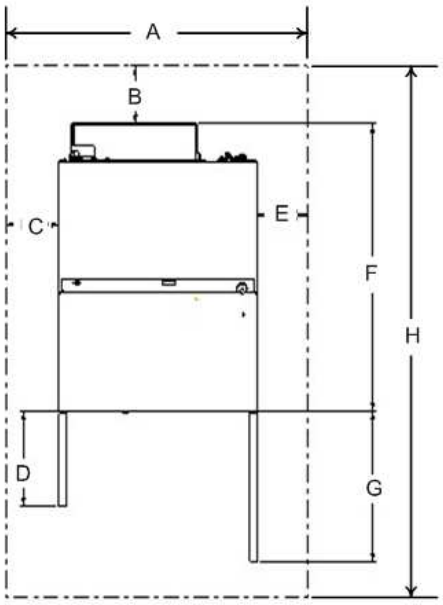


Figure 7 HOGEN S Series 2 Hydrogen Generator Plan View for Installation

Reference Dimension	Units		Reference Dimension	Units	
	Inches	cm		Inches	cm
A	54.9	139.5	E	12.0	30.5
B	12.0	30.5	F	38.25	97.2
C	12.0	30.5	G	20.0	50.8
D	13.0	33.0	H	76.25	193.7

Table 3 Plan View Dimensions

3.5 Electrical Interfaces

Electrical interface connections are made prior to mechanical connections. Once the HOGEN S Series 2 Hydrogen Generator has been properly located, electrical connections can be made. All user supplied I/O cables which interface with this system must not exceed 30 meters (98.4 feet) in length.

3.5.1 Surge Protection

The HOGEN hydrogen generator is designed, tested and certified to meet the electrical surge immunity standards as stated in IEC 61000-4-5.

CAUTION

Supply voltages higher than specified may result in system damage. Voltage surges higher than 2 Kv may result in system damage. It is recommended that the customer provide adequate surge protection in the plant power distribution so as to minimize any potential damage to the HOGEN system.

NOTE

PROTON offers a Surge and Under/Over Voltage Relay Module (KT-1000-0032) to minimize the effects of out of specification line voltage conditions, such as low voltage or large voltage transients.

To ensure proper operation, the user of this system is responsible for providing adequate surge protection for power being supplied to the system. Otherwise, in the event of an AC main high voltage surge, the system may shut down in the following manner:

- Product hydrogen flow and pressure will be lost
- System pressure will begin to bleed down until the C-03 “Low System Pressure” warning is reached. The system may then shutdown on E-02 “Low Cell Stack Voltage”
- Upon shutdown, the system power will need to be shutdown for a minimum of 5 seconds. The circulation pump must be allowed to perform its normal 60-second water circulation
- This shutdown allows the power supplies to clear a latched fault
- After the minimum 5-second shutdown, the system may be restarted and brought to normal operation

3.5.2 Cabling Procedure

The power connections made must be weather-tight, airtight, and compliant with electrical codes. A minimum #6 AWG wire is recommended.

CAUTION

The power connection must be sealed to prevent air pressure leakage. The internal cabinet must be pressurized during operation – Air pressure must be maintained.

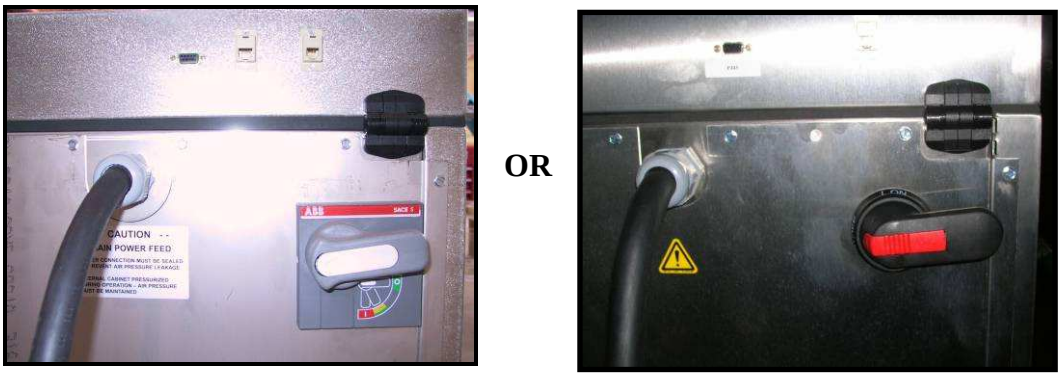


Figure 8 Electrical Interfaces on the Rear Panel

CAUTION

Proton requires the use of ferrules to connect power cables to the circuit breaker terminal lug.

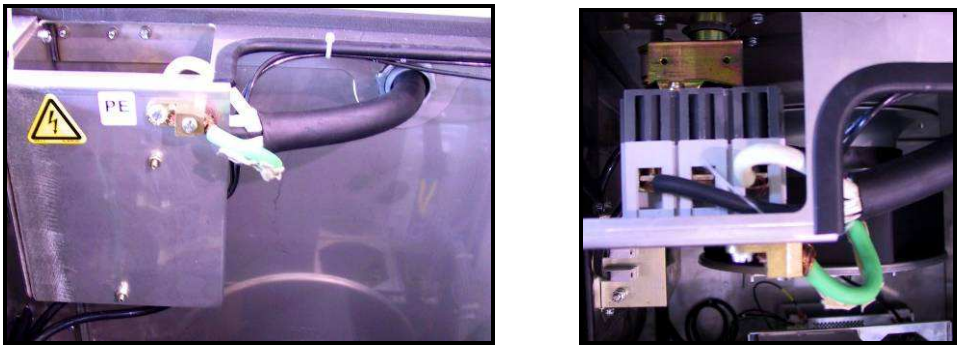


Figure 9 Terminal Connections of Main Power Feed

1. Remove the rear panel from the unit.
2. Feed the power and ground cables through the AC Power Feed (Refer to Figure 8).
3. Connect the power cables to the terminal lugs inside the unit (Refer to Figure 9).

NOTE

Terminals 1 and 3 are used for single-phase hookup.

4. Connect the ground cable to the power supply frame ground point.
5. Bring the protective earth ground conductor (#6 AWG) into the unit along with power to the conductors.
6. Terminate the conductors on the chassis ground point on the circuit breaker bracket (Refer to Figure 9).

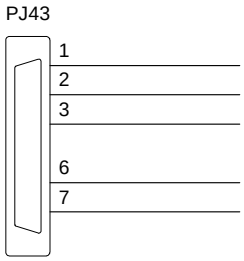
3.5.3 Remote Alarm Contact and Shutdown Connections

An external alarm to the HOGEN generator may be connected to confirm system status. Both Normally Closed (NC) and Normally Open (NO) contacts are available on the 9-pin serial connector located on the rear panel of the generator, as shown in Figure 9. The

form C alarm relay contacts are rated for 2 Amps. **DO NOT** exceed this rating. An external switch can shut down the system. Multiple switches can be wired in parallel. An external dry contact closure across pins 6 and 7 will trip the input power breaker and safely shut down the HOGEN generator (Refer to Figure 10).

NOTE

24 VDC is present on pin 6.



Pin Number	Connections
1	Relay Com
2	Relay NC
3	Relay NO
6	Remote E-Stop
7	Remote E-Stop

Figure 10 Alarm Contact Connections
Table 4 Alarm Contact Connections

3.6 Mechanical Interfaces

This section provides a detailed description of the mechanical interface requirements. The physical layout and dimensions of the HOGEN S Series 2 hydrogen generator are shown. Detailed interface connections for the hydrogen outlet and water supply are supplied also.

3.6.1 Physical Layout, Connections and Dimensions

The physical layout of the HOGEN S Series 2 hydrogen generator is shown in the following figures.

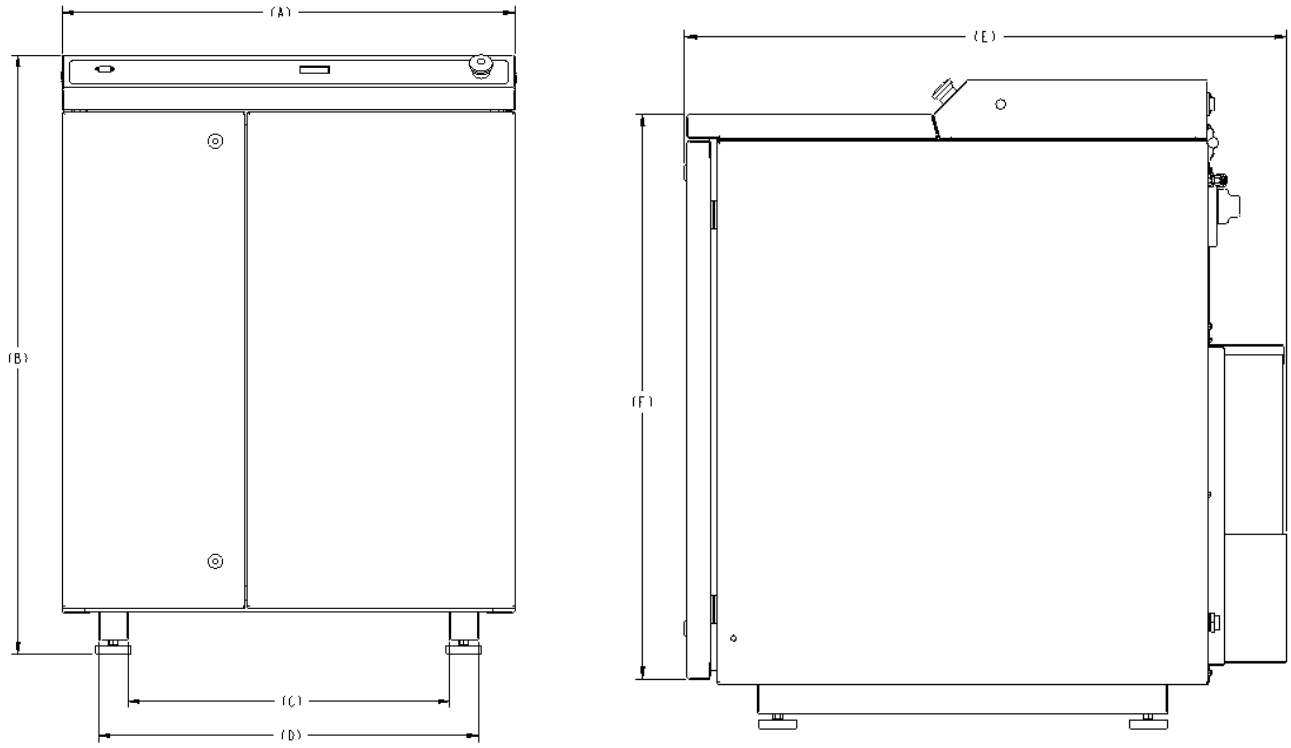


Figure 11 Front and Right Side Views

Reference Dimension	Units		Reference Dimension	Units	
	Inches	cm		Inches	cm
A	30.9	78.5	K	34.6	87.9
B	40.9	103.9	L	25.1	63.8
C	21.9	55.6	M	8.2	20.8
D	25.9	65.8	N	6.7	17.0
E	38.2	97.0	O	3.9	9.9
F	35.6	90.4	P	5.5	14.0
G	4.5	11.4	Q	2.8	7.1
H	2.1	5.3	R	32.9	83.6
I	11.5	29.2	S	35.3	89.7
J	4.6	11.7			

Table 5 Dimensions for Front, Right Side, and Rear Views

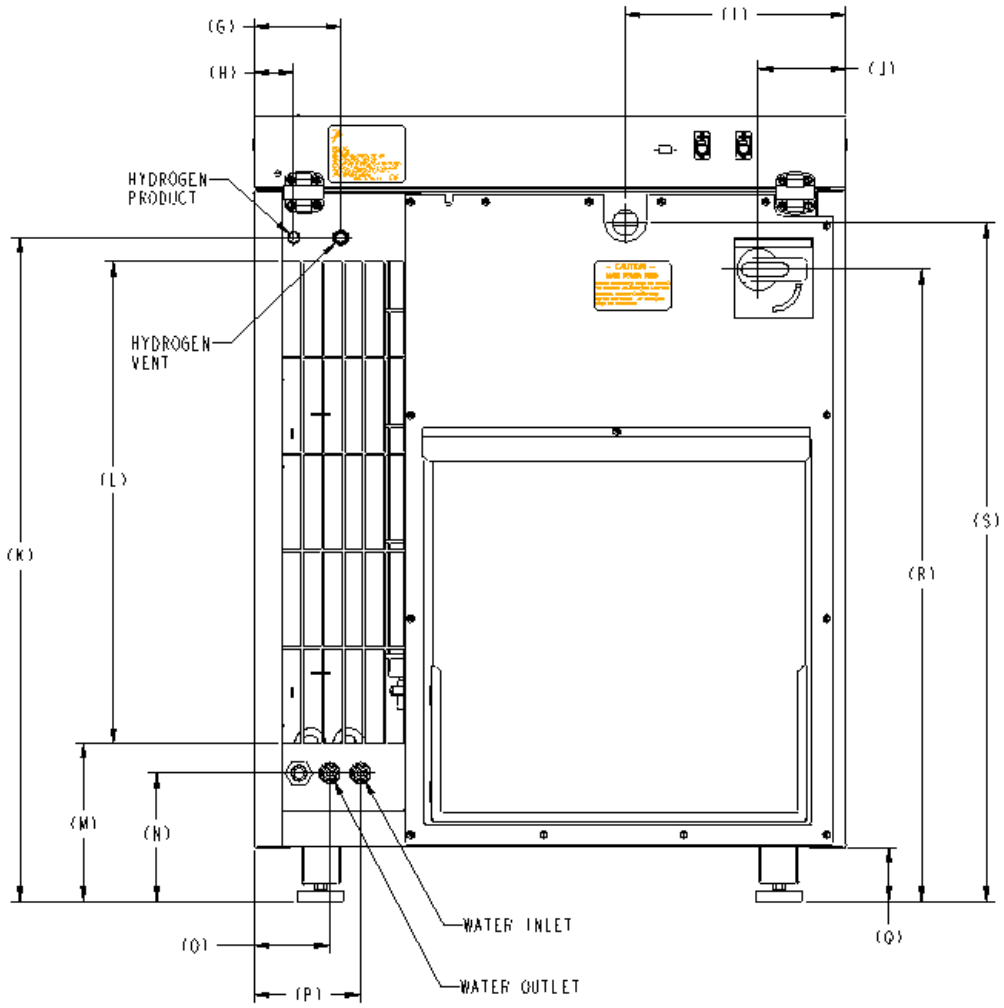


Figure 12 Rear View

3.6.2 Product Hydrogen Interface

The HOGEN S Series 2 hydrogen generator is designed to produce hydrogen that contains no more than 5 PPM of water and 1 PPM of other containments. Hydrogen can be delivered at pressures ranging from 0 to 200 psig and up to the unit's rated flow rate.

For conditions that do not require hydrogen product in the customer process, such as initial equipment commissioning, maintenance and repair conditions, PROTON suggests plumbing in the product bypass line at the time of hydrogen generator installation. (Refer to Figure 13 for suggested plumbing orientation.)

The product hydrogen port uses a Parker CPI compression tube fitting for ¼" OD tubing. Figure 3 shows the connection location.

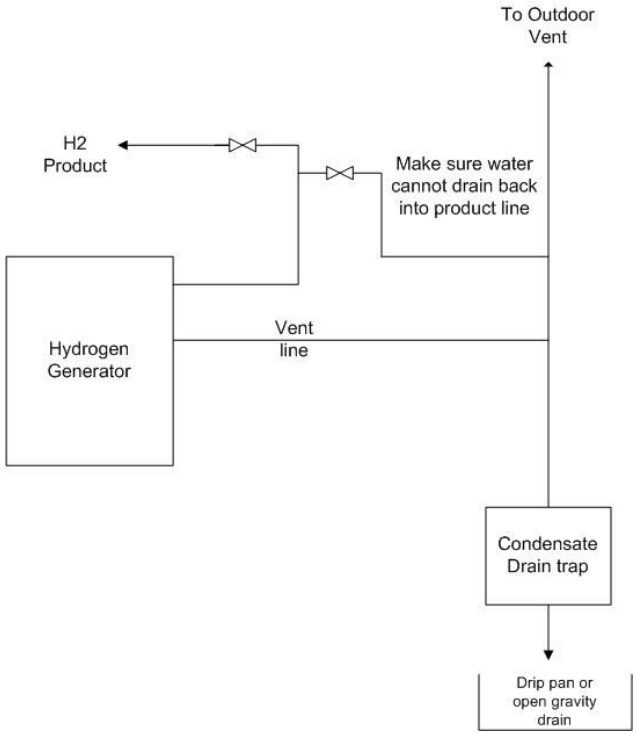


Figure 13 Suggested Plumbing Orientation

3.6.3 Hydrogen Vent Interface

The HOGEN S Series 2 Hydrogen Generator vents hydrogen during startup, system depressurization, dryer purging cycles, and overpressure relief. During startup of the HOGEN generator, the full production rate of hydrogen is vented while the unit is in the GENERATE-VENT state. Once the system switches states, the vent valve (P&ID Tag SV329) closes and the system begins to pressurize. During system shutdown, the entire on-board inventory of hydrogen (approximately 0.5 SCF/0.01 Nm^3) is vented. Depressurization occurs when the vent valve (P&ID Tag SV329) is opened, allowing hydrogen to flow out of the H_2/H_2O vent.
The internal dryer of the HOGEN generator is a pressure-swing dryer. In order to function properly, each bed operates alternately in two half-cycles of equal duration: pressurization followed by adsorption and depressurization followed by a purge. It is during this purge that hydrogen is blown out of the non-operating bed and directed out the H_2/H_2O vent. During these purge cycles, approximately 10 percent of the production rate of hydrogen will exit the H_2/H_2O vent port with residual moisture.

If a vent bypass valve is implemented, reference Figure 13 for a suggested plumbing orientation. This suggested orientation prevents any water build up in the vent line from entering the hydrogen product line when the vent bypass valve is opened.

The HOGEN generator is equipped with a pressure relief valve. If the system experiences an over-pressure condition, the relief valve cracks open and allows the system to depressurize by allowing hydrogen to flow out the H_2/H_2O vent.

CAUTION

The pressure relief valve (RV308) is factory set at 265 psi and should not be adjusted.

The H_2/H_2O vent port uses a Parker CPI compression tube fitting for ½" OD tubing. Figure 3 shows the connection location. The vent line to be attached to the port should be installed per NFPA 50A. The hydrogen should be vented separately into an approved hydrogen vent stack. Due to the residual moisture that exits through the H_2/H_2O vent port, it is recommended that a trap is employed to properly handle the accumulation of condensate.

WARNING

DO NOT ALLOW HYDROGEN TO VENT INDOORS, NEAR VENTILATION INTAKES, WORK AREAS, OR ANY SOURCE OF IGNITION.

WARNING

THE HYDROGEN VENT LINE MUST REMAIN FREE FROM OBSTRUCTIONS AND KEPT FROM FREEZING.

3.6.4 Oxygen Interface

The HOGEN generator produces oxygen in its electrolysis process. This oxygen gas and small amounts of water condensate are vented out of the system via the oxygen vent port. The oxygen gas production rate is approximately 50% of the hydrogen production rate and exits at ambient pressure from the Oxygen/Water Phase Separator (P&ID Tag A200).

CAUTION

Adequate ventilation must be provided to assure that oxygen concentration does not build to unsafe levels.

WARNING

THE OXYGEN VENT LINE MUST REMAIN FREE FROM OBSTRUCTIONS AND KEPT FROM FREEZING.

3.6.5 Water Interfaces

The water ports are ¼" diameter polypropylene plastic tube fittings. Figure 3 shows the connection locations of these two ports. Polypropylene plastic tubing is highly recommended for the water feed line. FEP and PFA plastics are also highly recommended for protecting the cell stack. The only recommended metal line is clean, passivated 316SS. The drain line should be appropriately plumbed based on your specific facility requirements. Post-deionization water tanks should be constructed from polypropylene only as stainless steel tanks will leach out impurities that will damage the system.

The HOGEN generator uses deionized water to produce hydrogen and to actively cool the cell stack. The HOGEN generator requires a minimum of ASTM Type II deionized

water. ASTM Type II deionized water calls for a resistivity of at least 1.0 MΩ-cm and a maximum 50-µg total organic carbon per L of water. Other qualities of the water can be found in ASTM designation D1193-99: Standard Specification for Reagent Water. Although ASTM Type II water is required, ASTM Type I deionized water is recommended. By using the highest quality water recommended, the life of the guard bed cartridge and the cell stack will be extended. The water quality sensor will trigger a failure if water quality drops below 1 MΩ-cm. Therefore, it is highly recommended that ASTM Type I deionized water be used to prevent this failure.

Water levels are controlled within the HOGEN generator control logic system. When the water level drops below a set point in the Oxygen/Water Phase Separator, the Water Feed Valve (P&ID Tag SV510) is opened to allow water into the system through the water inlet. Water is drained from the system during startup and when water quality is not maintained. During initial startup, approximately 2 gallons (8 liters) of deionized water may automatically be drained out of the system. When water quality is below 1 MΩ-cm the system flushes out by opening the Drain Valve (P&ID Tag SV211) and water feed valve (P&ID Tag SV510). This allows water to be drained, while adding fresh deionized water to the system. An internal water quality sensor controls this process. This feature ensures that the water quality meets the minimum requirements before electrolysis begins.

An obstructed drain line could prevent the HOGEN generator from draining properly and may result in permanent damage.

DO NOT USE: copper, aluminum, iron or other metal for deionized water inlet tubing as this will result in significant contamination and performance loss over time. *PVC plastics are not acceptable, as they will damage the cell stack.*

3.7 Combustible Gas Sensor Calibration (P&ID Tag CG220)

The HOGEN S Series 2 hydrogen generator contains an e2v Technologies VQ603/2 combustible gas sensor that monitors both the purge air and the oxygen stream from the oxygen/water phase separator (A200) for hydrogen gas. The detection of 50 percent of the lower flammability limit (LFL) of hydrogen within air triggers a safe shutdown of the system. The combustible gas sensor needs to be calibrated prior to the initial startup of the HOGEN generator.

WARNING

THE COMBUSTIBLE GAS DETECTOR NEEDS TO BE CALIBRATED EVERY 3 MONTHS FOR PROPER OPERATION OF GAS DETECTING EQUIPMENT WITHIN THE HOGEN GENERATOR.

The following items are needed to perform the calibration:

- Combustible Gas Sensor Calibration Kit OR:
  - 2 Percent Hydrogen in Air Calibration Gas
  - Calibrated Air Flow Meter capable of reading 0.5 to 1 liter/minute (Included in the Cal Kit with the regulator and the valve.)
- Gas Sensor Calibration Hood
- Portable Gas Detector and Charger for 115V or 220V applications
- 8 mm hex Wrench
- 5/16” Wrench

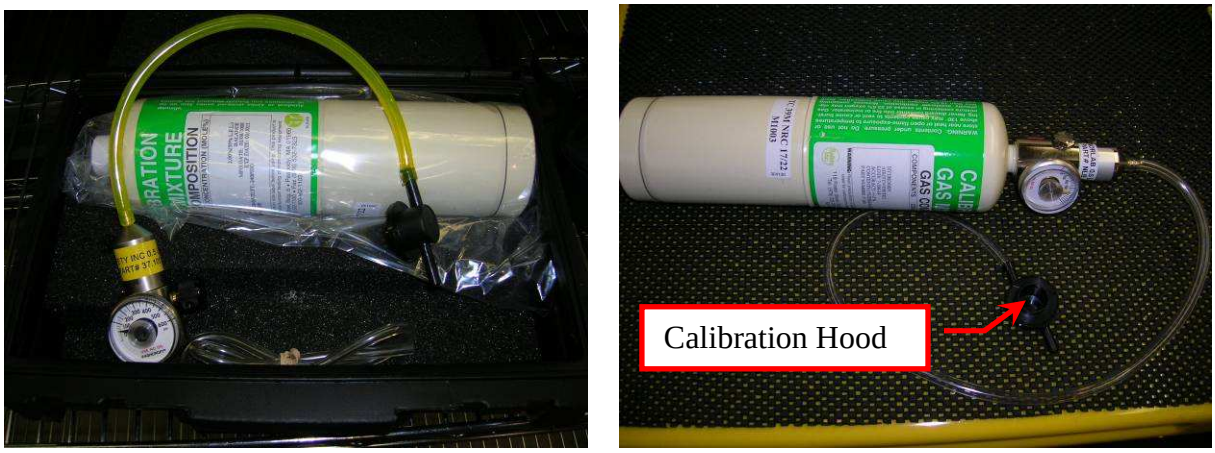


Figure 14 Combustible Gas Sensor Calibration Kit with Calibration Hood

Use the following procedure to calibrate the combustible gas sensor:

1. Shutdown the system and remove power using the main power disconnect switch on the rear panel of the unit.
2. Gain access to the fluids bay and remove the combustible gas sensor head by removing the two (2) screws that hold the sensor head mounting plate to the sensor shield. See Figure 15.

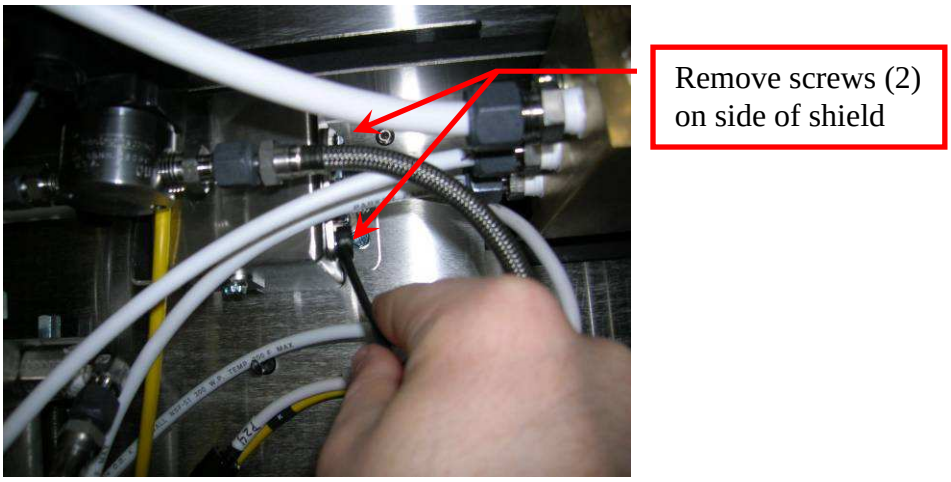


Figure 15 Combustible Gas Sensor Removal

3. Pull the sensor head and plate from the assembly. See Figure 16. Do not disconnect the wiring harness as the sensor needs to be powered to complete the calibration.

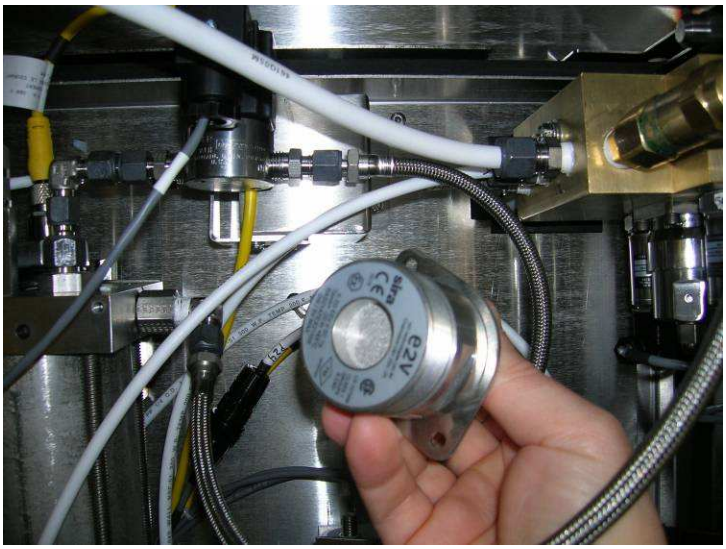


Figure 16 Combustible Gas Sensor Removed

4. Power up the system while depressing the "SELECT" and "SYSTEM PRESSURE" buttons. This enters the system into the combustible gas sensor calibration state.
5. After powering up the system in the calibration state, the symbol "6CAL" displays for 10 seconds to signify gas calibration.
6. After the "6CAL" symbol is removed, the symbol "00PC" is displayed to signify 0 percent LFL.
7. Depress the "START" button to begin a 30 second timer to allow the gas sensor to stabilize to 0 percent LFL. Once the "START" button is depressed, the display counts down from 30 to 0.
8. Upon completion of the countdown, "donE" is displayed. Then select the "START" button to continue. No further action is accepted until "donE" appears.
9. Once the "START" button is selected, the symbol "50PC" is displayed.
10. Select the "UP" display scroll button to increase or the "DOWN" display scroll button to decrease the display reading to match the percentage level of calibration gas being used. The acceptable range of calibration gas is 30 percent to 50 percent LFL. The first two digits of the display changes to reflect the selection. Values increase by 1 percent LFL.

% LFL	% Hydrogen in Air	% LFL	% Hydrogen in Air
50	2	39	1.56
49	1.96	38	1.52
48	1.92	37	1.48
47	1.88	36	1.44
46	1.84	35	1.4
45	1.8	34	1.36
44	1.76	33	1.32
43	1.72	32	1.28
42	1.68	31	1.24
41	1.64	30	1.2
40	1.6		

Table 6 Percent LFL to Hydrogen in Air Conversions

11. Install the calibration hood onto the combustible gas sensor head. When installing the calibration hood onto the combustible gas sensor, attach one of the tube ends on the hood to a ¼" flex hose, which is connected to the calibration gas supply. The other tube end remains open to the atmosphere.

Figure 17 Calibration Hood installed on Combustible Gas Sensor

12. Open the calibration gas supply and allow 0.5 to 1 liter/minute of calibration gas to flow to the combustible gas sensor. (Fully open the calibration gas supply when using the Cal Kit. An orifice located within the valve assembly sets the correct flow rate.)
13. Once there is flow to the combustible gas sensor head then select the "START" button to begin a 60 second timer to allow the gas sensor to stabilize to the user-selected percentage of LFL. Once the "START" button is depressed, the display counts down from 60 to 0.
14. Upon completion of the countdown, "donE" is displayed. The "START" button must be depressed to continue. Do not turn off Cal gas until you depress the "START" button. No further action is accepted until "donE" appears.

CAUTION

When not using the calibration gas, the supply should be shut off.

15. Once the "START" button is selected, the message "OFF" is displayed.
16. Ensure the Cal gas bottle is turned Off.
17. Cycle the power to the unit by shutting off the power to the unit through the main power disconnect switch on the rear panel.
18. At any point during the calibration procedure (except during timer countdown), if an error has occurred or if the user must repeat the previous step, the "STOP/RESET" button may be depressed. Depressing the "STOP/RESET" button cancels all actions of the current step and brings the user back to the previous step. A calibration error is signified by displaying "EAA".
19. To verify calibration, power up the system while depressing the "SELECT" and "PRODUCT PRESSURE" buttons. This allows the system to enter the combustible gas sensor verification state.

20. After powering up the system in the verification state, the symbol "6CPC" displays for 10 seconds to signify gas verification.
21. After the " 6CPC" symbol is removed, the symbol "00PC" is displayed to signify 0 percent LFL (assuming the sensor is reading 0 percent LFL).
22. Apply the calibration gas to the sensor head by turning on the calibration gas supply. The first two digits of the symbol "00PC" change based on the sensed value of combustible gas. If the "0" and cal gas percent readings are not within +/- 2 percent LFL as determined by the user, the calibration procedure is to be repeated. If the verification readings are acceptable, shut down the system using the main power disconnect switch.
23. Reinstall the combustible gas sensor removed in Step 2 using the two (2) retention screws.
24. Restart the unit in normal operating mode.

3.8 Installing the Cell Stack

The cell stack is typically installed in the system prior to shipment. However, if freezing conditions were anticipated, the cell stack may have been shipped separately. In that event, separate installation instructions will be provided with the cell stack.

Store the cell stack in a non-freezing area. The installed stack is full of water and has all input and output ports capped. Connections to the stack should be the last step in the installation process and should not be done until all previous steps are completed.

WARNING

NEVER ATTEMPT TO DISASSEMBLE THE CELL STACK, AS THERE ARE NO SERVICEABLE PARTS INSIDE. AVOID CONTACT WITH THE POSITIVE BUSS PLATE AS A CAPACITIVE CHARGE IS RETAINED AND A SEVERE ELECTRICAL SHOCK MAY RESULT. IF YOU SUSPECT A PROBLEM WITH THE CELL STACK, PLEASE CALL PROTON'S SERVICE DEPARTMENT IMMEDIATELY.

CAUTION

Never leave the input and output ports uncapped. Irreversible damage to the stack results if it is allowed to dehydrate.

3.9 Hydrating the Cell Stack

In the event the HOGEN S Series 2 hydrogen generator is not placed in service upon receipt, the cell stack must be properly hydrated.

CAUTION

Check for DI water content in the hoses every 30 days. If DI water is not present in the hoses, rehydrate the hoses as needed. A hydration kit is available through PROTON (KT-1000-0022).

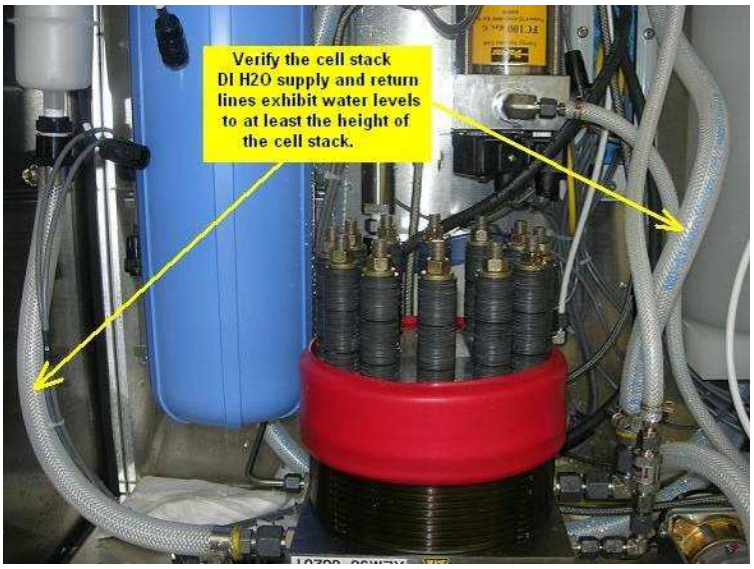


Figure 18 Cell Stack and Hydration Hoses

Perform the following procedure to hydrate the cell stack:

1. Apply power to the generator, by turning the breaker to the "ON" position.
2. Wait for the green "START" button/LED to begin flashing.

NOTE

It may take approximately 20 minutes for the light to begin flashing after power is applied to the unit. If the feed water pressure is low, it may take over an hour for the internal water vessels to fill. If this occurs, Error Code 15 is triggered and the system needs to be reset.

3. Once the light is flashing, depress the "START" button.
4. After 20 seconds, depress the red "STOP" button. DO NOT use the "EMERGENCY STOP" button to shut the system down.

NOTE

The yellow "GENERATE" light illuminates after 120 seconds, indicating hydrogen generation. If you do not wish to generate hydrogen, it is important to press the red "STOP" button before the 120-second time period to stop the system.

5. The system circulates water through the cell stack for 60 seconds after the "STOP" button is depressed.

4 OPERATION

The HOGEN S Series 2 hydrogen generator is a fully automated system. Upon depressing the green "START" key, the system starts a control sequence that leads to the generation of hydrogen gas. Error codes are embedded in the control scheme of the HOGEN generator. The error codes spawn from the monitoring of system parameters.

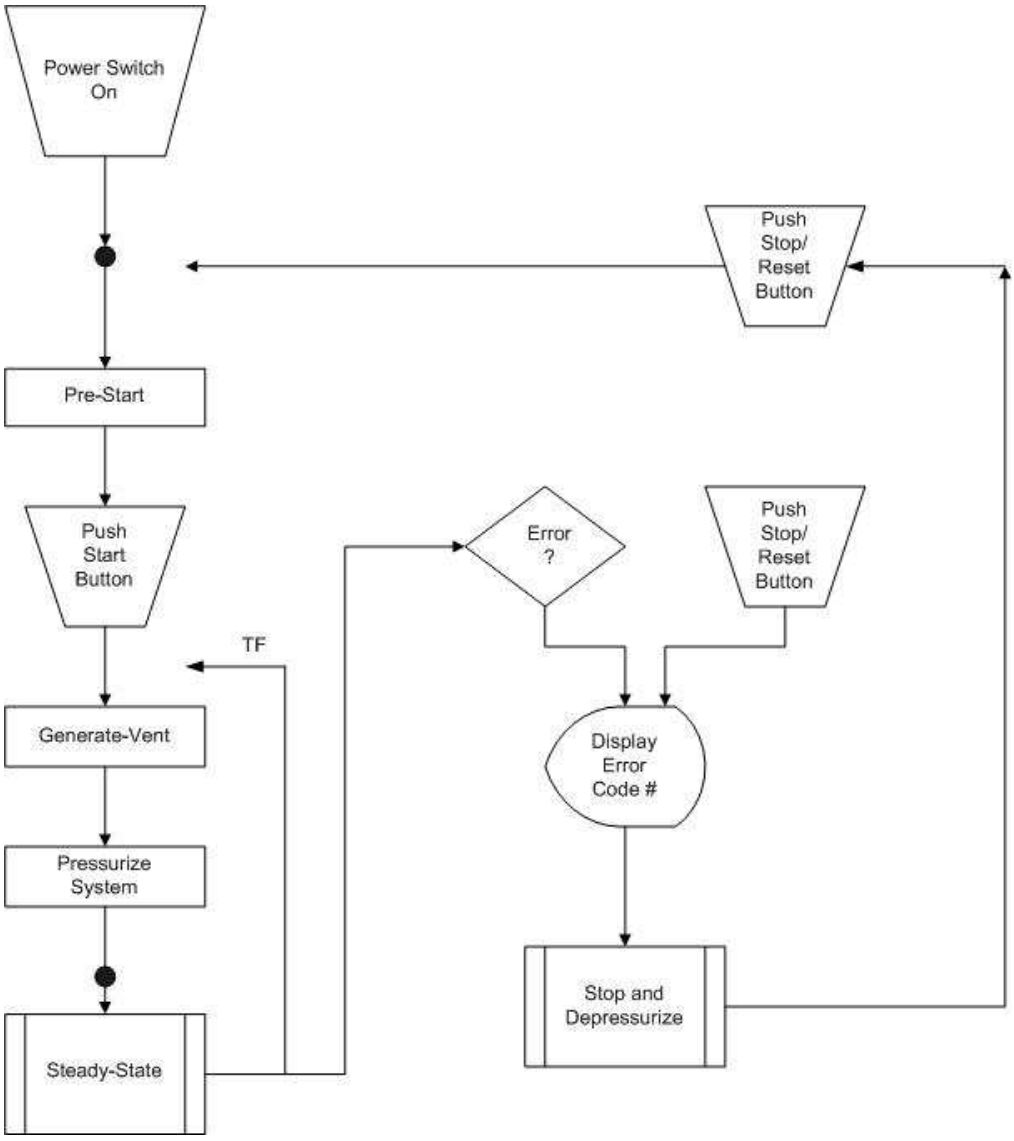


Figure 19 Basic Control Sequence

4.1 Control Panel

The HOGEN S Series 2 hydrogen generator's control panel contains all the buttons to operate the unit. Figure 20 shows the layout of each interface point.

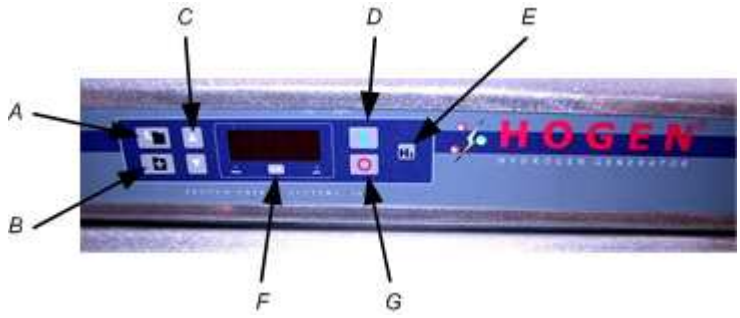


Figure 20 Control Panel Details

Reference	Detail	Reference	Detail
A	Product Pressure	E	Hydrogen Generation Indicator
B	System Pressure	F	Units Toggle (Select)
C	Display Scroll Keys	G	Stop/Reset Button
D	Start Button		

Table 7 Control Panel Details

4.2 Turning ON the Main Power

Turning on the main power to the cabinet initiates the on-board air purge blower. The blower pressurizes and cools the cabinet. The cabinet doors must remain closed and secured in place, as the cabinet must maintain a minimum of 0.2" water column (25 Pa) pressure in order for the system to operate.

1. Verify the cabinet doors are closed and secured.
2. Verify the air inlet and exhaust openings (refer to Figure 3) are not blocked.
3. Switch the Main Power Disconnect Switch (refer to Figure 3) from the OFF (**O** position) to the ON position (**I** position).

WARNING

POWER IS STILL PRESENT AT THE CIRCUIT BREAKER (Electrical Schematic Tag CB101) IN THE GENERATOR UNTIL THE MAIN POWER DISCONNECT SWITCH IS DEPRESSED TO THE OFF POSITION.

WARNING

ONLY USE THE E-STOP IN EMERGENCY SITUATIONS. TO REMOVE POWER TO THE SYSTEM, USE THE STOP BUTTON ON THE KEYPAD DISPLAY AND WAIT FOR THE SYSTEM TO COMPLETE A NORMAL STOP (RED LED ON STOP BUTTON WILL BE FLASHING).

4.3 PRE-START Operation

PRE-START operation begins automatically when the main power disconnect switch is turned ON. During this operation the following occurs:

1. The system flushes itself out if water quality is below the required resistivity.
2. Water levels in the oxygen/water phase separator (P&ID Tag A200) and hydrogen/water phase separator (P&ID Tag A300) are adjusted if they are low.
3. During the PRE-START process, a dashed line moves across the center of the display.

Once the PRE-START operation is complete, the green “START” key light flashes indicating the completion of the PRE-START state. The operator can either allow the HOGEN generator to maintain an idle state or enter the GENERATE-VENT state by pushing the green “START” key.

4.4 GENERATE-VENT Operation

The GENERATE-VENT state is initiated after all of the PRE-START conditions are met and the operator presses the green “START” button. Pressing the button at this time activates the following sequence:

1. The circulation pump (P&ID Tag CP205) is turned on.
2. The water flow rate is verified.
3. The quality of the water is verified.
4. During the circulation tests, a dashed line moves in a “racetrack” pattern around the perimeter of the display.
5. Full current is applied to the system after approximately 120 seconds. Once current is applied to the cell stack, a yellow H_2 indicator light illuminates, signaling that hydrogen is being generated.
6. The system verifies hydrogen/water phase separator (P&ID Tag A300) level controls.
7. The system verifies the voltage conditions within the cell stack.
8. The system verifies the rectifier operation.

During the sequence, the system vents oxygen and hydrogen at full production. Once the system goes through the sequence above and the unit passes all the checkpoints

(approximately 60 seconds), the unit closes the vent valve (P&ID Tag SV329) and the system begins pressurization.

4.5 PRESSURIZE STORAGE Operation

This operation starts when the HOGEN generator's vent valve (P&ID Tag SV329) closes after the GENERATE-VENT state. During this state, the system pressurizes its hydrogen lines up to the back pressure regulator set point. The system pressure is set through the backpressure regulator (P&ID Tag BPR310).

4.6 STEADY-STATE Operation

During STEADY-STATE operation, the system outputs hydrogen through its product hydrogen port. There are two modes the system can run in during STEADY-STATE operation: load following mode or tank filling mode.

4.6.1 Load Following Mode

This mode maintains pressure at the set point (225 psig for current production units and 200 psig for early production units) as long as the demand for hydrogen does not exceed the rated capacity of the product.

4.6.2 Tank Filling Mode

In tank filling mode, the product pressure transducer (P&ID Tag PT312) controls the gas generation cycle of the HOGEN generator. At pressures below the product pressure set point, full rated flow of hydrogen is delivered. When product pressure reaches the product pressure set point, the power used to generate hydrogen is automatically switched off and the unit goes into an idle state. The HOGEN generator maintains the idle state until the product pressure drops below the product refill pressure set point. When this does occur, the HOGEN generator again delivers full gas production until the product pressure reaches the product pressure set point.

4.7 Monitoring Operation

The HOGEN S Series 2 hydrogen generator is equipped with on-board sensors to monitor system conditions within the unit. The digital display is a 4-digit/ 7-segment display with the ability to display five different parameters during normal operation:

- **Pressure Set Point**: The output of the pressure set point circuit is scaled for 0 to 225 psig (0 to 1,551 kPa) (200 psig for units before serial number 342) and is accessed by pressing either display scroll key for 5 seconds. There are two pressure set points that can be set, Product Pressure and System Pressure. The Product Pressure Key and the System Pressure Key gives the operator the ability to toggle between the two values.
- **Operating Parameters**: Basic system operating parameters can be accessed once the system has reached pressure and is delivering gas. The parameters can be displayed by adjusting the up/down arrow keys while the generator is in this mode of operation. The display of a particular parameter is preceded by a 2-letter symbol identifying the parameter on display. The following is a list of parameters and the associated symbol identifier:

Parameter	Units		Symbol
	English	SI	
System Pressure (default)	PSI	kPa	SP
Product Pressure	PSI	kPa	PP
Hydrogen Flow Rate	SCFH	LPM	HF
System Temperature	℉	℃	SE
Cell Stack Voltage	VDC	VDC	SU
Cell Stack Current	Amps	Amps	SC

* If kPa is selected for pressure display then LPM and °C will be displayed

Table 8 Operating Parameters

The display area has an indication of the measurement units in use, English or SI. Underneath the 4-digit/ 7-segment display is a button to toggle between the two unit measurements.

- **Elapsed Timer**: The amount of time that has elapsed in 10-hour counts of system generation time (current >1 amp) can be accessed through the display panel. Pressing both the product and system pressure keys simultaneously for 5 seconds accesses this option.
- **Error Code**: The output from the shutdown circuit is displayed as a numerical code 0-43.
- **System Idle Condition**: When the water levels are being adjusted, the display segments flash in a sequential pattern.

4.8 Automatic Warnings

The HOGEN S Series 2 hydrogen generator provides an automatic warning when the combustible gas sensor (P&ID Tag CG220) has not been calibrated within 14 days of its three (3) month calibration interval. If the sensor has not been calibrated, the LED display flashes "C-00" for one (1) second, and then returns to normal display for five (5) seconds before flashing the warning again. The combustible gas sensor must be calibrated and the power to the unit must be cycled for the warning to be cleared. Once the calibration interval is beyond the three (3) month interval, the warning results in an automatic shutdown with error code E-25 shown on the LED display.

The HOGEN S Series 2 hydrogen generator is equipped with software that monitors the health of the combustible gas sensor. It detects a blocked or a removed gas sampling line from the oxygen/water phase separator to the combustible gas sensor and provides combustible gas sensor health check monitoring based on hydrogen/water phase separator cycles. The software provides an automatic warning if it detects the combustible gas sensor is not sensing an adequate flow of hydrogen. The automatic warning flashes "C-01" if a too low level of combustible gas is detected. The automatic warning flashes "C-02" if an expected cyclical pattern of combustible gas is not detected.

To clear the warning, the system must be stopped and the combustible gas sensor must be calibrated. While calibrating the combustible gas sensor, it is recommended that the sample stream to the combustible gas sensor (from the oxygen/water phase separator) be checked for loose connections or signs of blockage. Once the sample line is verified to be functioning properly, restart the system and verify the warning has cleared and does not reappear. Continued warnings could signify problems with the combustible gas sensor.

The HOGEN S Series 2 hydrogen generator is also equipped with software that monitors the system temperature. In the event the system temperature falls below a specified limit, "C-30" flashes as a warning providing 48 hours of operation prior to an "E-30" shutdown. (See Table 9 for other warnings.)

4.9 Manual Shutdown

Manual shutdowns of the HOGEN S Series 2 hydrogen generator occur in three ways: by pressing the red "STOP/RESET" button, engaging the E-Stop, or switching the main power disconnect switch to the OFF position.

Do not use the E-Stop or main power disconnect switch to stop gas generation except in the event of emergency. To properly stop the process or reset the control processor, press the red "STOP/RESET" button.

By pressing the red "STOP/RESET" button, the following sequence occurs:

1. The system de-energizes all outputs, except the circulation pump.
2. Water is circulated for 60 seconds after the button is pressed.
3. The power supplies are disabled.
4. The system displays an error code.
5. The system waits for the red "STOP/RESET" button to be pressed again, which resets the controller.

NOTE

The operator is not allowed to reset the unit until the 60-second circulation of water is complete.

By switching the main power disconnect switch OFF, all power for the system is disconnected simultaneously and the HOGEN generator is depressurized.

NOTE

The E-stop is a NORMALLY CLOSED circuit. *Engaging the E-Stop trips the contactor but leaves the breaker and line filter energized*. The generator safely depressurizes when the E-Stop is engaged.

CAUTION

Repeated manual stops while the system is operating in its generate-vent state may cause an A300 flooded condition. To avoid potential A300 flooded conditions and possible water in the plumbing lines downstream of the A300, PROTON highly recommends that, if possible, the operator wait until a generate-vent state is completed (after the initial 60 seconds of hydrogen generation) prior to manually shutting the system down.

4.10 Automatic Shutdowns

The HOGEN S Series 2 hydrogen generator provides automatic shutdowns through continuous monitoring of critical operating parameters. If a parameter is not within its specified limits, the controller takes the appropriate action to the HOGEN generator gas generation process. Upon shutdown of the unit, the controller shows the error code for the type of shutdown on the 4-digit/ 7-segment display.

Code	Description	Default Limit	Sensor (P&ID Tag #)	Time Activated
C-00	Calibration Gas Warning	> 3 Months	N/A	On Power Up
C-01	Calibration Gas Drift Warning	< 2 % LFL	CG220	On Start Switch
C-02	Calibration Gas Peak Warning	< 1 % LFL	CG220	On Start Switch
C-03	System Pressure Low Warning	< 180 psig	PT307	On Pressurize + 60/120 Sec (S40/S20 & S10 Dependent)
C-04	VCC Low Warning	VCC < 4.75	N/A	On Power Up
C-05	VCC High Warning	VCC > 5.25	N/A	On Power Up
C-06	VEE Low Warning	VEE < -5.25	N/A	On Power Up
C-07	VEE High Warning	VEE > -4.75	N/A	On Power Up
C-08	3VDC Low Warning	< 3.135	N/A	On Power Up
C-09	3VDC High Warning	> 3.465	N/A	On Power Up
C-10	24VDC Low Warning	< 22.8	N/A	On Power Up
C-11	VREF Low Warning	< 22.8	N/A	On Power Up
C-12	VREF High Warning	> 25.2	N/A	On Power Up
C-13	High Product Pressure	> 250 (220*) psig	PT312	On Power Up
C-30	System Temperature Low Warning	< 5C	TS218	On Circ. Test + 10 Sec
E-00	Manual Shutdown	Switch Closure	Stop Switch	On Power Up
E-01	Cell Voltage High	> (# Cells x 2.6)	N/A	On Generate + 5s
E-02	Cell Voltage Low	< (# Cells x 0.5)	N/A	On Generate + 5s
E-03	A200 Empty	< Empty Level	LS201-1	On Start Switch
E-04	A200 Flooded	> Flooded Level	LS201-4	On Drain + 30s
E-05	A300 Empty	< Empty Level	LS301-1	On Generate
E-06	A300 Flooded	> Flooded Level	LS301-4	On Generate + 15/30s (S40/S20 & S10 Dependent)
E-07	Poor Water Quality	< 1 MΩ-cm	RS209	On Circ Test + 20s
E-08	Failed Water Quality Sensor	> 18 MΩ-cm	RS209	On Circ Test + 20s
E-09	Low Recirculation Flow	< 3.79 LPM (1GPM)	WS207	On Circ Test + 10s
E-10	System Pressure High	> Pressure Set Point + 25 (50*) psig	PT307	On Power Up
E-11	System Pressure Low	< 180 psig	PT307	C-03 + 180 sec
E-12	Product Pressure High	> Product Pressure Set Point + 25 (20*) psig	PT312	On Power Up
E-13	Hydrogen Leak Detected	> 50% LFL	CG220	On Power Up
E-14	System Temperature High	> 60°C	TS218	On Circ Test + 10s
E-15	A200 Pre-Start Timeout	> 2 Hours	LS201	On Power Up + 2 hrs

Code	Description	Default Limit	Sensor (P&ID Tag #)	Time Activated
E-16	A300 Pre-Start Timeout	> 2 Hours	LS301	On Power Up + 2 hrs
E-17	Rectifier #3 Fault	Fault Signal High	PWR102-3	On Generate + 5s
E-18	Cabinet Purge Pressure Low	< 0.2" Water Column	PS121	On Power Up + 10s
E-19	Rectifier #1 Fault	Fault Signal High	PWR102-1	On Generate + 5s
E-20	Rectifier #2 Fault	Fault Signal High	PWR102-2	On Generate + 5s
E-21	Processor Fault	Internal Watchdog Failure	N/A	On Power Up
E-22	FPGA Fault	Control Board		All States
E-23	High Current	> 150 Amps	PWR102-1	On Generate
E-24	A300 Flooded Restarts	1 Restart Max	N/A	After 1 E-06
E-25	CG Sensor Out of Calibration	Calibration Past Due	N/A	On Circ Test + 45s
E-26	E-Stop Circuit Fail	E-Stop (Open)	M101	On Power Up
E-27	CG Drift Error	< 2% LFL	N/A	On Generate
E-28	CG Peak Error	< 1% LFL Range on A300 Cycle	N/A	On Generate
E-29	CG Full Production Peak Error	< 1% LFL Range on A300 Cycle	N/A	On Generate
E-30	System Temperature Low	< 5°C	TS218	On Circ Test + 10s
E-31	State Machine Fault	Control Board		All States
E-32	Flow Switch	Closed on Power Up	WS207	Active at Power Up
E-34	A200 Invalid State		LS201	Active at Power Up
E-35	A300 Invalid State		LS301	Active at Power Up
E-36	System Pressure Transducer	Input is Below 0.25V	PT307	Active at Power Up
E-37	System Pressure Transducer	Input is Above 4.75V	PT307	Active at Power Up
E-38	Product Pressure Transducer	Input is Below 0.25V	PT312	Active at Power Up
E-39	Product Pressure Transducer	Input is Above 4.75V	PT312	Active at Power Up
E-40	System Temperature Sensor	Input is Shortened	TS218	Active at Power Up
E-41	System Temperature Sensor	Input is Open	TS218	Active at Power Up
* = value for units before serial number 342 or Tank Filling Units				

Table 9 Warning and Error Codes for HOGEN S Series 2 Hydrogen Generator

Table 9 lists the possible warning and error code displays, their cause, and the system response as warning or controlled shut down and depressurization. Consult the maintenance manual or PROTON field service for corrective action.

Code	Description	Comment	Sensor	Activated
S 0	Corrupt FPGA Load	Call Factory	N/A	On Power Up
S 1	Corrupt FPGA Scratch	Call Factory	N/A	On Power Up
S 2	Corrupt Dataflash Init	Call Factory	N/A	On Power Up
S 3	Corrupt Calibration Load	Load Calibration File	N/A	On Power Up
S 4	Corrupt PID Load	Load Configuration File	N/A	On Power Up
S 5	Corrupt Parameter Load	Load Configuration File	N/A	On Power Up
S 6	Corrupt GasCal Load	Calibrate CG sensor	N/A	On Power Up
S 7	Corrupt RTC Set	Set Time and Date	N/A	On Power Up
S 8	Corrupt RTC OSC	Call Factory	N/A	On Power Up
S 9	Corrupt Name & Password	Reset default passwords	N/A	On Power Up
S 10	Corrupt Generation Hours	Reset Elapsed Timer	N/A	On Power Up
S 11	Corrupt System Information	Load System Info File	N/A	On Power Up
S 12	Corrupt CG Test Load	Call Factory	N/A	On Power Up
S 13	Corrupt CG Drift Recal	Call Factory	N/A	On Power Up
S 14	Corrupt CG Peak Recal	Call Factory	N/A	On Power Up
S 15	Corrupt CG Full Prod Recal	Call Factory	N/A	On Power Up
S 16	Watchdog Test Failure	Call Factory	N/A	On Power Up
S 17	Post Remote Info Load	Load System Info File	N/A	On Power Up
S 18	Post Remote Email Load	Load System Info File	N/A	On Power Up

Table 10 Post Error Codes

4.11 Routine Maintenance and Extended Shut-down

Routine maintenance schedules are defined in the Maintenance Manual, PD-0200-0001. Operators should regularly inspect the incoming air filter to establish the change frequency required under local or seasonal conditions.

Extended shut down of the HOGEN S Series 2 hydrogen generator is considered to be one month or longer without operation. The HOGEN generator must be kept hydrated or damage to the PEM cell stack may occur. PROTON recommends a schedule of monthly operation of the generator to maintain good water hydration of the cell stack.

If you need to shut down the HOGEN S Series 2 hydrogen generator for a period of longer than 1 month, then make provisions to keep the cell stack hydrated.

Contact PROTON field service for advice on your application.

APPENDIX A: INSTALLATION CHECKLIST

Installation Checklist

This checklist is intended to guide installation personnel during the initial installation of a HOGEN hydrogen generator at a customer site. This form should be completely filled out and faxed back to Proton personnel arriving on-site for the installation verification and initial start-up phase.

1. Power

1.1 Provide the plated electrical service including Protective Earth ground to the hydrogen generator following local wiring codes for industrial equipment installation.

(Refer to Section 3.5)

Initial	Date

1.2 Verify proper electrical service is provided for the installation

Unit	Volts	Phase	Amps	Hz	kVa
S10	205-240	1	30	50/60	5.8
S20	205-240	1	30	50/60	7.2
S40	205-240	1	50	50/60	12.0
Actual:					

Initial	Date

2. Fluids Hookup

2.1 General guidelines

All water, drain and vent lines should be heat traced and insulated if freezing temperatures may be experienced.

All plumbing materials should conform to the guidelines outlined in Section 3.6. Listed below are the fluid connections that need to be connected prior to system operation.

- Feed water in accordance with ASTM TYPE II minimum required ASTM TYPE I recommended

(>1 MΩ-cm)

Initial	Date

- DI water drain connected and free from obstruction and freezing

Initial	Date

- Verify the oxygen vent is free from obstruction and freezing

Initial	Date

- Hydrogen vent installed in accordance with local codes and free from obstruction and freezing

Initial	Date

- Hydrogen product connected to process in accordance with local codes

Initial	Date

NOTE

Pressure must be reduced prior to the process connection if less than 200 psig is required.

3. Site Information

Generator Model:	Serial Number:
Customer Name:	
Customer Site:	
Site Contact:	
Site Phone #:	
Signature:	Date:

Please fax Installation Checklist to:

ATTN: Customer Service at **203-949-8016**

APPENDIX B: OPTIONS DIAGRAM

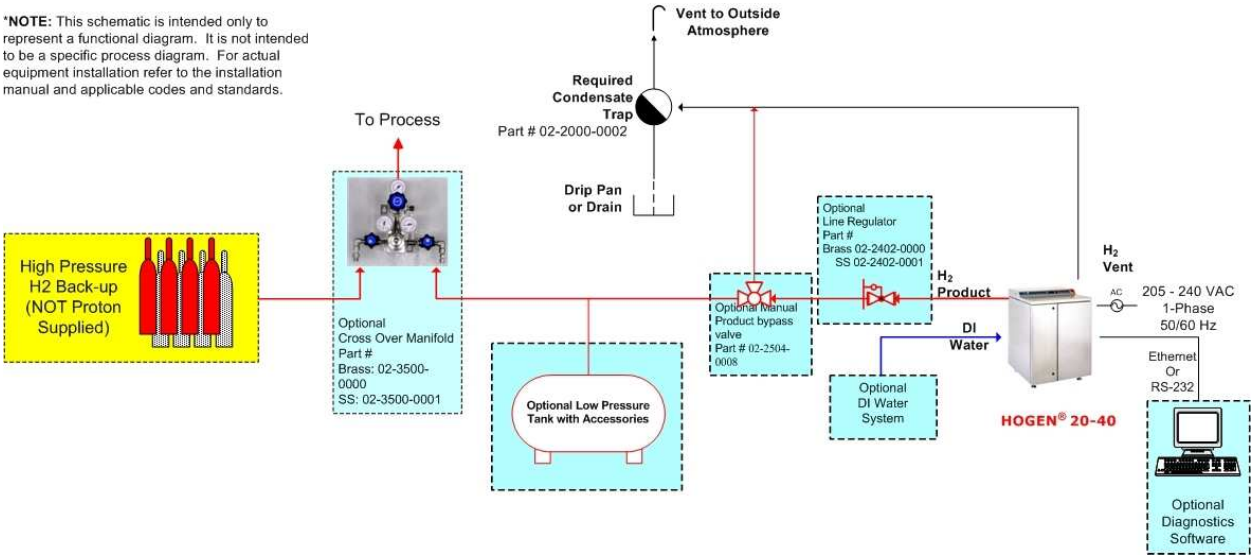


Figure 21 Options Diagram

APPENDIX C: CROSSOVER MANIFOLD OPTION

The crossover manifold option is available for use when high-pressure, backup storage is desired.

Figure 22 Crossover Manifold

The crossover manifold is available from PROTON using the following part numbers:

- Part # 02-3500-0001 for SS
- Part # 02-3500-0000 for Brass

NOTE

There is a 50 psi pressure drop with this component.

To install the crossover manifold, use the following instructions:

1. The cross over manifold assembly is wall mountable.
    a. Hole Pattern: 3 13/16” X 5 ¼” on center. Hole Size: 5/16”

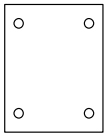


Figure 23 Wall Mountable Crossover Manifold Diagram

2. The left side of the manifold is for high-pressure feed and is labeled H.P. IN with a 4,000 psi pressure gauge. This side is connected to a storage tank or a high-pressure back up.
    a. Plumbing connection is: CGA or ¼” FNPT
3. The right side of the manifold is for low-pressure feed [hydrogen generator connection] and is labeled L.P. IN with a 250 psi pressure gauge.
    a. Plumbing connection is ¼” CPI or ¼” FNPT
4. The hydrogen supply exit is located at the top right.
    a. Plumbing connection is ¼” CPI or ¼” FNPT

NOTE

This option may not be compatible with the StableFlow® Hydrogen Control System as part of the total integrated solution. Consult with the Proton Energy Systems Applications or Service Departments for further information.

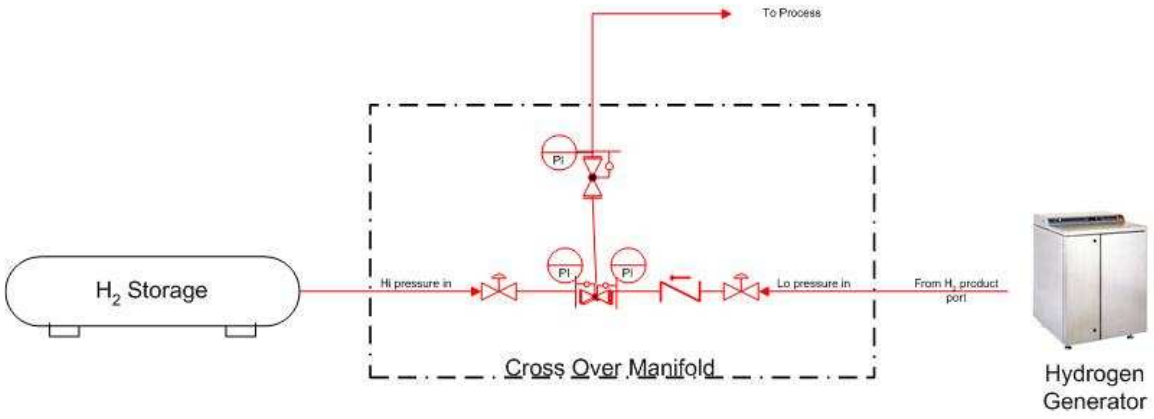


Figure 24 Crossover Manifold Diagram

APPENDIX D: PRESSURE REDUCING REGULATOR OPTION

The HOGEN S Series 2 is capable of supplying product hydrogen up to 200 psig. The hydrogen product line pressure can be reduced from 200 psig down to ambient using a pressure reducing regulator. The pressure reducing regulator may be installed anywhere between the product outlet on the HOGEN S Series 2 system and the point of use.

CAUTION

Selection of a regulator must be rated for hydrogen service.

NOTE

The reducing regulator should be sized for the desired pressure drop and maximum flow rate.

NOTE

The unit can only produce its rated output of flow. If flow requirements exceed the unit's rated output flow, it cannot maintain the desired delivery pressure.

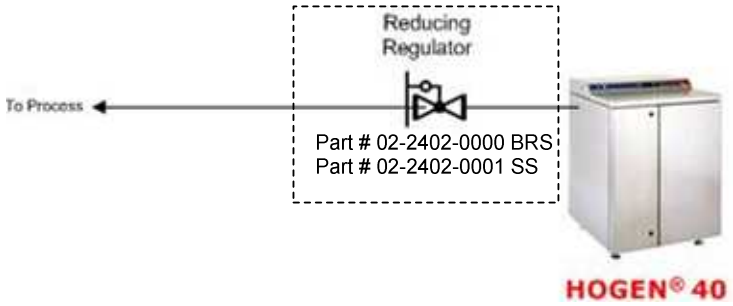


Figure 25 Pressure Reducing Regulator Schematic

APPENDIX E: DI WATER OPTION

Aqua Solutions® Deionized (DI) water treatment system is designed to support the S Series 2 HOGEN hydrogen generator. The system is designed to provide Type 2 or better DI water to one or more HOGEN S Series hydrogen generators. The system requires tap water, a drain and a grounded 100-240 VAC, 50-60 Hz electrical outlet in order to operate properly. The system can be bench, wall or shelf-mounted up to 10 feet from the hydrogen generator.

Figure 26 Aqua Solutions DI Water Option

Refer to the Aqua Solutions Model H-40-C Operating Manual, Revision 3.02 – 10/04 or later, for information regarding your DI water system.

APPENDIX F: WINDOWS DIAGNOSTIC SOFTWARE OPERATION

Windows-based Diagnostic Software is available as an option for the HOGEN S Series 2 hydrogen generator and can be purchased through Proton. The software enables users to monitor data, data log, modify configuration settings, and download software to the system control board. Instructions on how to operate these functions are detailed below.

System Information

To obtain miscellaneous system information use one of the two following procedure (screens cannot be used at the same time):

1. System Monitoring

   Monitoring I/O

   To monitor any analog or digital signal available from the system use the following procedure:

   1. Select VIEW > SYSTEM MONITORING from the toolbar.
   2. Select “Start Monitoring” button to start monitoring data
   3. Select “Stop Monitoring” button to stop monitoring data

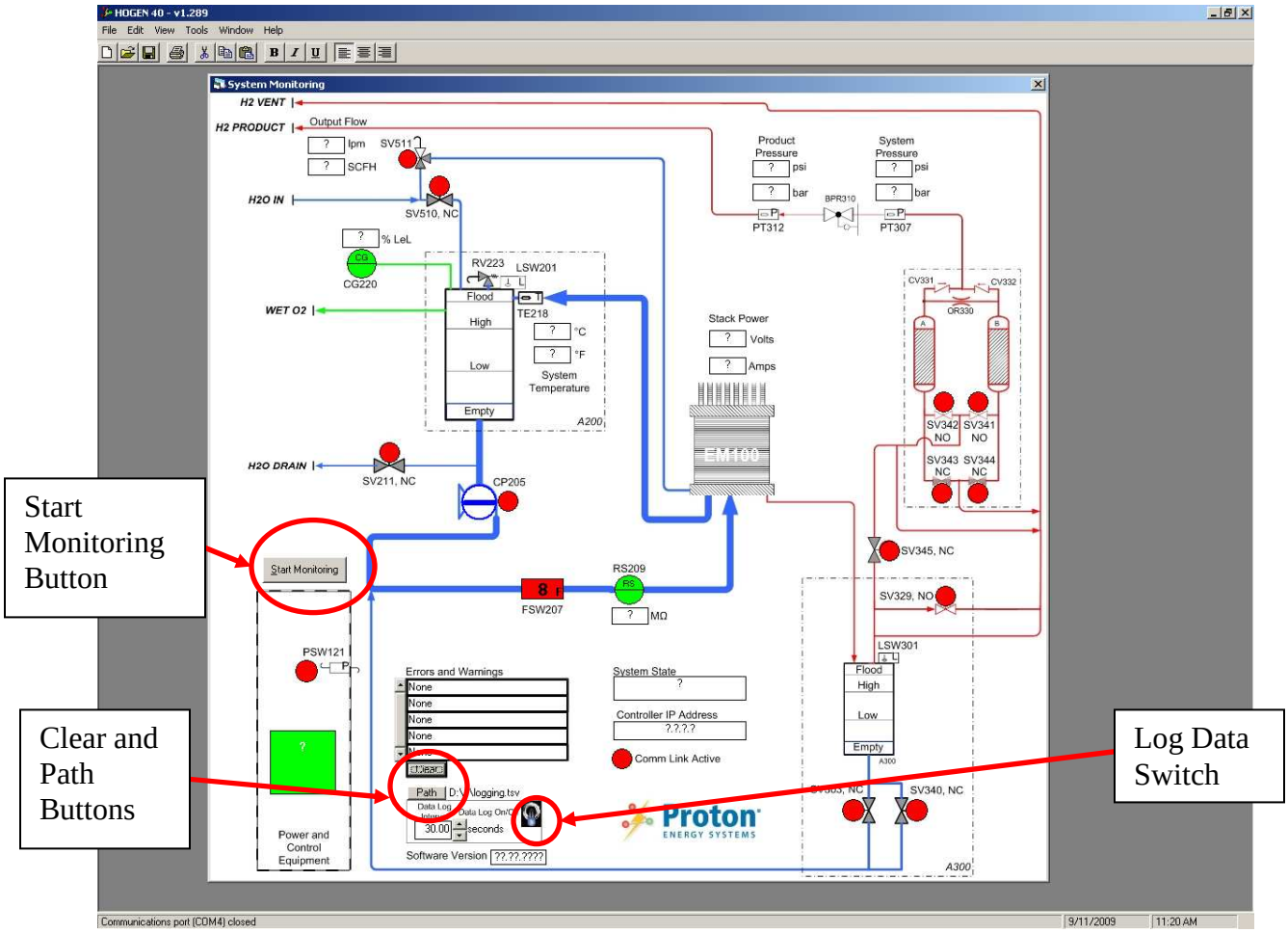


Figure 27 System Monitoring Screen

Logging Data

1. Select “Path” and choose a file name and location to log the data to.
2. Select a sampling Interval (minimum 3 seconds, maximum 60 seconds)
3. Click on the Log Data Switch

Errors and Warnings

Errors and Warnings are displayed live while the software is monitoring. To clear Errors and Warnings from the screen press the “Clear” button.

NOTE

The System Monitoring screen must be stopped (press the “Stop Monitoring” button) to perform other functions (use Diagnostics screen, get/set configuration or calibration files, etc.)

2. Diagnostics
   1. Select VIEW > DIAGNOSTICS from the toolbar.

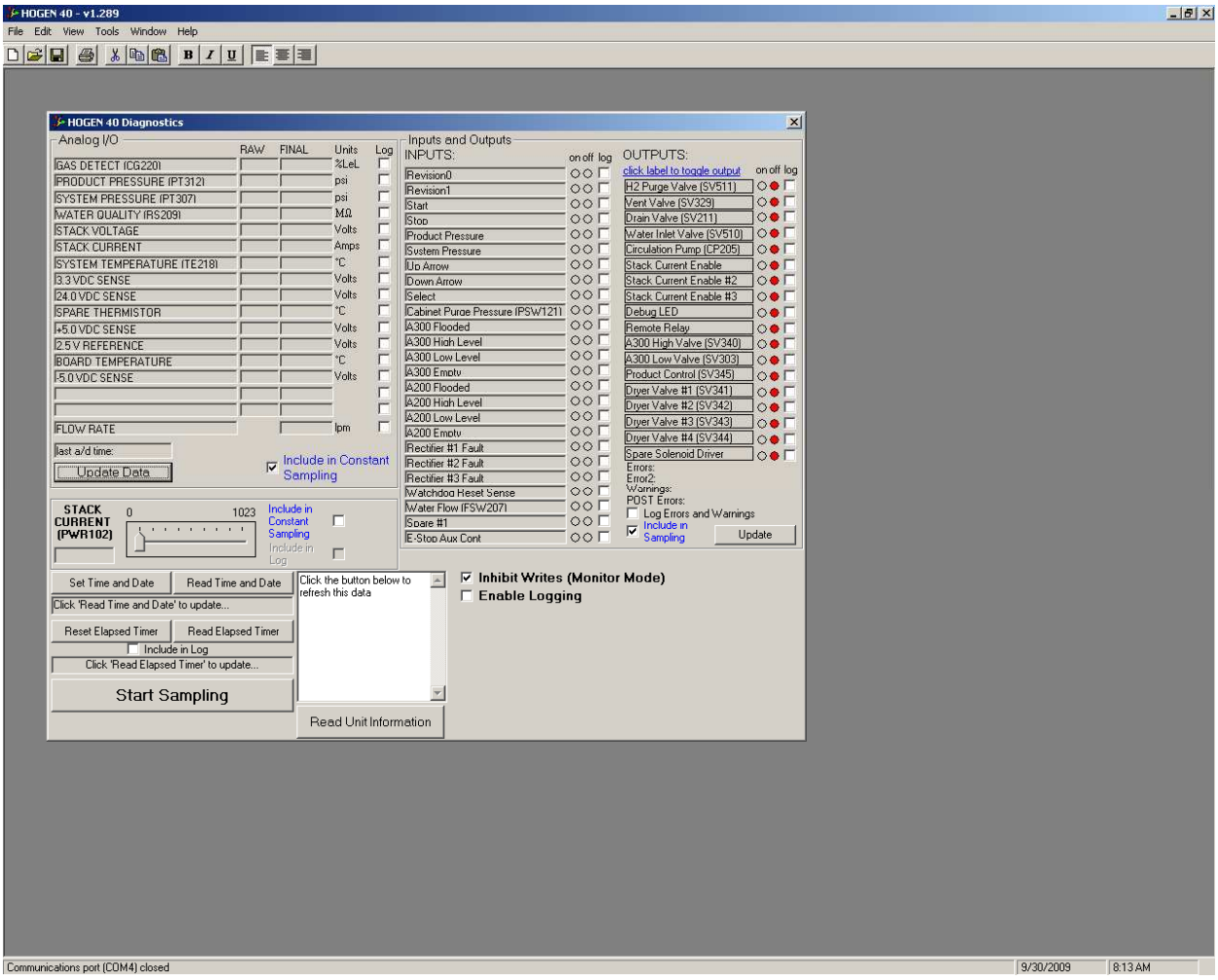


Figure 28 Diagnostics Window

2. Select the “Read Unit Information” button to obtain the FPGA version and the Board Hardware version.

3. To set or read the system time and date, select the appropriately labeled button. To set the system time and date requires technician level or higher security access.

4. To reset or read the system Elapsed Run Timer in hours, select the appropriately labeled button. To reset the system Elapsed Run Timer requires technician level or higher security access.

Monitoring I/O

To monitor any analog or digital signal available from the system use the following procedure:

1. Select VIEW > DIAGNOSTICS from the toolbar.
2. Once in the Diagnostics screen, ensure the “Inhibits Writes” box is checked.

3. Check the appropriate boxes for all signals desired for monitoring; i.e., Analog Inputs, Digital Inputs, Digital Outputs and Stack Current.
4. Select the "Start Sampling" button to begin data monitoring.
5. Select the "Stop Sampling" button to end data monitoring.
6. To perform updates for particular sets of I/O, select the "Update Data" button.

NOTE: For Digital Inputs and Outputs: Green implies "ON", or that a state has been met. Red implies "OFF", or that a state has not been met.

Logging I/O

To data log any analog or digital signal available from the system use the following procedure:

1. Select VIEW > DIAGNOSTICS from the toolbar.
2. Once in the Diagnostics screen, ensure the "Inhibits Writes" box is checked.
3. Ensure the "Enable Logging" box is checked.
4. Check all Log boxes for signals desired for logging. Use "All" and "None" buttons as required.
5. Select a desired sample rate from the pull down menu.
6. Use the "Change Path" button to select the file where the data is to be logged to.

Configuration and Calibration Parameters

To retrieve or send configuration or calibration parameters (Technician level or higher security required for sending) use the following procedure:

1. Select VIEW > CONFIGURATION or CALIBRATION OPTIONS as required from the toolbar.
2. Select the "Get From Device" button to upload parameters from the system. (Note: Configuration parameters P-00 through P-11 will appear in the shaded boxes.)
3. Select the "Get From File" button to obtain a specific file (installed on host computer or via a network connection.)

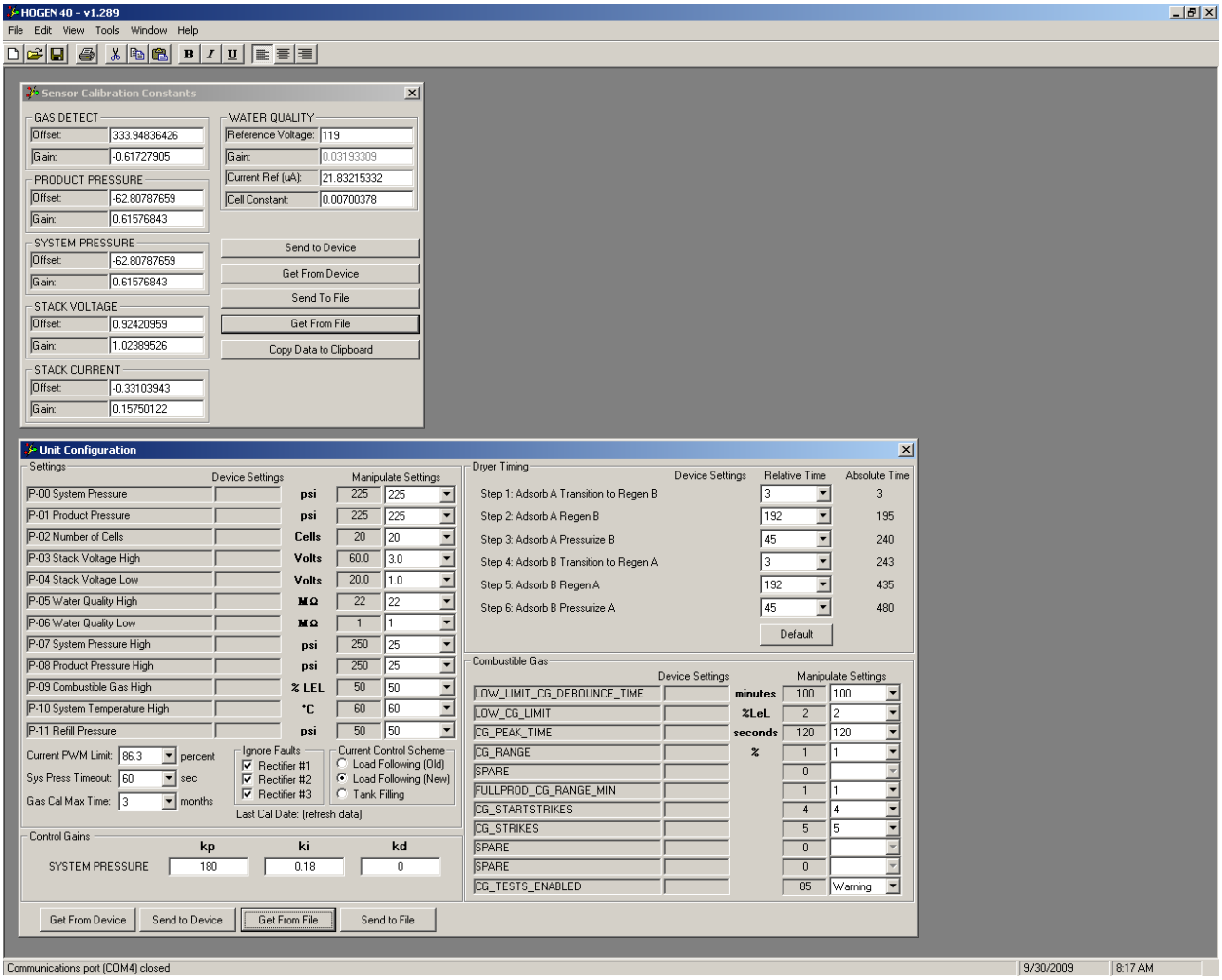


Figure 29 Configuration and Calibration Windows

4. Select the “Send to Device” button to send a particular set of parameters to the system.
5. Select the “Send to File” button to save a particular set of parameters to a file.
6. FOR CALIBRATION FILES ONLY: To copy the calibration constant values to a clipboard, select the “Copy Data to Clipboard” button.

Application and FPGA Downloads

To download application and FPGA codes to the system (Service Level or higher security required) use the following procedure:

1. Power off the unit.
2. Press and hold the stop and select button on the keypad display.
3. While holding the stop and select button power on the unit.

4. Continue to hold the stop and select button until the word IDLE is displayed on the screen. The unit is now in IDLE mode and it is safe to load the software.
5. Select VIEW > APPLICATION or FPGA OPTIONS as required from the toolbar.
6. To select a file to download, select the “Change Path” button (file installed on host computer or via a network connection.).
7. To download a listed file to the system, select the “Send to Device” button.

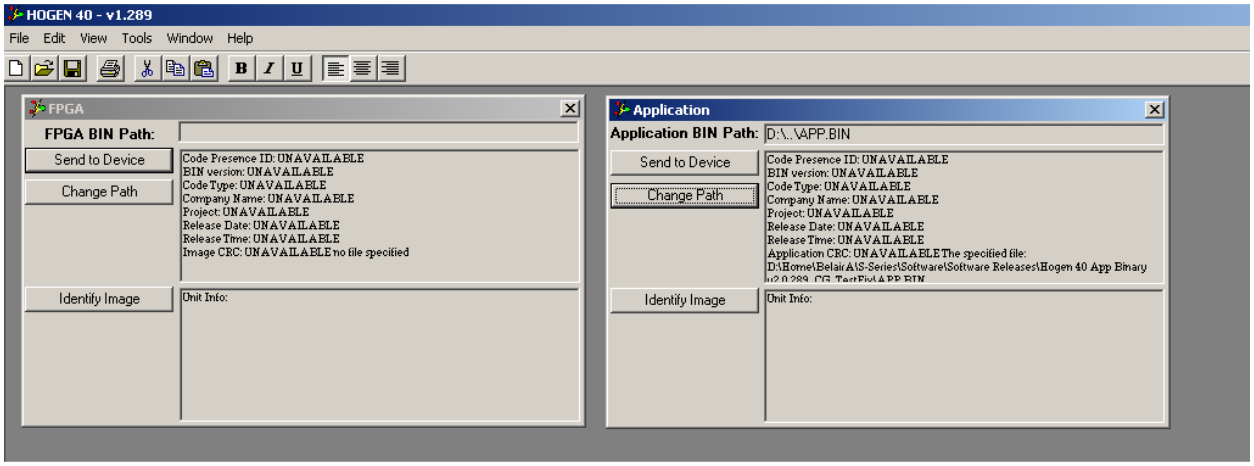


Figure 30 FPGA and Application Windows

8. Cycle power to the system after the device is sent.
9. FOR APPLICATION FILES ONLY: To retrieve the version of Application Code presently loaded into the system, select the “Get From Device” button. No security required for version retrieval.

Real Time Data Collection

To perform real time data collection use the following procedure:

1. Select VIEW > REAL TIME DATA and select the “Configuration” button.

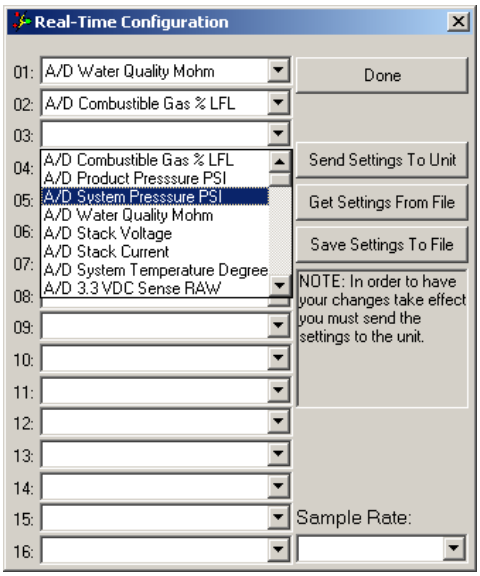


Figure 31 Real Time Data Configuration Window

a. To obtain a file of parameters/signals to collect, select the “Get Settings From File” button.

b. To save a particular set of data collection parameters to a file, select the “Save Settings To File” button.

c. To send a selected set of signals for data collection to the system along with a sample rate, use pull down menus as necessary to make selections. Upon completion of the selections select the “Send Settings To Unit” Button.

d. Upon completing the configuration setup for the Real Time Data Collection, select the “Done” button.

2. To monitor a pre-selected set of parameters (see Step 1), select the “Start Monitoring” button. To end the monitoring session, select the “Stop Monitoring” button.

3. To begin streaming data collection of a pre-selected set of parameters, select the “Start Streaming” button and verify the “Direct to File” box is checked.

   a. Select the file name and path to stream to, then select “Save”.

   b. To end the Real Time Streaming session, select the “Stop Streaming” button.

4. If communication to the system is lost while in the middle of real time streaming, select the “Reset Unit” button to stop the streaming process and allow for proper disconnection from the system.

Options

To set or adjust file paths and communication options use the following procedure:

1. Select TOOLS > OPTIONS from the toolbar.
2. To select the Communications Port and other settings, select the “Communications” tab and select the appropriate Com port for the local computer.
3. If communicating via a Communications Module over Ethernet, select the TCP/IP connection box and enter the IP address assigned to the Communications Module.
4. To select default file paths for configuration, calibration, Application and FPGA files, select the “Directories” Tab.

Usernames and Passwords

To log into the system use the following procedure:

1. Select TOOLS > LOG IN from the toolbar and enter a valid username and password (service level or higher security required).
2. To log out of the system, select TOOLS > LOG OUT from the toolbar.
3. To update usernames or passwords, select TOOLS > USERNAMES/PASSWORDS from the tool bar and enter a valid username and password.
    a. To obtain existing usernames and passwords from the system, select the “GET” button.
    b. To modify a username or password, make changes to the appropriate boxes. Selecting from the pull down menus can modify user levels.
    c. To send a set of usernames and passwords to the system, select the “SEND” button.

NOTE

A service/administrator must always be sent to the system or the username and password feature will no longer be fully operational to the customer once the service/administrator logs out of the system. Also, sending a list of new usernames and passwords without the default usernames and passwords will result in deleting the defaults from the control board.

4. Reference the attached Table for a list of username and password permissions.

Function Performed	Minimum Security Level
Set Time and Date	Technician
Reset Elapsed Timer	Technician
Calibration File Load	Technician
Configuration File Load	Technician
Application Load	Service

FPGA Load	Service
User Name and Password Change	Service
Real Time Data	N/A
Diagnostics Logging	N/A
Read Time and Date	N/A
Read Elapsed Timer	N/A
Read Calibration File	N/A
Read Configuration File	N/A
Read Application Version	N/A

Table 11 Function Needs for Usernames and Passwords

5. The Default password for the control board is (case sensitive):

   Username: Technician **Password:** PRTNTECH (Technician)

6. In the event they have been corrupted or eliminated, performing a specific power up sequence will retrieve default usernames and passwords. Power down the system. Power the system back up while depressing keypad buttons Start, Stop, Select, and the Up arrow simultaneously. Upon power up the control board will “chirp.” Once the “chirping” has stopped the default passwords will have been reset.

Errors/Warnings

To view a list of runtime error codes use the following procedure:

1. Select HELP > ERROR CODES from the toolbar.
2. To view a list of start up / power up error codes, select HELP > POST ERROR CODES from the toolbar.
3. To view a list of warning codes, select HELP > WARNING CODES from the toolbar.
4. To view a list of shutdown error codes, select HELP > ERROR CODES from the toolbar.
5. To view a list of Post (Power Up) error codes, select HELP > POST ERROR CODES from the toolbar.

Emulated Console

To view the Emulated Console, use the following procedure:

1. Select VIEW > CONSOLE from the toolbar.
2. The Emulated Console is a virtual representation of the front keypad display on the system. In order for the Emulated Console to be active, the Diagnostics screen must be Sampling Data.
3. To stop the generator remotely, select the STOP button [0] . Service level security required.
4. To reset or reboot the control board, select the [RESET] button. Service level security required. A RESET is required after any write command performed on the control board.

Pop Up Errors

To view the Pop Up Errors, use the following procedure:

1. Select VIEW > ERRORS from the toolbar.
2. The Pop Up Error box displays all current Warning and Shutdown Error Codes associated with the system.
3. In order for the Pop Up Error box to automatically display on a Warning or Shutdown condition, the Diagnostics screen must be Sampling Data.

Errors and Warnings can also be seen in the System Monitoring screen while monitoring the unit.

Communications over Ethernet (TCP/IP 10/100 Base-T)

Requirements:

- Host Computer with Windows 2000 or Windows XP Professional
- Ethernet Card and Associated Cable. Maximum Cable Length of 100 Meters between Transmitter and Receiver

System Information

To set or adjust Ethernet communication options for IP and Email addresses, use the following procedure:

1. Select VIEW > SYSTEMS INFORMATION from the toolbar.
2. Entries are required for the following sections and must be obtained from a Network Administrator: IP Address, Subnet Mask, Gateway, DNS Server, To Email Address, SMTP Server, and SMTP Domain.
3. The remaining sections can be entered in based on the user's specific descriptions. For example, the Model Number, Serial Number and Build Date are specific to the HOGEN generator. The Subject is the message appearing in the header each time an email is sent. To activate email notification in the event of a warning, shutdown or other system status change, ensure the Enable Remote Email Notify button is checked.
4. System information must initially be sent to the control board via RS232. The Communication Module leaves the factory with default settings.
5. A system power cycle or a control board reset is required for the parameter change to be accepted.
6. Select the "From Device" button to upload parameters from the system.
7. Select the "From File" button to obtain a specific file (installed on host computer or via a network connection).
8. Select the "To Device" button to send a particular set of parameters to the system.
9. Select the "To File" button to save a particular set of parameters to a file.

10. The “Send Test Email” button is for a feature to be activated in future releases (V287 and higher).

Communication Module Website

As a troubleshooting aid, the Communication Module hosts a simple website. This website consists of the PROTON logo along with a computer that is updated every five (5) seconds. In the event the user is unable to communicate to the Communication Module with Windows Diagnostics software, enter the IP address assigned to the Communication Module into the Address section of Windows Explorer (ex: http://192.168.10.99) and select ENTER. If the website can be accessed, then a connection to the Communication Module exists and the user must verify the System Information and Options sections of the Windows Diagnostic software.

NOTE

If while performing a Read or Write operation and communication is lost, a Socket Error message may appear at the bottom of the Windows Diagnostics page. If communication does not re-establish automatically, try on the following:

- Close and then Re-Open the Windows Diagnostics Software
- Reboot the Control Board

NOTE

To prevent a potential communication loss, perform only one action a time. For example, stop sampling or logging data prior to performing a “write” operation, such as logging into the system as a Technician. Also, once communication is re-established after a loss (such as reconnecting a cable), it may take up to 60 seconds before full communication to the control board can be restored.

APPENDIX G: COMMUNICATIONS MODULE SOFTWARE OPERATION

Communication over Ethernet

Requirements:

- Host Computer with Windows 2000 or Windows XP Professional.
- Ethernet Card and associated cable. Maximum cable length of 100 meters between transmitter and receiver.

Adjusting Ethernet Communication Options for IP and Email Addresses

To set or adjust Ethernet communication options for IP and Email addresses, use the following procedure:

1. Select VIEW > SYSTEM INFORMATION from the toolbar.
2. Entries are required for the following sections and must be obtained from a Network Administrator: IP Address, Subnet Mask, Gateway, DNS Server, To Email address, SMTP Server, SMTP Domain.
3. The remaining sections can entered in based on the user's specific descriptions. For example, the Model Number, Serial Number and Build Date are specific to the HOGEN Generator. The Subject is the message appearing in the header each time an email is sent. To activate email notification in the event of a warning, shutdown, or other system status change, ensure the Enable Remote Email Notify button is checked.
4. System information must initially be sent to the control board via RS232. The Communication Module leaves the factory with default settings.
5. A system power cycle or a control board reset is required for the parameter change to be accepted.
6. Select the "From Device" button to upload parameters from the system.
7. Select the "From File" button to obtain a specific file. (Installed on host computer or via a network connection.)
8. Select the "To Device" button to send a particular set of parameters to the system.
9. Select the "To File" button to save a particular set of parameters to a file.
10. The "Send Test Email" button is for a feature to be activated in future releases (V286 and higher).

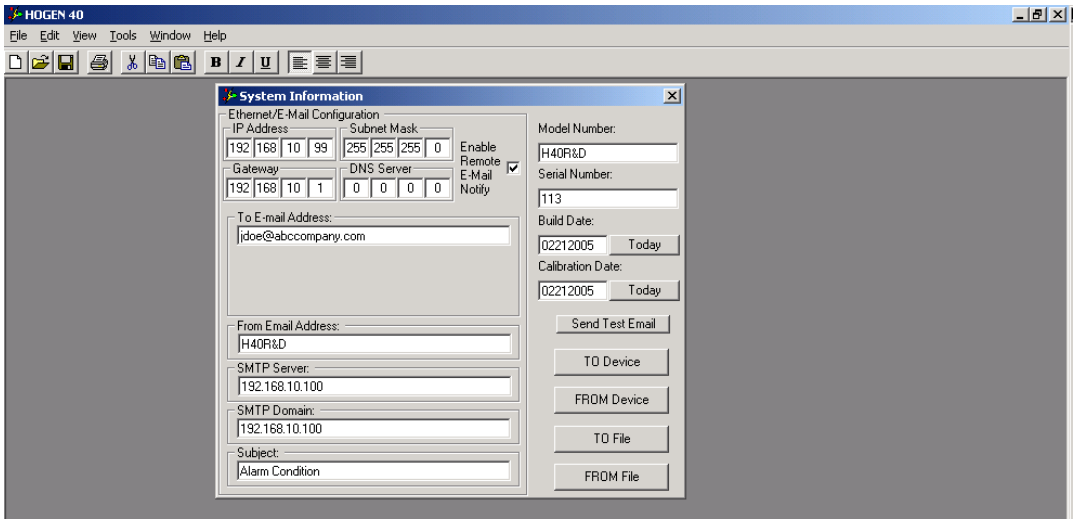


Figure 32 Ethernet System Information Window

Communications Module Application

To download the Communication Module application (Service Level or higher security required) use the following procedure:

1. Select VIEW > COMM MODULE OPTIONS as required from the toolbar.
2. To select a file to download, select the “Change Path” button. (The file installed on host computer or via a network connection.)
3. To download a listed file to the system, select the “Send to Device” button.
4. A system power cycle or a control board reset is required for the parameter change to be accepted.

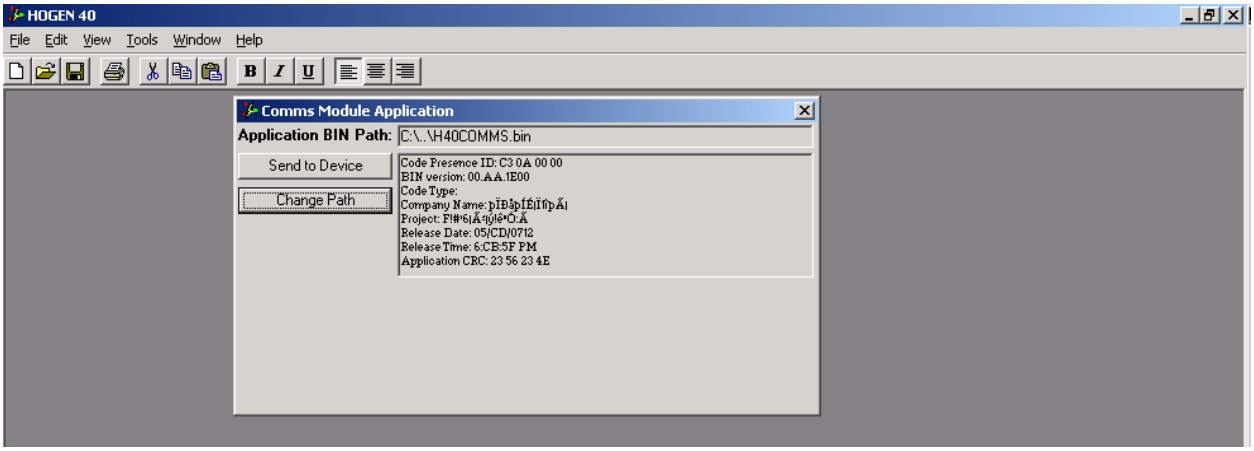


Figure 33 Communications Module Application Window

Communications Module Website

As a troubleshooting aid, the communications module hosts a simple website. This website consists of the Proton logo along with a counter that is updated every five (5) seconds. In the event the user is unable to communicate to the communications module with Windows Diagnostic software, use the following instructions:

1. Enter the IP address assigned to the communications module into the Address section of Windows Explorer (example: http://192.168.10.99) and select ENTER.
2. If the website can be accessed, then a connection to the communications module exists. Verify the System Information and Options sections of the Windows Diagnostics software.

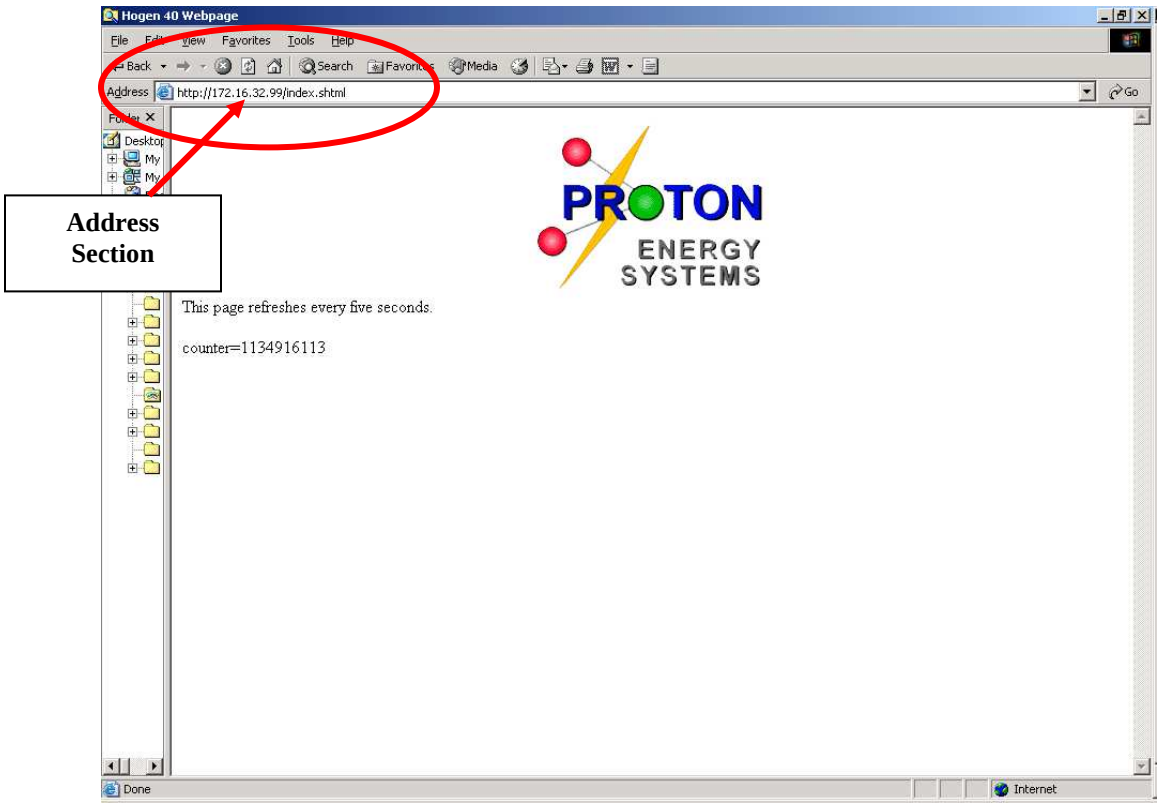


Figure 34 Communications Module Hosted Website

NOTE

If while performing a Read or Write operation and communication is lost, a Socket Error message may appear at the bottom of the Windows Diagnostics page. If communication does not re-establish automatically, try one of the following:

1. Close and then re-open the Windows Diagnostic software.
2. Reboot the control board.

CAUTION

To prevent a potential communication loss, perform only one action at a time. For example, stop sampling or logging data prior to performing a Write operation, such as logging into the system as Technician or Service.

NOTE

Once communication is re-established after a loss (such as reconnecting a cable), it may take up to 60 seconds before full communication to the control board can be restored.