



SGX

SENSORTECH

An Amphenol Company



SGX-BLD1

Hydrogen and Battery Leakage Detection Sensor

Datasheet

SGX-BLD1 is a Hydrogen and Battery Leakage Detection sensor that measures H₂ concentration when different battery leakage occur through CAN communication.

The sensor module has to be placed near the Hydrogen storage system or in the battery enclosure allowing to sense H₂ gas generated during a leakage or Li-ion battery Thermal Runaway failure mode.

The **SGX-BLD1** solution will allow the Vehicle Management System or Battery Management System to monitor the safe operation of the hydrogen system or Li-ion battery and generate an **early warning signal** when a leakage occurs or a Thermal Runaway event happens, this so that passengers can leave the vehicle early.



Quality, Safety, Responsibility

Functional specifications

Features

- Automotive product
- Fast response time (< 1 s)
- Thermal conductivity gas sensor (high reliability technology)
- High H₂ range detection from 0 up to 10%
- Low power consumption (25mA)
- CAN 500kbps High Speed communication
- Standard automotive 4 pins connector
- Watertight housing IP6K7
- Configurable ID



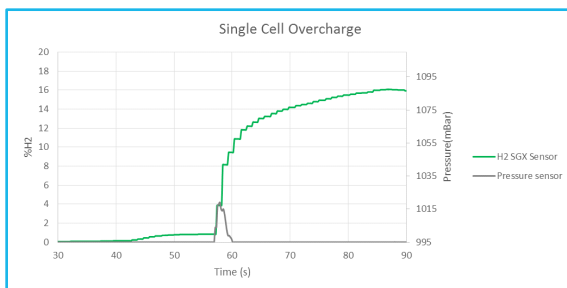
Principle

There are different failure modes possible in the hydrogen fuel-cell or li-ion battery system. To prevent a dangerous situation for passengers, the Fuel-cell or Battery management system should send an alarm to the passengers to leave.

Inside Li-ion battery packs, our sensors can robustly and early detect the hydrogen gas during various failure modes of a thermal runaway event. Other sensing technologies, like pressure measurements, often only detect some of these failure modes and will not work well in all battery pack architectures as venting solutions can prevent a pressure increase detection.

See below some failure mode examples with a comparison between H₂ SGX sensor and a pressure sensor:

Cell Overcharge:

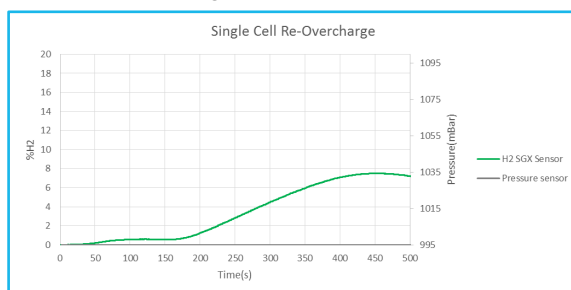


- The H₂ sensor (green curve) is reacting 10 seconds faster than the pressure sensor

- Small pressure increase in short period (gray curve) and similar to environment change

Pressure sensor reference for testing: NPA-201

Cell Re-Overcharge:

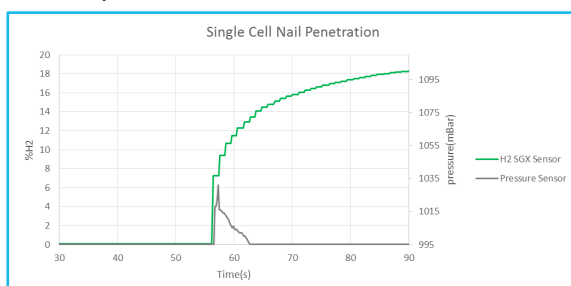


- The H₂ sensor is reacting (green curve).

- The pressure sensor **is not reacting** (gray curve).

Pressure sensor reference for testing: NPA-201

Cell Nail penetration:



- The H₂ sensor is reacting (green curve) faster than the pressure sensor (gray curve).

- Small pressure increase in short period (gray curve) and similar to environment change.

Pressure sensor reference for testing: NPA-201

Main technical characteristics

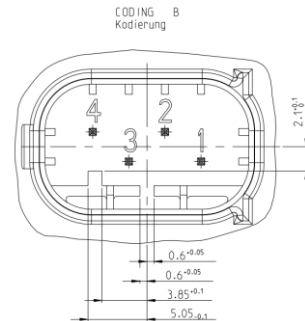
| | |
|----------------------------------|---|
| Temperature and humidity range | 0~95% RH -40°C to +85°C |
| Temperature storage | -40°C to 120°C |
| IP level | IP6K7 |
| Fixing | Bayonet Delphi clip (optional) |
| Connector | 4 pins Tyco Electronics AMP-1-0967640-1 coding A |
| External dimensions | 39mm x 35mm x 27 mm |
| Weight | < 15 g |
| Power supply operating range | 9 to 18V |
| Current consumption (Average) | < 25 mA, @12V < 100uA (Sleep mode) |
| Output signal | CAN 500kbps High Speed |
| H2 Concentration range | Minimum 10 vol.% in air (Inflammability level >4%) ± 0.4 vol.% in air H2 ≤4% ± 10% in air H2 ≥4% At 23 °C |
| Accuracy | H2 vol.% in air ≤ 4% : ± 0.4 vol.% H2 H2 vol.% in air ≥ 4% : ± 10% |
| Response time | < 1 s (one CAN frame every 100ms) |
| Start-up time | < 400ms |
| Lifetime | Minimum 10 years or 13'000h |

SGX-BLD1

Interface and integration

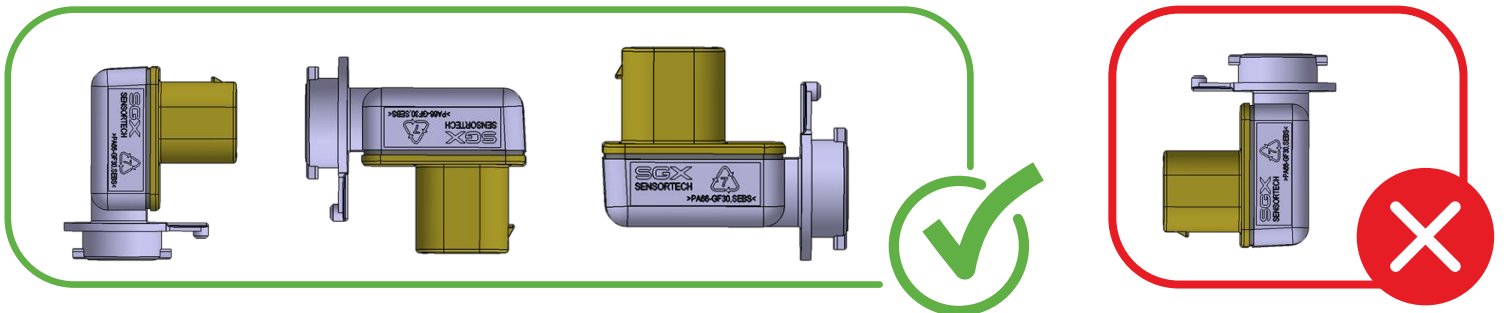
Principle

| | |
|-----------------------|---|
| Connector type | Tyco Electronics AMP-1-0967640-1 coding A |
| Communication | 500kbps High Speed |
| Pinout | Pin1: Vbat Pin2: Ground Pin3: CAN Low Pin4: CAN High |

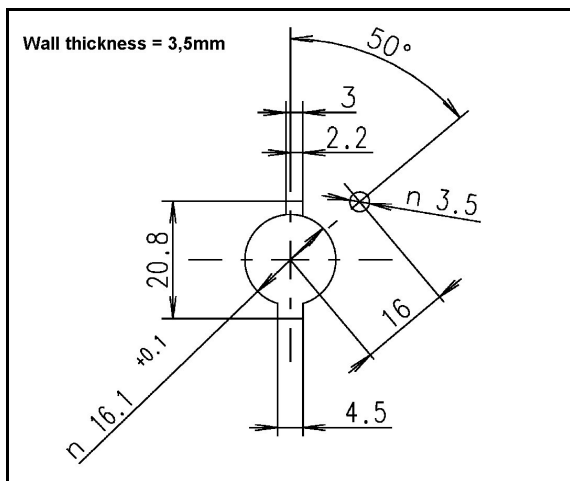


Recommendation for integration

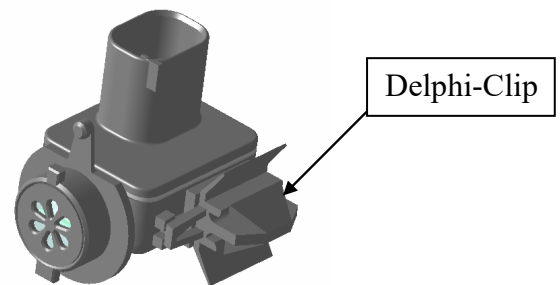
The sensor must be exposed to measure the air from the **battery pack only**. Preferably, the filtering membrane included in the module should be facing downward. If this is not possible, it should be vertical, but should never be facing upward, to prevent accumulation of dirt, water.



Bayonet fixing, mating with following interface:



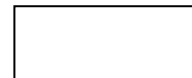
Optional, the sensor can be mounted with a standard Delphi-clip.



Recommended hole for Delphi-Clip

15±0.1mm

8±0.1mm



Sheet Metal Thickness (Max) 0.8 – 2.8mm

Proposed CAN frame description

The default ID is 0x256 and CAN frame layout is as shown below:

| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|-------------------------|--------------------------|--------------------|-------------------------|---------------------------|----------------|----------------|-------------------|
| 0 | Temperature_u8 msb 7 | 6 | 5 | 4 | 3 | 2 | 1 | lsb 0 |
| 1 | msb 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
| 2 | Hydrogen_u16 23 | 22 | 21 | 20 | 19 | 18 | 17 | lsb 16 |
| 3 | 31 | Sensor_replacement 30 | undervoltage 29 | Temperature_issue 28 | H2_out_of_range 27 | RH_issue 26 | TC_issue 25 | overvoltage 24 |
| 4 | Voltage_u8 msb 39 | 38 | 37 | 36 | 35 | 34 | 33 | lsb 32 |
| 5 | Humidity_u8 msb 47 | 46 | 45 | 44 | 43 | 42 | 41 | lsb 40 |
| 6 | 55 | 54 | 53 | 52 | Roll_Counter_u8 msb 51 | 50 | 49 | lsb 48 |
| 7 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 |

Signal factor and offset are described below:

| Name | Message | Start bit | Length | Byte Order | Value Type | Initial Value | Factor | Offset | Min. | Max. | Unit |
|------------------------|-----------------|-----------|--------|------------|------------|---------------|--------|--------|------|------|------|
| Temperature (u8) | Sensor_Status_1 | 0 | 8 | Intel | Unsigned | -55 | 1 | -55 | -55 | 195 | °C |
| Hydrogen percent (u16) | Sensor_Status_1 | 16 | 16 | Motorola | Unsigned | 0 | 0.01 | 0 | 0 | 100 | % |
| Overvoltage | Sensor_Status_1 | 24 | 1 | Intel | Unsigned | 0 | 1 | 0 | 0 | 0 | |
| TC issue | Sensor_Status_1 | 25 | 1 | Intel | Unsigned | 0 | 1 | 0 | 0 | 0 | |
| RH issue | Sensor_Status_1 | 26 | 1 | Intel | Unsigned | 0 | 1 | 0 | 0 | 0 | |
| H2 out of range | Sensor_Status_1 | 27 | 1 | Intel | Unsigned | 0 | 1 | 0 | 0 | 0 | |
| Temperature issue | Sensor_Status_1 | 28 | 1 | Intel | Unsigned | 0 | 1 | 0 | 0 | 0 | |
| Undervoltage | Sensor_Status_1 | 29 | 1 | Intel | Unsigned | 0 | 1 | 0 | 0 | 0 | |
| Sensor replacement | Sensor_Status_1 | 30 | 1 | Intel | Unsigned | 0 | 1 | 0 | 0 | 0 | |
| Low power bit | Sensor_Status_1 | 31 | 1 | Intel | Unsigned | 0 | 1 | 0 | 0 | 0 | |
| Voltage (u8) | Sensor_Status_1 | 32 | 8 | Motorola | Unsigned | 0 | 0.1 | 0 | 0 | 25.5 | V |
| Humidity (u8) | Sensor_Status_1 | 40 | 8 | Motorola | Unsigned | 20 | 0.5 | 0 | 0 | 100 | % |
| Roll Counter (u4) | Sensor_Status_1 | 48 | 4 | Motorola | Unsigned | 0 | 1 | 0 | 0 | 15 | |

- Voltage, Temperature and Humidity are internal for Hydrogen compensation purpose
- Hydrogen is the output of the sensor in %
- The bits are for diagnosis purpose
- Roll counter is a counter that increases from 0 to 15, with an increase of 1 at each frame sending

DISCLAIMER:

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SGX Europe Sp. z o.o. sensors are designed to operate in a wide range of harsh environments and conditions. However, it is important that exposure to high concentrations of solvent vapours is to be avoided, both during storage, fitting into instruments and operation. When using sensors on printed circuit boards (PCBs), degreasing agents should be used prior to the sensor being fitted. SGX Europe Sp. z o.o. makes every effort to ensure the reliability of its products. Where life safety is a performance requirement of the product, we recommend that all sensors and instruments using these sensors are checked for response to gas before use.

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