SBS
TEST & MONITORING EQUIPMENT

Powered by

Exponential™
POWER

SBS-H2 DoD

Hydrogen Gas Detector Kit

*(Meets UC 3-520-05 Spec)

For battery charging rooms and other areas where hydrogen gas may be present

Installation, Operation & Maintenance Instructions

Protects Life, Property and Profits
Electrical Safety – UL 61010-1

Compliant with NFPA 70E® and IEEE Recommendations
Pollution Degree 2

cNemkoUS

Warnings

- This detector is added protection, not a substitute for prudent safety measures, for where hydrogen gas may be present.
- For large or highly-sensitive areas, Exponential Power, Inc. recommends installing additional sensors for increased coverage area.
- The hydrogen sensor does not provide protection from fires or hydrogen explosions. The relay contacts are intended to be connected to a safety system that would enable audible alarms, system shutdown and ventilation.
- Ensure that installation complies completely with all relevant Local, State, Federal and OSHA safety and health regulations.
- If a sensor enters warning or alarm mode there is a risk of combustion or explosion. To avoid injury, leave the area immediately.
- The sensor is calibrated for operation in air. Tampering with the sensor or operation in environments that are exposed to other types of gases can lead to inaccurate readings, false alarms or permanent damage.
- Please see troubleshooting guide for list of gases and compounds that may damage or alter a sensor's performance.
- Uncured silicone compounds or extended exposure to silicone off gassing can give inaccurate readings or false alarms on a sensor.

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Main Unit and Accessories

Part No.	Description
SBS-H2-DoD	Hydrogen Gas Detector
H2-JB	Includes: one (1) main control, one (1) H2-SENSOR and one (1) 25 ft. cable
H2-SENSOR	Junction Box with Knockouts, 4 11/16" X 4 11/16", Metal
H2-SENSOR-25FT	Hydrogen Gas Sensor Only (No Cable)
H2-SENSOR-50FT	Additional/Replacement Hydrogen Gas Sensor with 25 ft. Cable
H2-SENSOR-100FT	Additional/Replacement Hydrogen Gas Sensor with 50 ft. Cable
H2-DoD-TESTKIT	Additional/Replacement Hydrogen Gas Sensor with 100 ft. Cable
H2-TESTKIT-INTL	Field Test Kit for SBS-H2
E190399	Includes: case, regulator, tubing and two (2) cylinders of H2 gas (0.5% and 1%)

1.0 Overview

Batteries on charge emit hydrogen gas as part of the chemical reaction of recharge.**Concentrations of 4.1% to 75% H2 mixed with air can be explosive.** Sparks or hot surfaces can ignite hydrogen gas.

The SBS-H2-DoD hydrogen detector acts as a monitor and provides a visual and audible alarm when hydrogen is detected. The unit also has a 0.5% concentration relay that can trigger exhaust fan operation and a 1.0% concentration relay that can trigger a building management/alarm system (via dry contact) before the gas reaches the lower explosive limit (LEL) of 4.1%.

**The design of this unit has been built to meet the maximum allowable gas concentration levels allowed in the Department of Defense Specification UFC 3-520-05 Section 3-5.1 when integrated Battery Exhaust System.*

2.0 Benefits

In addition to protecting employees and property, the detector may also reduce the following costs:

Energy Efficiencies

Instead of continuously running an exhaust fan to prevent hydrogen gas accumulation, use the detector to activate a fan only if the gas concentration reaches 0.5%.

Insurance Savings

Installation of a detector in areas where batteries are charged may result in a premium reduction.

3.0 How it Works

Should the concentration of hydrogen gas in the air surrounding the sensor reach 0.5% by volume, the **"0.5% Warning"** yellow LED will light up on the main control of the unit. In addition, the 0.5% internal relay will de-energize and can be used to activate a remote exhaust fan.

Should the hydrogen gas concentration reach 1.0% by volume, the **"1% Alarm"** red LED will light up, the strobe will flash and an audible alarm will sound. In addition, the 1% internal relay will de-energize and can be used to activate a building management/alarm system (via SCADA/Modbus).

The SBS-H2 provides automatic operation, continuous detection, high sensitivity, stability and solid-state reliability. The unit uses 120/240 Vac 50/60 Hz and/or 12 - 48 Vdc operating voltages.

4.0 Specifications

Dimensions

- Main control: 4.7” L x 4.7” W x 1.2” D
- Sensor: 3.1” L x 1.6” W x 0.87” D

Mounting

- Wall: two 3/16” screws (not included)
- H2-JB Junction box: 4 11/16” x 4 11/16” 2-gang junction box

Power Requirements/Options

Warning: Power requirements for the unit and relays should not exceed min/max specifications

- 120 Vac, 50/60 Hz Nominal (Terminal J8)
  - 3 - 121 Vac
  - 250mA / 10W Max
- 220 Vac, 50/60 Hz Nominal (Terminal J8)
  - 185 - 242 Vac
  - 125mA / 10W Max
- 12-48 Vdc Nominal (Terminal J9)
  - 9 - 58 Vdc
  - 600mA / 6W Max
  - Note: An earth ground must be supplied to the GND terminal on the AC terminal block when using only the DC power supply

Relays

- 0.5% Warning Relay (Terminal J6) “Fail Safe Mode of Operation”
  - 1 Normally Open and 1 Normally Closed contact
  - Rated for 15 A resistive @ 120 Vac
  - Rated for 10 A resistive @ 277 Vac
  - Rated for 10 A resistive @ 28 Vdc
- 1.0% Alarm Relay (Terminal J3) “Fail Safe Mode of Operation”
  - 1 Normally Open and 1 Normally Closed contact
  - Rated for 0.5A @ 28 Vdc

Temperature/Humidity

- Operating Temperature Range: 32°F (0°C) to 122°F (50°C)
- Operating Humidity Range: 20-95% non-condensing
- Storage Humidity Range: 5-95% non-condensing

Maximum Altitude

- 2000 meters

Audible Alarm

- 85 dB at 10’ @ 1.6 - 3.2 KHz

Strobe LED

- 146 lumens at 1A @ 3.2-4.2V

5.0 Sensor

The H2-SENSOR consists of an electronic sensing element whose electrical conductivity increases when hydrogen is detected at its surface. Conductivity of the sensor is proportional to the gas concentration, which is continuously monitored by the electronic alarm circuits.

The sensor only monitors for hydrogen gas (H2) and will not alarm for Hydrogen Sulfide (H2S), which has an odor at very low concentration

Hydrogen Sensor

Cat5 Cable
(25 ft std., 50/100 ft optional)

6.0 Main Control

Individual Sensor Indicators

(For troubleshooting, refer to page 14.)

Main Control

7.0 Installation

WARNING

AC voltage relay terminals (120/240 Vac) are located within this detector, presenting a hazard to service technicians. Only qualified technicians should open the detector case and service the internal circuits. Ensure power is removed from the detector relays prior to servicing the unit. Failure to do so may result in injury or death.

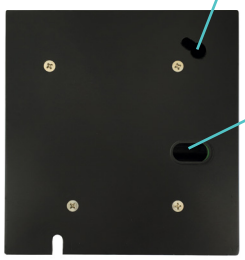
Alarm Wiring

Input Power

Wall Mountable
Integrated back mounting plate allows user to easily mount directly to any wall using 3/16" screws (not included).

Wiring
Power and alarm wires can run through the sides of the unit.

H2-JB Junction Box Mountable (optional)
Mounts to a standard, 4 11/16" x 4 11/16" 2-gang junction boxsides of the unit.



Hardwire Option
Run AC and/or DC power and alarm wires through back of the unit, into the gang box and out through conduit.

E190399 AC Line Cord
3-prong grounded AC cord, 18-3 AWG

Mounting Location

Hydrogen is colorless and odorless; the lightest of all gases, and thus rises. The sensor should be installed at the highest, draft-free location in the battery room, cabinet or compartment where hydrogen gas would accumulate. The detector measures hydrogen gas concentration in the air immediately surrounding the sensor. The area one sensor will monitor depends on the properties of the battery compartment or room. Hydrogen gas may accumulate in several areas of the battery compartment or room and multiple sensors/ detectors may be necessary.

The main control can be mounted wherever is convenient for the user, but should be within the cable length range to connect to each sensor.

The sensor should be mounted at the highest, draft-free location in the battery room, cabinet or compartment. Each sensor connects with the main control via the cable.

Carefully remove the main control cover by removing the two screws located on the front of the cover. Attach the main control to the wall, ceiling or optional junction box using the mounting holes at the top and bottom of the main control's mounting plate.

After the power and relay wiring is complete, connect each cable from main control to each sensor and refasten the main control cover.

Power Options
The detector has terminal blocks for connections to a single-phase 120/240 Vac 50/60 Hz power source (Terminal J8), and/or a 12-48 Vdc power source (Terminal J9). The power supply inputs are redundant, so the unit can use the DC input as a backup source.

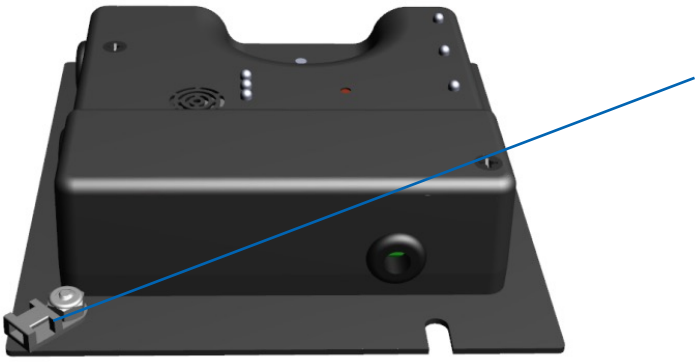
Relays
The detector has two (2) internal alarm relays:

- 0.5% warning relay (Terminal J6) is activated when a sensor detects 0.5% concentration of hydrogen gas. The 0.5% relay's dry contacts are rated at 10A/250 Vac, sufficient for most 1/3 HP exhaust fans.
- 1% alarm relay (Terminal J3) is activated when a sensor detects 1% concentration of hydrogen gas. The 1% relay's dry contacts are rated for 0.5A/28 Vdc.
- Note: For higher current requirements, add an external relay.

Mounting Options

Junction Box Mounted
For 120/240 Vac power, use 18-3 gauge stranded wire.
For 9 - 58 Vdc power, use 18-2 conductor insulated wire.
For relay wires, use stranded wire. Maximum wire size for connector terminations is **14 AWG**.
Stranded conductors must be terminated in a manner to prevent shorting from one terminal to another by a loose strand. Tin the wires with solder if required.

Wall Mounted
For 120 Vac power, an 18-3 gauge insulated line cord is required.
For 9 - 58 Vdc power, use 18-2 conductor insulated cable from the DC supply.
For relay wires, use stranded wire. Maximum wire size for connector terminations is **14 AWG**.



Exponential Power, Inc. supplies a tie-wrap to secure the AC mains' wiring. The tie wrap can rotate up to 270 degrees to accommodate your installation.

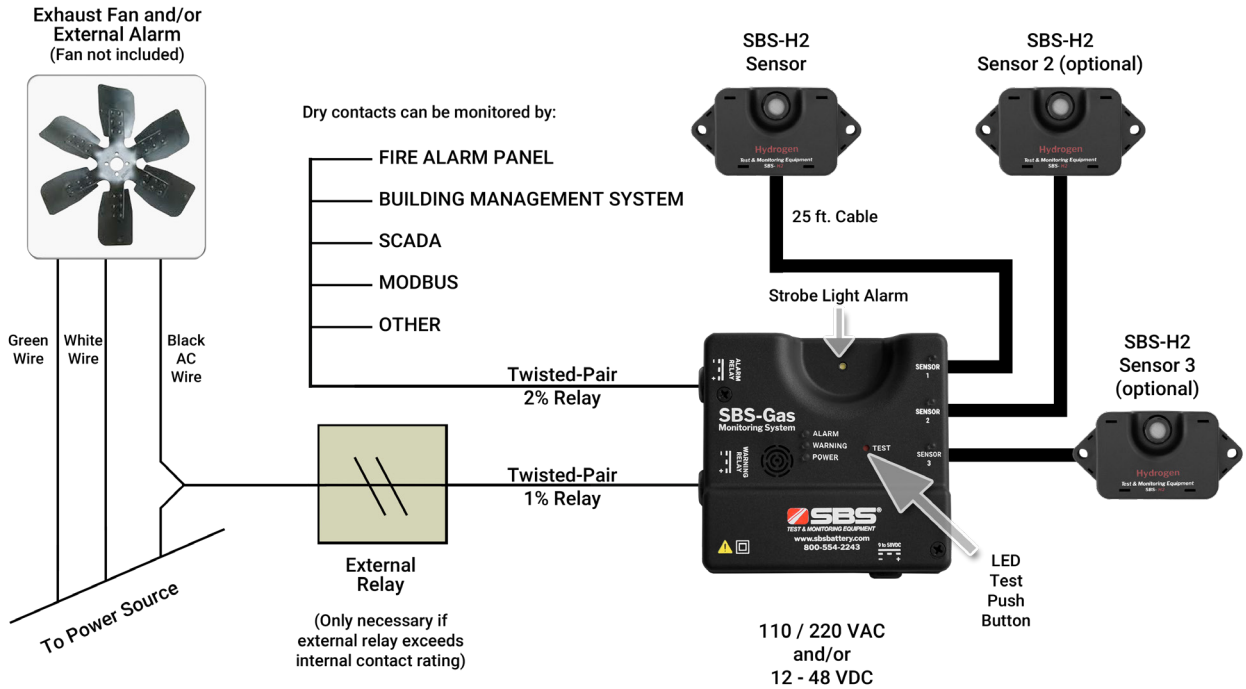
Disconnection of Supplying Power

When the unit is hard wired, an external 10 Amp (minimum) circuit-breaker or switch should be installed to act as a disconnecting device. The circuit-breaker must open all supply conductors simultaneously, be easily reached by operators and be marked as the disconnecting device for the equipment.

For Installation of Additional Sensors

A maximum of three (3) sensors may be connected to each main control. Multiple detectors and sensors can be installed to meet the space coverage requirements of your particular installation.

Locate the additional sensors' installation points within cable reach of the main control and mount the sensor. Connect the cables from any additional sensors to the Sensor 2 and Sensor 3 inputs on the main control.

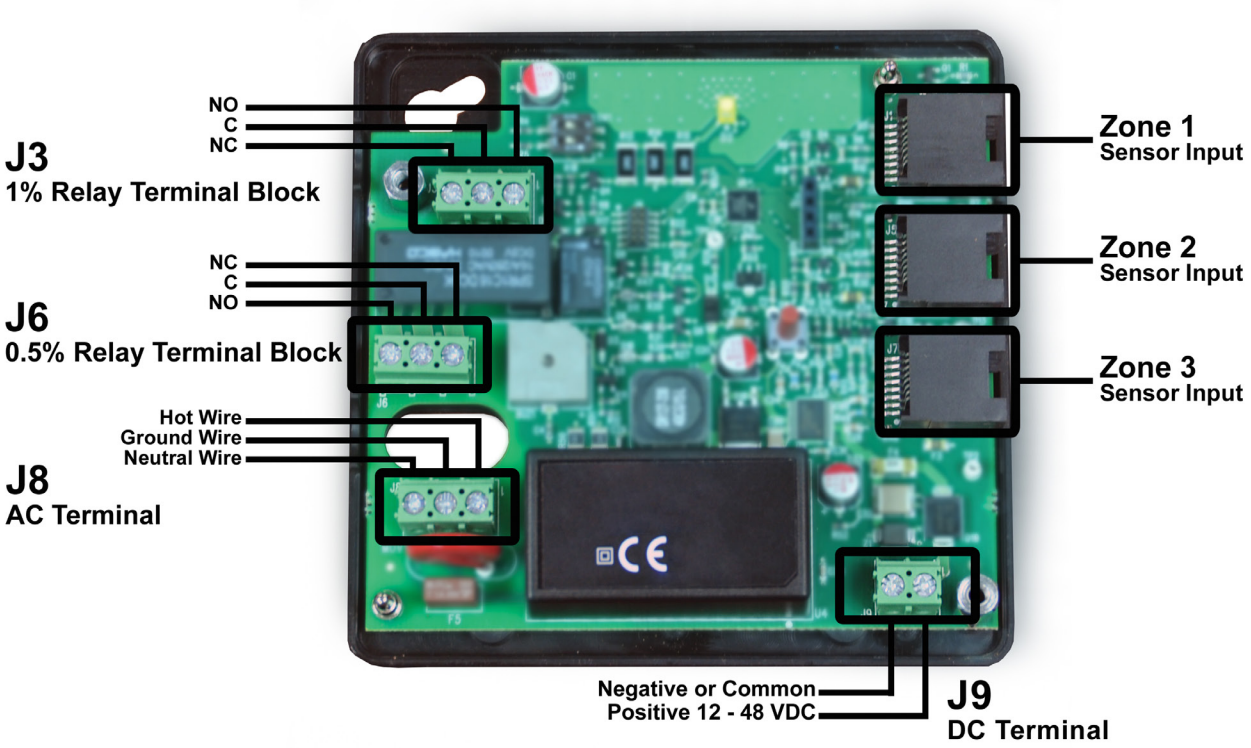


Alarm System Electronics

Please refer to the illustration below to identify proper power and relay connection points in the detector. It is advisable to use a pair of 14 gauge or smaller stranded wire for the relay contacts to help reduce any interference within the area that may cause false alarms.

Each of the Cat5 sensor input connections has a status indicator LED on the main control, which will illuminate solid green when a sensor is connected and operating normally. A sensor's corresponding LED will flash at the same rate as the strobe LED when detecting 0.5% or 1% H2 concentration. The LED for a sensor that is in alarm mode will flash at the same rate as the strobe LED. The alarming sensor and strobe LED will flash at a faster rate than the LED for a sensor that is only in warning mode.

Terminal Connection Diagram



Using the Mechanical Relays

1. Remove the front cover of the main control by removing two fix screws and pulling straight off the body. This will reveal the inner electronics of the alarm box.
2. Locate the terminal blocks for the relays and determine which condition you would like the relay to be related to. Use the 0.5% relay (Terminal J6) for the warning condition and the 1% relay (Terminal J3) for the alarm condition.
3. Replace the front cover on the alarm box.

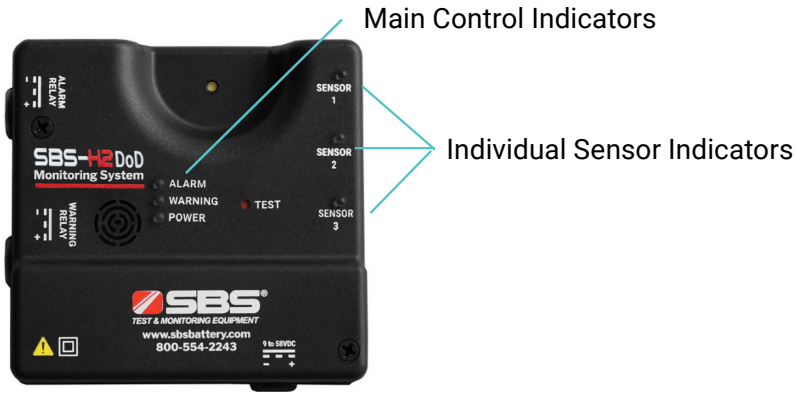
8.0 Operation

Keep the detector on at all times. The solid green LED for 'POWER' on the main control indicates that the detector is powered on.

When power is first turned on, the 0.5% and 1.0% relays will energize switching the positions of the contacts, a warm up period of 30 seconds will elapse before the unit will function. This delay is to prevent false activation of the internal relays and alarm.

Should the concentration of hydrogen gas in the air surrounding the sensor reach 0.5% by volume, the **"0.5% Warning"** yellow LED will light up on the main control of the unit. In addition, the 0.5% internal relay will de-energize and can be used to activate a remote exhaust fan.

Should the hydrogen gas concentration reach 1.0% by volume, the **"1% Alarm"** red LED will light up, the strobe will flash and an audible alarm will sound. In addition, the 1% internal relay will de-energize and can be used to activate a building management/alarm system (via dry contacts).



Condition	Main Control Indicators			Individual Sensor Indicators	Relay Closure	Audible Alarm	Strobe
	Power	Warning	Alarm				
Normal Operation	G	○	○	G (sensor installed)	**Energized**	None	None
H2 Warning (0.5% H2)	G	G	○	(blinking green)	**Warning Relay De-Energized**	None	None
H2 Alarm (1% H2)	G	G	G	(same flash rate as strobe)	**Warning and Alarm Relay De-Energized**	**ON**	**ON**
Sensor/Cable Fault	G	○	○		**N/A**	None	None
Communication with Sensor Lost	G	○	○	○ (plugged in, but not lit)	**N/A**	None	None

9.0 Electrical Testing

A “TEST” button is located on the front of the main control. Push and hold this button for approximately 10 seconds to test the unit’s electronic circuitry.

The warning and alarm LEDs will light up in sequence, the strobe will flash, the relays will activate whatever is connected to them and the internal warning alarm will sound.

Note: The “TEST” button does NOT test the sensor(s) itself – only the unit’s electronic circuitry.

10.0 Testing the Sensor

The sensors and main controls are factory calibrated. It is recommended to test each sensor’s functionality every 12-18 months with the H2-DoD TESTKIT.

The H2-TESTKIT is intended for periodic testing of the functionality and proper operation of the system. Once a sensor is installed, calibration or adjustment of the sensor is not possible. Please contact your sales representative if sensor calibration is desired or required.

The H2-DoD TESTKIT includes the following:

- 0.5% (17 liters) H2 in air calibrated gas canister
- 1.0% (17 liters) H2 in air calibrated gas canister
- Regulator
- Flexible tubing with sensor head adapter

Testing the 0.5% Warning and 1.0% Alarm State

1. Connect the calibration fixture to the 0.5% H2 air gas cylinder.
2. Secure the test fixture to the sensor module connected to sensor by pressing the flexible tubing completely over the inlet to the sensor head.
3. Turn on the gas flow by fully opening the valve on the cylinder regulator to allow gas to flow. Please wait 30 seconds to ensure the air in the tubing has been purged.
4. Continue gas flow and wait for the yellow LED warning to light up and the 0.5% relay to energize.
5. Turn off gas and remove from sensor.
6. Repeat Steps 1-5 above using the 1% H2 air gas cylinder to activate the 1% alarm and relay. The 1% alarm threshold is connected to the red LED, the audible alarm and the strobe light up, which will activate during testing.
7. Repeat steps for every sensor installed.

Note: If the unit does not alarm during these tests the sensor may need to be replaced.

Replacing the Sensor

In a typical operating environment Exponential Power, Inc. recommends that each sensor be replaced every three years. An abusive operating environment can and will shorten a unit’s useful life. In dusty/dirty applications or in situations where a sensor is often subjected to different gases, it is recommended to replace each sensor after one (1) year.

11.0 Troubleshooting and Maintenance

No Power

Verify the AC and/or DC power cables are installed per the connection diagram on page 11.

Relays

The SBS-H2 system was designed for the relays to operate in a failsafe condition when the power supply is interrupted. If the fan connected to a relay runs as soon as the unit is powered on, the unit has been wired for the use of the Normally Open contact instead of a Normally Closed contact.

False Alarms

Each sensor has been calibrated for the detection of hydrogen gas, however any combustible gas that comes in contact with a sensor has the potential to activate the warning and/or alarm relays. Contact with any individual or combination of the following gases could trigger false alarms and/or contaminate a sensor.

Gases include but are not limited to:

- Acetone
- Acetylene
- Ammonia
- Benzene
- Butane
- n-Butyl Acetate
- Carbon Dioxide
- Carbon Monoxide
- Ethane
- Ethanol
- Ethyl Acetate
- Ethyl Ether
- Ethyl Oxide
- Gasoline
- Heptane
- Hexane
- Hydrogen
- Hydrogen Cyanide
- Hydrogen Sulfide
- Isopropyl Alcohol
- Methane
- Methanol
- Methyl Ethyl Ketone
- Nitric Oxide
- Nitric Dioxide
- Propane
- Propylene Oxide
- Styrene
- Sulfur Dioxide
- Toluene
- Turpentine
- Vinyl Acetate
- Xylene

If a sensor's warning or alarm condition is reached, **ventilate the area with clean air**. This should reduce the concentration of most gases and the warning or alarm condition should clear.

Note: when a warning occurs at 0.5%, the warning will not clear until concentrations drop below 0.3%. Similarly, when an alarm occurs at 1%, the alarm will not clear until concentrations drop below 0.6%.

Avoid installation in highly corrosive environments where high densities of hydrogen sulfide, sulfur oxide, chlorine, hydrogen chloride, etc. may be present. These gases can cause corrosion of the element and the power leads to the circuit board.

A sensor's output characteristics can be affected if the sensor becomes contaminated or exposed to heavy alkaline metals.

A sensor cannot operate in a zero or low oxygen content atmosphere.

If a sensor collects water condensation, its characteristics may temporarily drift. However, light levels of condensation under normal indoor use should not pose a significant problem with performance.

Storage

The longer a sensor is stored prior to being energized, the longer the warm up and stabilization period may become. Storage Humidity Range: 5 - 95% non-condensing.

Maintenance Tips

To maintain the unit, it is recommended to:

1. Test the detector once a month by pressing the 'TEST' button.
2. Vacuum the alarm cover once a month to remove accumulated dust.
3. Never use detergents or solvents to clean the unit or sensor. Chemicals can permanently damage or temporarily contaminate a sensor.
4. Avoid spraying air fresheners, hair spray, paint or other aerosols near a sensor.
5. Never paint the unit or sensor. Paint will seal the vents and interfere with proper sensor operation.

WARNINGS

Do not disassemble unit or attempt to repair or modify any component of this instrument. This instrument contains no user serviceable parts, and substitution of components may impair in-trinsic safety, which may adversely affect product performance and result in injury

The SBS-H2 Hydrogen Alarm System is not a standalone safety device and does not provide protection from hydrogen explosions. The relay contacts are intended to be connected to a safety system, enabling audible alarms, system shutdown, ventilation, or other measures to ensure monitoring of hydrogen gas occurs before concentrations reach dangerous levels.

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Hydrogen Sensor and Monitoring System Instruction Manual