Product Information Pack

H2 3E 4% Gas Sensor Module
(Hydrogen)

CONTENTS

Scope and Purpose of Document

The purpose of this document is to present the performance specification and operating instructions of the H2 3E 4% Gas Sensor Module. All information required for the correct use of the Gas Sensor Module is included in this document.

For Product Safety Datasheets (PSDS), REACH and RoHS information, please visit www.citytech.com.

The data provided in this document are valid at 20°C, 50% RH and 1013 mBar. Output signal can drift below the lower limit over time.

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Product Data Sheet

Key Features & Benefits:

- **Industry standard 4-20 mA output**
- **40-200 mV option**

Technical Specifications

MEASUREMENT

Target Gas	Hydrogen (H$_2$)
Operating Principle	3-electrode electrochemical
Measurement Range	0.1 - 4%vol. H$_2$
Filter	None
Output	4-20 mA, 2 wire loop powered 40-200 mV
Response Time	
T$_{50}$	<40 Seconds
T$_{90}$	<60 Seconds
Resolution	0.01 mA
Linearity	<10% of full scale

ELECTRICAL

Power Supply Required	10 - 30 VDC single-ended
Maximum Loop Resistance	700 Ω
Calibration	Via PCB mounted button and potentiometer

MECHANICAL

Mounting	Via 3mm PCB mounting holes
Weight	<13 g
Sensor Housing Material	ABS

ENVIRONMENTAL

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Operating Temperature Range	-20°C to +40°C
Recommended Storage Temp	4°C to 10°C
Operating Humidity Range	15% to 95% rH non-condensing

LIFETIME

Long Term Output Drift	<10% in 6 months
Expected Operating Life	2 years in air

Specifications are valid at 20°C, 50% RH and 1013 mBar.

Product Dimensions
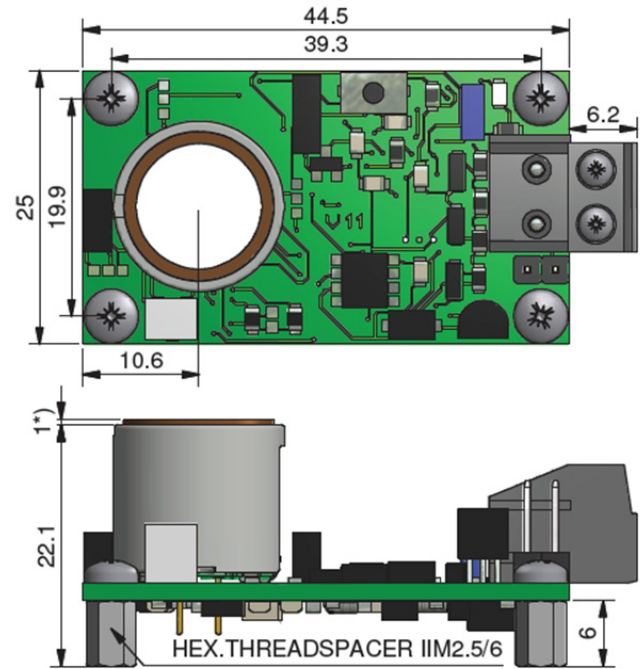
All dimensions in mm
All tolerances ±0.15 mm unless otherwise stated

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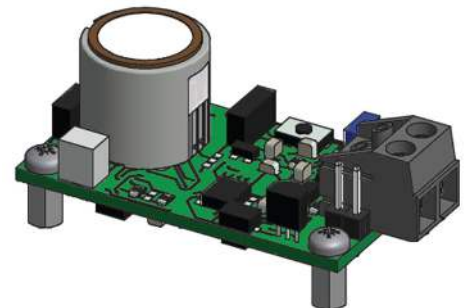
Poisoning

These sensors are designed for operation in a wide range of environments and harsh conditions. However, it is important that exposure to high concentrations of solvent vapours is avoided, both during storage, fitting into instruments, and operation.

When using Gas Sensor Modules with printed circuit boards (PCBs), degreasing agents should be used before the module is fitted. Do not glue directly on or near the modules as the solvent may cause crazing of the plastic.

Cross Sensitivity Table

Whilst these sensors are designed to be highly specific to the gas they are intended to measure, they will still respond to some degree to various other gases. The table below is not exclusive and other gases not included in the table may still cause a sensor to react.

IMPORTANT NOTE : The cross sensitivity data shown below does not form part of the product specification and is supplied for guidance only. Values quoted are based on tests conducted on a small number of sensors and any batch may show significant variation. For the most accurate measurements, the Gas Sensor Module should be calibrated using the gas under investigation.

Gas	Concentration Used	Reading (ppm H$_2$)
Ammonia, NH$_3$	100 ppm	0
Arsine, AsH$_3$	0.2 ppm	0
Carbon Dioxide, CO$_2$	1000 ppm	0
Carbon Monoxide, CO	100 ppm	0
Chlorine, Cl$_2$	5 ppm	0
Hydrogen Cyanide, HCN	20 ppm	0
Hydrogen Sulfide, H$_2$S	20 ppm	44
Methane, CH$_4$	1%vol	0
Nitrix Oxide, NO	100 ppm	0
Nitrogen Dioxide, NO$_2$	10	0

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Product Operating Instructions

Introduction

The Gas Sensor Module provides easy to use connectivity and output, compactness, and ease of calibration for most life safety and environmental monitoring applications. It provides a calibrated 4-20 mA output as well as a 40-200 mV signal output.

Features:
- Fully calibrated 4-20 mA (and 40-200 mV) output for each target gas;
- Linear output across detection range;
- Power in / output out, no setup required;
- Board allows user to calibrate gas sensor against target gas;
- Equipped with four mounting holes for prototyping.

All Gas Sensor Modules can be mounted via four 3 mm mounting holes in the PCB.
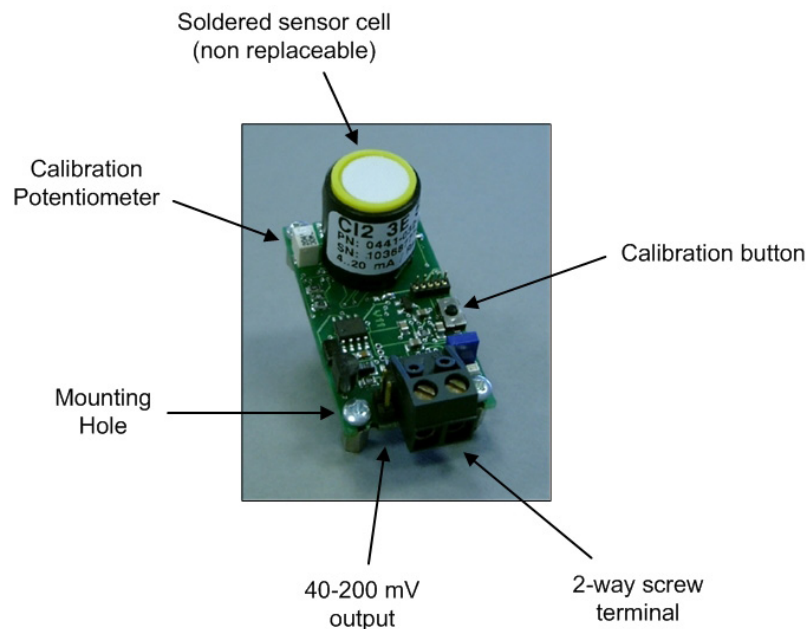
Gas Sensor Module Features

The Gas Sensor Module is shipped calibrated to a 4-20 mA output. There are two options for recalibration:
- by use of the PCB mounted calibration button (for zero and span calibration);
- by use of the potentiometer (for span calibration).

The PCB incorporates on-board temperature compensation and allows the use of an optional external temperature sensor.

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Electrostatic Discharge Guidelines

This component is susceptible to Electrostatic Discharge (ESD) when being installed or adjusted. To prevent ESD related damage during installation, the following guidelines should be considered:

- Ensure all power supplies are turned off;
- Wear an ESD strap connected to ground or discharge yourself by touching a metal part of the equipment into which the module is being installed;
- Ensure that any tools are discharged by contacting them against a metal part of the equipment into which the Gas Sensing Module is being installed;
- When adjusting potentiometers, with power applied, use an appropriate potentiometer adjustment tool or a small insulated screwdriver.

Mounting Orientation

Gas Sensor Modules should be installed with the sensor gas inlet side pointing downwards. The minimum requirement is to install the sensor with the sensor's gas inlet in a horizontal direction. It is not advisable to install the sensor with the gas inlet side permanently pointing upwards.

Connection and Wiring

The Gas Sensor Module is designed for standard two-wire operation, where the 4-20 mA output is supplied via the same wire pair as the power supply. The external circuit loop is connected to the transmitter PCB via the screw terminal connector - see below. The connector can be used in two orientations - vertically or horizontally.
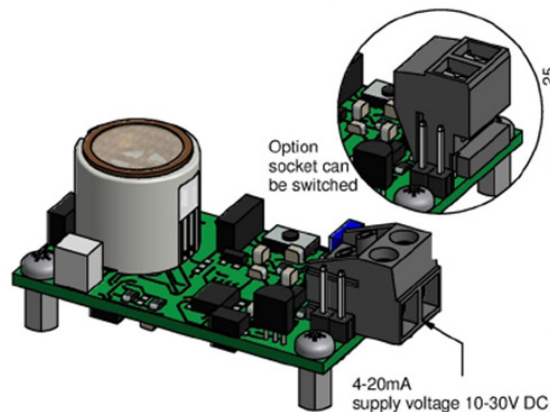
The Gas Sensor Module offers reverse polarity protection, so the power supply can be connected in either direction.

The sensor only requires a few seconds to settle after power is applied. In addition to the 4-20 mA signal in the 2-wire loop, a 40-200 mV voltage output is also available.

Operational status can be retrieved by pressing and holding the calibration button for between 0.5 - 3.0 seconds. The blinking pattern of the LED shows the calibration status, as follows.

1 blink : Factory settings (as delivered)
2 blink : Individual settings (recalibrated)
3 blink : Factory settings after reset

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Product Operating Instructions

Error Conditions

In normal use, the Gas Sensor Module output will remain within the range of 4 mA (for zero gas) and 20 mA (for span gas). An output of 0 mA represents a fault on the circuit board. Other error conditions are signalled by the module output going to 21 mA.

Error conditions recognised by the board are as follows:
- Output dropping below 3.8 mA;
- Output rising above 20.5 mA;
- The board is used at temperatures more than 5°C outside of its temperature specification.

Calibration Guidelines

The Gas Sensor Module is calibrated before shipping to the customer. It provides a stable signal over its standard life and for many applications, only requires occasional recalibration. The time interval required between initial calibration and subsequent recalibrations depends on various factors. In strenuous applications involving extremes of operation, or for sensors used in safety applications, frequent calibration may be required.

Calibration Period

Calibration is required if the deviation of the measured value is outside the limits required by the application.

Calibration Gas Concentration

For maximum accuracy, the Gas Sensor Module should be calibrated using a gas concentration in the range where most measurements are to be made. Where this is not possible, a concentration towards the top of the measurement range should be chosen. Calibration gases exceeding the measurement range must not be used as this may not provide an accurate calibration.

Electrochemical gas sensors need a certain amount of oxygen to function. Generally, a few thousand ppm oxygen is sufficient. However, as calibration only involves a short exposure to gas, the calibration gas need not contain oxygen - sufficient is supplied from the ambient air for a limited time. In most cases, a five minute exposure time is sufficient to achieve a stable calibration signal. However the sensor should not be completely potted with resin or totally immersed in an anaerobic gas mixture for long periods as this can affect the sensor's performance.

Calibrating to Cross Sensitive Gases

Electrochemical sensors are cross sensitive to certain non-target gases. Cross sensitivity data is only approximate and cross sensitivities will vary between sensors and sensor batches. Calibrating Gas Sensor Modules to non-target gas will result in measurement errors and is not advised.

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Product Operating Instructions

Recommended Gas Flow Rates

A minimum flow rate is required to ensure accurate calibration. The minimum flow rate is dependant on the gas type.

Gas Type	Minimum Flow Rate (ml/min)
Ammonia, NH$_3$	250
Carbon Monoxide, CO	150
Hydrogen, H$_2$	150
Hydrogen Sulfide, H$_2$S	250
Nitrogen Dioxide, NO$_2$	250
Ozone, O$_3$	250

These flow rates are based on gas delivery apparatus used by City Technology. Other designs of gas delivery may have an influence on the flow rates required.

User Calibration Procedure

Note that warranty on calibration is lost once a recalibration is performed.

Zero Reading Calibration

- Connect and apply power to the Gas Sensor Module.
- Allow the sensor to stabilize for a minimum of 5 minutes in clean air.
- Once the output signal is stable, press and hold the calibration button for between 6 and 12 seconds.
- The LED acknowledges calibration by blinking 6 times.

Span Calibration

Via calibration button

- Apply calibration gas to the sensor at the appropriate flow rate for a minimum of 5 minutes.
- Once output signal is stable, press and hold the calibration button for between 12 and 60 seconds.
- The LED acknowledges calibration by blinking 8 times.
- Remove gas and reapply clean air.

Via potentiometer

- Apply calibration gas to the sensor at the appropriate flow rate for a minimum of 5 minutes.
- Once output signal is stable, set the output to the appropriate value by adjusting the potentiometer.
- Remove gas and reapply clean air.

Factory Reset

- Press and hold the calibration button for between 3 and 6 seconds.
- The LED acknowledges the factory reset by blinking 4 times.

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Handling and Storage

Gas Sensor Modules are relatively insensitive to mishandling and following the simple guidelines given below should ensure correct operation.

● Gas Sensor Modules must not be exposed to temperatures outside the range -55°C to +60°C. Modules should be stored in their original sealed packaging within the temperaure range of +4°C to 10°C with the sensor membrane faced downwards.

● Gas Sensor Modules should not be stored, assembled or used in areas containing solvent vapours. Exposure to solvents will result in performance degradation and premature sensor failure.

● Exposure of modules to alcohol containing antiseptic products such as wipes and sanitizing gels should be avoided. Modules can respond to the alcohol based solvents and generate an output, which could manifest itself as an exaggerated baseline signal or prolonged recovery time.

● Gas Sensor Modules must not be subjected to any pressure when handling or clamping.

● To avoid damage to the sensing face of the sensors, Gas Sensor Modules must not be stacked on top of each other.

● At the end of its life, the product should be disposed of in accordance with local regulations. The hazardous waste disposal regulations depend on geographic location, and local regulations should be checked before discarding sensors.

SAFETY NOTE
This module is designed to be used in safety critical applications. To ensure that the Gas Sensor Module and/or instrument in which it is used are operating properly, it is a requirement that the function of the device is confirmed by exposure to target gas (bump check) before each use of the module and/or instrument. Failure to carry out such tests may jeopardize the safety of people and property.

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