

SM_H2_LC

Hydrogen Gas Detector Kit with replaceable semiconductor sensor

For battery charging rooms and other hydrogen producing environments

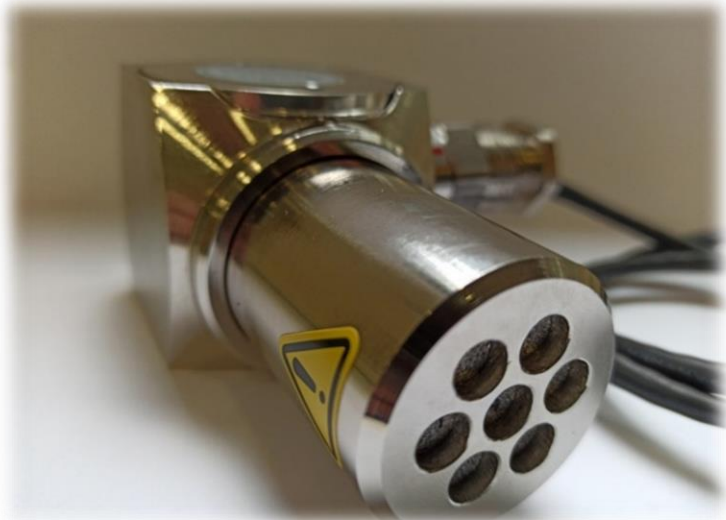
SM_H2_LC Standard Edition

- Quick installation
- Easy maintenance
- Reliable
- Flexible
- Compatible with external relays



SM_H2_LC EX-i (Explosion Protected)

- Encapsulated sensors
- Sealed electrical parts
Designed for explosive vulnerable environments
- Flexible
- Reliable
- Customizable sensor heads on request





General safety information

Please read the following safety instructions carefully

- This detector is not a substitute for general safety measures for detecting hydrogen gas. It is an additional device to enhance operation safety.
- When operating inside large sensitive zones, we recommend to install additional sensors to cover up the entire operating space.
- The hydrogen sensor is not suitable to run or trigger fire or hydrogen explosion prevention measures directly – the potential-free contacts are designed to contact safety management systems for alarm and notification behavior, automatic ventilation or emergency system shutdown procedures.
- Ensure your installation meets the local safety and health regulations. If you are unsure, contact the local authorities in your country.
- If warning or alarm state is active, an imminent risk of combustion or explosion is pending:
 - Leave this area immediately!
 - Contact the responsible department!
- This sensor is calibrated to operate in environments with air – when operating in environments with other gas, the sensor may not work as expected:
 - Inaccurate measuring / altered measuring behavior
 - False alarm / No Alarm
 - Damage the sensor itself permanently

Do not place the sensors next to uncured silicone compounds – Due to the fact they will gassing off, measured values may be corrupted.



General information

Function

The sensor is designed to detect dangerous hydrogen concentrations (H₂) in the interior of a system in good time. The SM_H2_LC hydrogen sensor is not designed for installation and use in open or large locations. The sensor head can be replaced during regular maintenance work. On request, a specially sealed version that fits to EX-i requirements for designated areas at risk of explosion is available.

Connection types

The contacts of both sensor types (Standard and EX-i version) are standardized, they can be combined within a daisy chain as well as operated individually. The additional hardware required for using the sensors varies depending on which connection type is to be used.

The power connection can be done either via its own 12 V power supply unit directly via the terminal strip or via the RJ45 connector, provided by a suitable power source.

Direct power supply is also available via the CON_R_AUX4. For GX_R_AUX, an external power source is recommended.

Alarm behavioural

LEL describes the **Lower Explosive Limit**,

In gas detection systems, the amount of gas present can be described with a specific percentage (%) of the LEL. The zero percent lower explosion limit (0% LEL) denotes an atmosphere that is completely free from flammable gases. A one hundred percent lower explosion limit (100% LEL), on the other hand, describes an atmosphere in which the gas concentration has reached the flammability limit. From this point onwards, the air / gas mixture can form up dynamically a high explosive environment.

The relationship between percent in LEL and volume percent differs depends on the gas – for the SM_H2_LC hydrogen detector, the value 100% LEL (LEL) for hydrogen is defined with 4% volume.

This allows to calculate an estimated hydrogen concentration and take them in direct relation with the pre-selected alarm thresholds:

$$4/100*20 = 0,8\% \text{ VOL}$$

$$4/100*40 = 1,6\% \text{ VOL}$$

The warning will be active at 20% LEL / 0,8% VOL

The alarm will be active at 40% LEL/ 1,6% VOL



Monitoring large Areas

One single sensor can cover a room of up to 50 m² (in normal rooms with a flat, horizontal ceiling and a hydrogen gas producing source in the centre). More sensors with overlapping sensor ranges should be installed within large rooms to increase the nominal operational safety.

Notes on installation with irregular ceiling structures e.g. for smoke protection, sound and pressure breakers, cross members, etc.

- Install the sensor at the highest point in rooms that run upwards.
- In the case of an irregular ceiling structure, several sensors may be necessary at the individually highest points.
- If necessary, install additional sensors directly above the battery or the hydrogen sensor

For highly critical hydrogen risk without human inspection, it is recommended to increase security by installing two hydrogen sensors and overlap the sensor range.

Differences between the sensor models:

It should be noted that the standard sensor model cannot be used in locations classified as hazardous areas for explosive gases, vapor or dust. For These areas, the EX-i conform special encapsulated sensor version needed.

Features

- Optical notification via LED for
 - o general operating
 - o Alarm and error
 - o Calibration / maintenance
- Hardware features
 - o Replaceable sensor head for maintenance work on site
 - o Independent relays for direct control of external signal generators, ventilation systems, etc.
 - o Open interface for direct communication with freely configurable SNMP cards
 - o Integrated heat exchanger for protection against operational overheating



Board layout of the SM_H2_LC standard sensor device

LEDs:

<i>General function</i>	
PWR	General operation
A1	Low H2 Threshold: Warning
A2	High H2 Threshold: Alarm
<i>Advanced LED notification</i>	
A1 and A2 flashing alternately	Sensor initialisation / boot in progress
ERR static on	Sensor error, missing sensor head
ERR flashing	Sensor head calibration error / replace sensor head



J2 connector - relay output:

Relay outputs for A1 and A2 alarms, normally open (NO) and normally closed (NC) contacts are available.

Pin number	alarm	function
1	A2	NO contact
2		COM contact (common)
3		NC contact
4	A1	NO contact
5		COM contact (common)
6		NC contact

Relay behavior in case of an alarm

The relays are switched depending on the corresponding alarm state. If alarm state is active, both relays are triggered.

state	Relay A1	Relay A2
No alarm	Not active	Not active
Active alarm A1 (exceeding the first alarm threshold)	active	Not active
Active alarms A1 and A2 (exceeding the second alarm threshold)	active	active
Active only alarm A2	System error, invalid switching state*	

**) If this switching status is encountered, there is a defect because this alarm status is not possible.*

J1, J5, J9 connectors – Power and communication interface

The sensor communicates via relay circuits. The communication interface available at J1 and RJ45 connections is not potential-free. The outputs are 12 V or the outputs are in a high-resistance state (these are typical transistor outputs that are configured for high-side control). Please note that the communication interface (J1, J5, J9) was specially developed for easy connection of GENEREX devices. If the detector needs to be connected to 3rd party systems, it is recommended to use relay contacts (these are potentially free outputs). By doing so, the relay contacts may be used for independent control of light and sound alarms, fans, etc. (max. Parameters 0.5 A 125 VAC, 1 A 24 VDC).

The following PIN assignment defines how to wire potential-free contacts:

J1 connector:

Pin number	Function
1	Communication interface – alarm A2
2	Communication interface – alarm A1
3	Communication interface – required calibration (CAL)
4	Communication interface – sensor error (ERR)
5	Power VCC
6	Ground GND



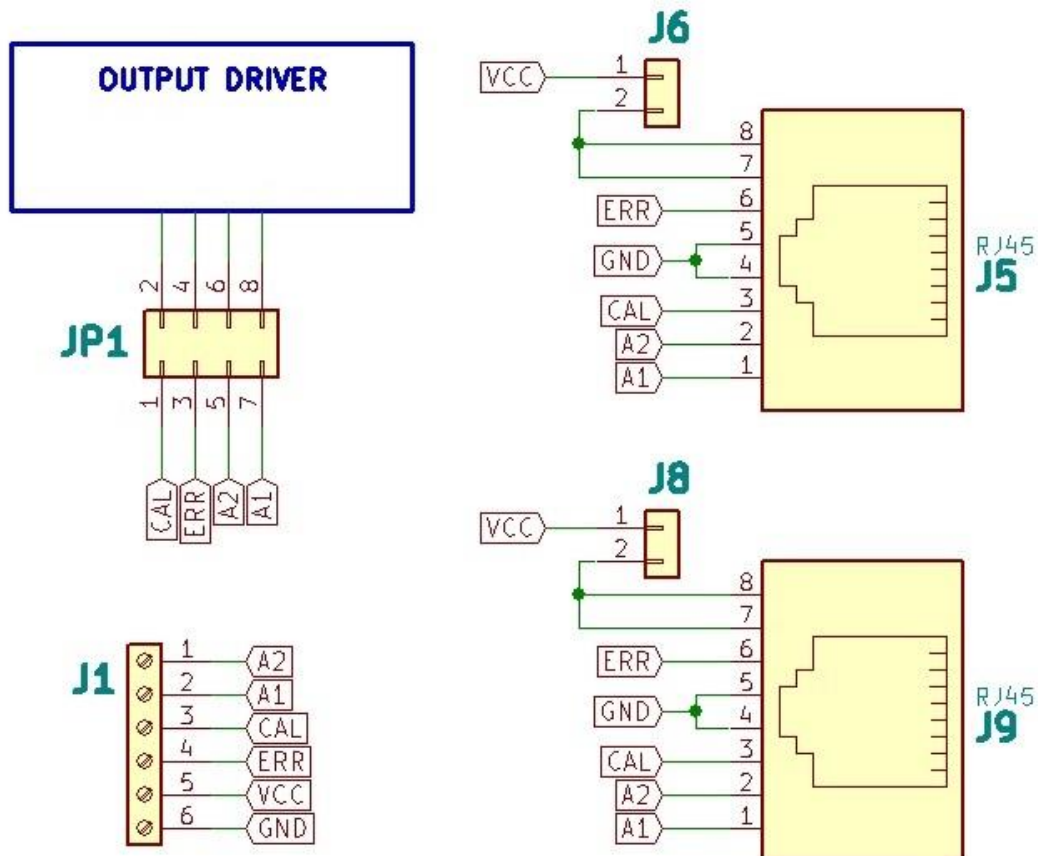
J5, J9 connector (RJ45):

The RJ45 connection is not a LAN connection for use on routers and switches!

If necessary, the contacts can be patched to a central administration room of a standardized patch field is in use.

Pin number	function
1	Communication interface – alarm A2
2	Communication interface – alarm A1
3	Communication interface – required calibration (CAL)
4	Ground GND
5	Ground GND
6	Communication interface – sensor error (ERR)
7	Power VCC
8	Power VCC

Output connector circuit:





Jumper description

- J3 connector: diagnostic (do not use)
- J4 SENS connector: for connect semiconductor replaceable sensor
- J7 connector: configure the device

position 1-6	reserved (for future use)	
position 7	Selection of the detector work mode	
	Jumper J7-7 not fitted	Jumper J7-7 fitted
	Communication interface working in negative logic	Communication interface working in positive logic
	Active = high impedance state (HiZ)	Active = 12V (max 40mA)
	Not Active = 12 V (max 40mA)	Not Active = high impedance state (HiZ)

Interface behavior in case of an alarm

Basic behavior

State	A1	A2	CAL	ERR
No alarm	OFF	OFF	OFF	OFF
Active alarm A1 (exceeding the first alarm threshold)	ON	OFF	OFF	OFF
Active alarms A1 and A2 (exceeding the second alarm threshold)	ON	ON	OFF	OFF

Advanced behavior:

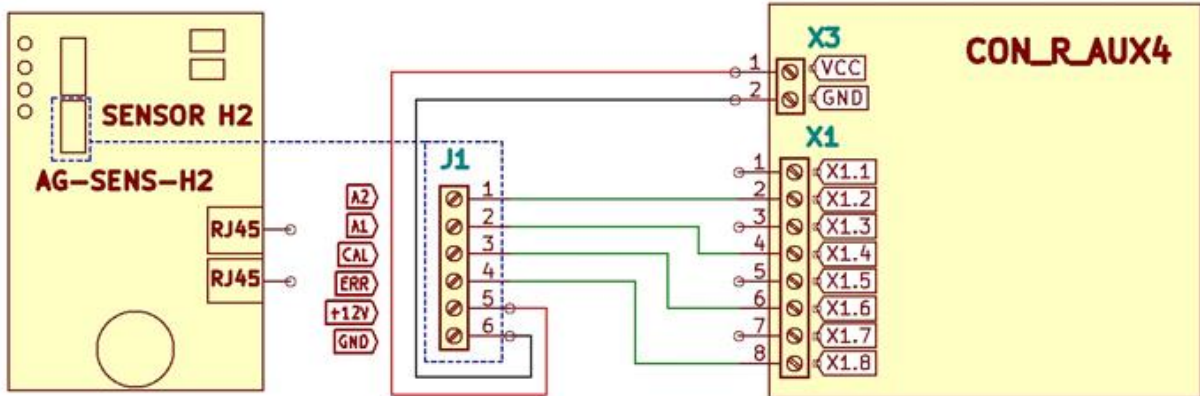
State	A1	A2	CAL	ERR
Active only alarm A2	forbidden state (never occurs)		X	X
Sensor error or no present in system	Active		x	Active
Calibration required	x		active	x



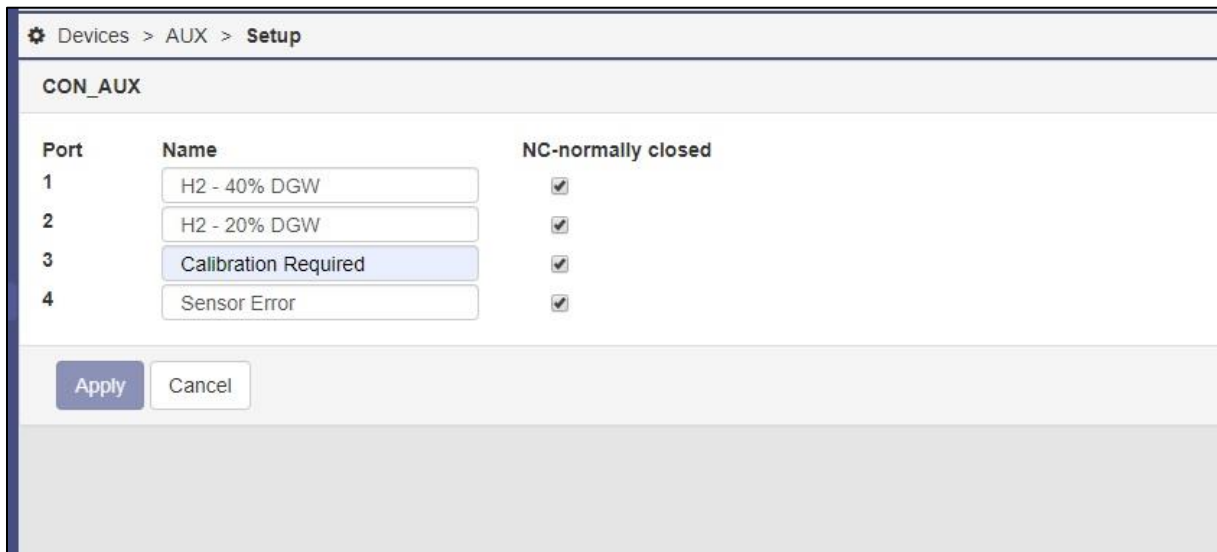
Connecting the Sensor to CS141

The sensor cannot be connected directly to the CS141 - the hardware required for wiring varies depending on the type of connection you choose for your installation:

Connection example: CON_R_AUX4



Configuration example: CS141 configuration menu for the CON_R_AUX4:

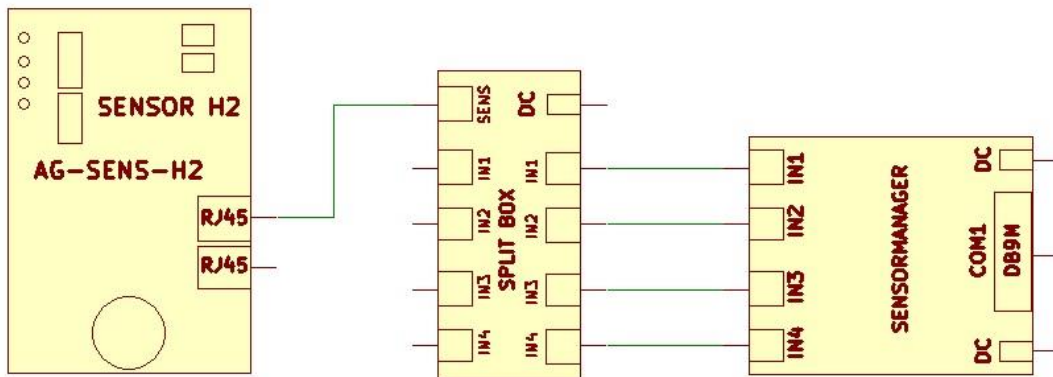




Configuration example: *SENSORMANAGER*



You can use the RJ45 / RJ12 splitting adapter for use in conjunction with a SENSORMANAGER. The outputs are redirected to the inputs of the sensor manager according to the current switching status.



Configuration work will be done within the SENSORMANAGER configuration dialog:

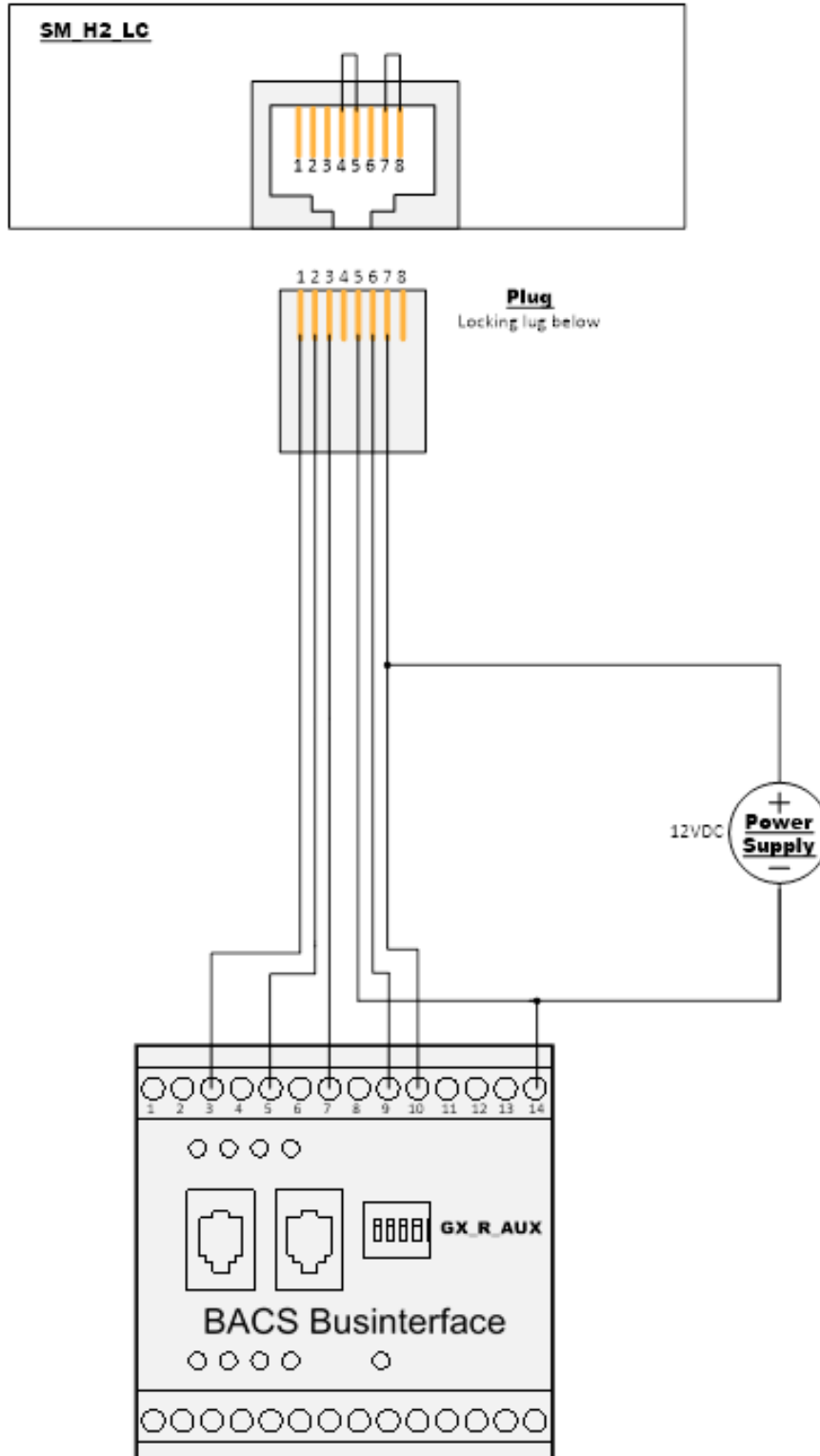
SensorMan2 Inputs

Input	Name	NC Contact	Active
1	H2 - 40% DGW	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	H2 - 20% DGW	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Calibration Required	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	Sensor Error	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Configuration example: GX_R_AUX

The GX_R_AUX offers various options for reading and managing external devices by the BACS WEBMANAGER.

As a normally passive device, the SM_H2_LC offers the option of informing BACS as soon as questionable hydrogen concentrations form. For this, either the direct connections can be used or, alternatively, the open ends of an RJ45 cable can be connected to the inputs of the GX_R_AUX.

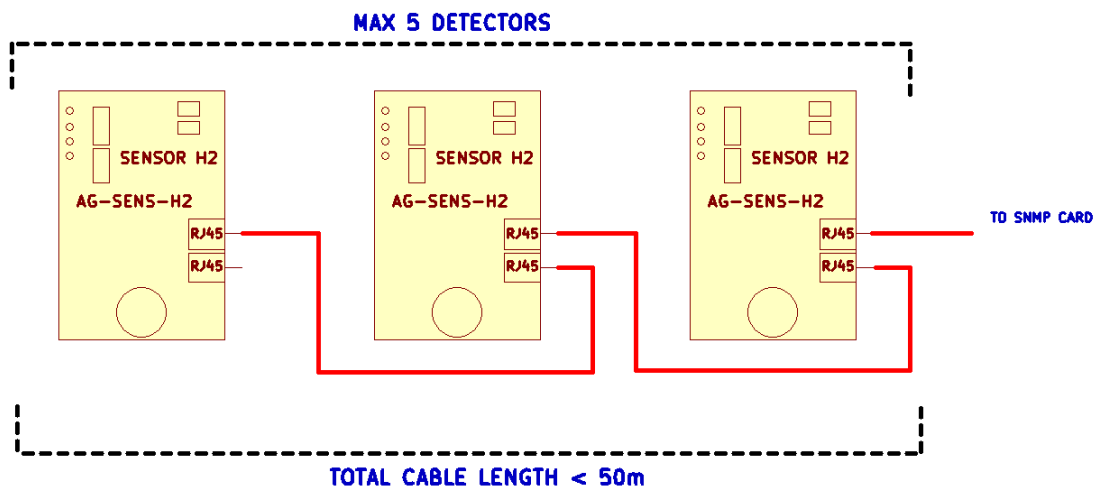




Connecting the SM_H2_LC hydrogen sensor in series (Daisy Chain)

The SM_H2_LC provide a daisy chain with up to 5 devices. In this operating mode, a master warning or alarm is triggered at the according WEBMANAGER, whereby any of the connected devices may be the cause for triggering. The according device will light up with LED warning or alarm states. For a working daisy chain, the following parameters must be met:

- All sensors must be set to the positive switching logic (jumper J7-7 is ON)
- A maximum of 5 sensors may be connected in a daisy chain.
- The maximum cable length for the entire daisy chain is 50 m. Additionally, the maximum cable length between the sensors is 15 m.
- A UTP / FTP CAT 5e Ethernet cable is recommended for the connection in a daisy chain

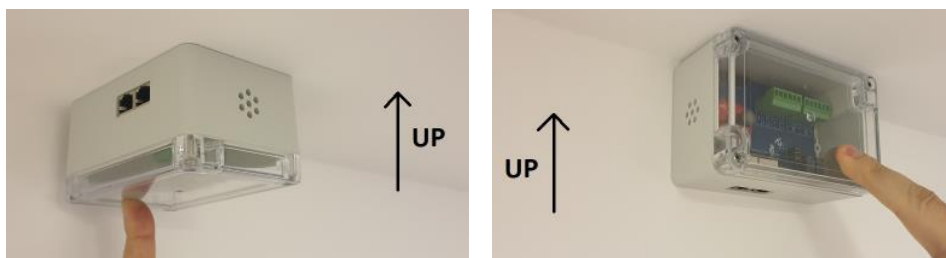


Placing the sensor

The location for mounting the sensor is not completely free form - the place will be defined by the monitored area:

Since hydrogen is lighter than air, it will rise and can be found in cavities, shelves, in control cabinets, ventilation outlets, etc.

It must be ensured that contact with hydrogen is possible for the sensor.



Note:

The location and the exact alignment of the sensor strongly depend on the conditions on site. Since hydrogen is very volatile, the places hydrogen clusters can form dangerous concentrations depend on many individual factors.



Typical locations

- *The highest Point*

Hydrogen always rises to the highest point and accumulates at this location. If this location is a flat ceiling, hydrogen can move with the air flow if someone opens the door, a fan is put into operation, temperature differences generate air turbulence, etc.

Due to this fact, an explosive air / hydrogen mixture can form and solve very dynamically.

- *Control cabinets*

If control cabinets are located above hydrogen producing batteries, the hydrogen gas can enter the control cabinet via not sealed cable ducts. As a consequence, within a control cabinet a high explosive atmosphere can form up.

- *Shelves, cable bundles, cable ducts and maintenance channels, ...*

When hydrogen rises and hits an obstacle, it remains there as a so-called "nest". This can happen wherever installations are placed above hydrogen producing batteries. Typical locations are shelves, underneath cable bundles or in cable ducts and maintenance ducts protected from drafts.

- *Ventilation systems and concepts*



Depending on the area of application, it is possible that a ventilation system should be installed for regularly solving the risk of hydrogen explosive concentration. Due to the design, a lot of hydrogen can accumulate very quickly in such places if the ventilation follows a time scheduled concept to save power.

This place should be monitored specially.



Specification

Supply Voltage	9-12V DC (stabilized)
Supply Current	300 mA max
Operating Temperature	0 – 40 °C
Operating Humidity	< 90%
Dimension , Weight	120mm x 80mm x 60mm , 0.25 kg
Alarm Thresholds A1, A2	A1 – 20% LEL, A2- 40% LEL (100 % LEL – 4% VOL)
Relay - Rated Load	0.50A 125 VAC, 1 A 24 VDC
Communication Interface	Outputs with Open Emitter, maximum current 40 mA per output, High state – min. 0.8*VCC Low state – high impedance state (HiZ)
Sensor interference gases	Chlorine, nitrogen oxides, significant oxygen deficiency (<18% vol.), rapid increase in humidity
Factors limiting sensor durability	Silicone compounds, long-term operation in the concentration above 3..5% LEL, constant presence of strongly reducing gases such as acetylene, hydrogen sulphide, hydrogen, carbon sulphide, etc.
Response time	T _{P50} 15 – 120 s. (without diffusion time to the detector), metrological readiness from 0.5hto 12h - depending on the time of power failure
Thresholds accuracy	+/- 20 % under calibration conditions (20 °C, 1013 hPa, hum. 65%)
Stability of alarm thresholds	+/- 20 % long-term in 1 year, but not worse than +/-30% in 3 years
Max. instantaneous hydrogen concentration H ₂	100% LEL(<1min/30min)
Calibration period	recommended – 1 year / max. 3 year
Max. areal monitoring	1 single sensor can monitor up to 50m ² (normal room height, flat ceiling and center hydrogen producer).
MTBF SM_H2_LC Main Board	90000
MTBF SM_H2_LC Sensor	26300

Optional parts: EX-i und IP-52 / ATEX approved



- ➔ Special membrane protects against spark formation during switching processes.
- ➔ Adaptable sensor heads: on request, characteristic data for the Sensor detection and the gas type can be changed
- ➔ Screwed housing protects against accidental opening when the sensor is running.
- ➔ EX-i und IP-52 / ATEX approved