

# DGM10

Solid Polymer Electrochemical Gas Sensing Technology

## Smart Double Gas Sensor Module



### Easy To Use

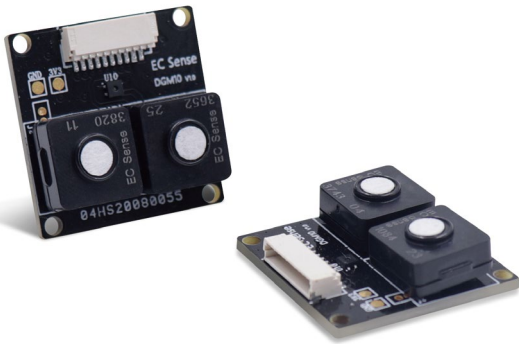
Pre-Calibration

Sensor Lifetesting

Digital Interface UART Modbus-RTU, I<sup>2</sup>C, SPI

## Overview

# DGM10 Smart Double Gas Sensor Module



The DGM10 Gas Sensor Module is an intelligent digital double gas sensor module from EC Sense, which is the perfect combination of a state-of-the-art sensing device based on the solid polymer sensor technology with a sophisticated circuit board.

By using intelligent micro process and algorithm calculation and combining temperature and humidity measurement in one sensor module, DGM10 Sensor Module has excellent stability and reliability. In general, the Sensor Module provides a simple and easy-to-use solution for your application. In fact, it makes using a gas sensor so easy by converting a small sensor signal into a standardized digital output.

The gas sensor module effectively shortens gas instrument development time, reduces cost and risk in new product development, saves production time, avoids complex gas calibration steps and ensures high reliability and accuracy. The standard digital output signal module facilitates fast instrument and system setup.

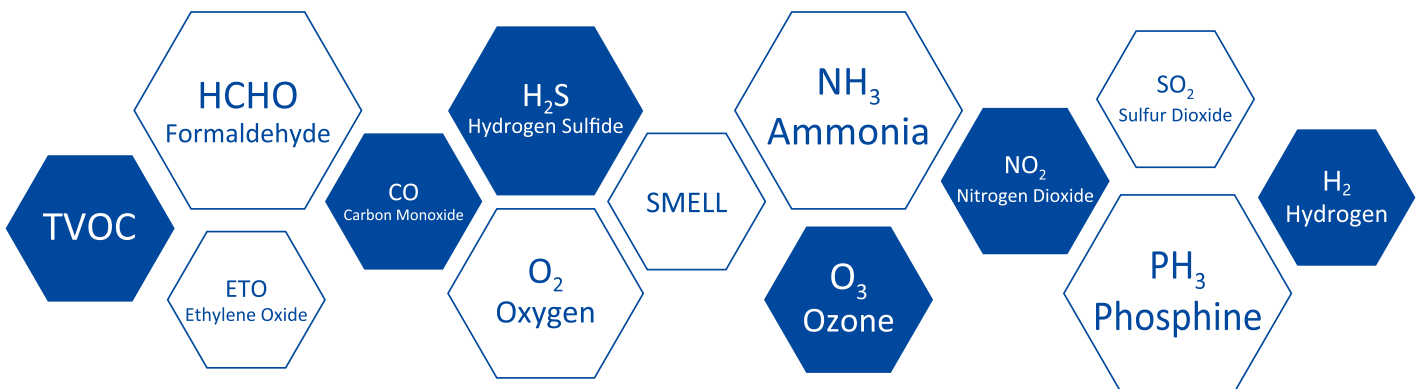
The DGM10 smart Gas Sensor Module has a wide range of applications and is designed to industry performance standards.

## Available Gas

Available gas for Industry, Indoor Air Quality, Outdoor Air Quality, IoT and Smart City applications.....

The DGM10 Gas Sensor Module adapts the ES1 Gas Sensor from EC Sense. Available gas:

TVOC, HCHO, CO, H<sub>2</sub>S, O<sub>2</sub>, O<sub>3</sub>, NH<sub>3</sub>, NO<sub>2</sub>, SO<sub>2</sub>, SMELL, CH<sub>4</sub>S, ETO, PH<sub>3</sub>, H<sub>2</sub>, etc. (For other gases, please contact us.)



# Easy Gas Sensor Module Solutions

## Detection Parameters

The DGM10 detects gases, temperature and humidity and easily receives all data simultaneously. The changing state of gases is closely related to temperature and humidity, for which this combination with EC Sense's DGM10 Gas Sensor Module provides a professional solution.

## Output Interface

The design of coexistence of multiple types of outputs, the simultaneous output of UART (Modbus-RTU), I<sup>2</sup>C, and SPI interfaces, provides users with a variety of flexible options. The wide supply voltage ranges from 3.3 to 5.5VDC, which can be easily integrated with various devices.

## Low Power Consumption

The module has a power-saving sleep mode that can be used to save energy and is convenient for user with low battery applications. It can be switched from working mode to sleep mode by instructions. In sleep mode, the sensor remains in operation to ensure that the gas can be detected immediately after waking up.

## Fast Stabilization Time

The Solid Polymer Electrochemical Gas Sensor features a stable and fast signal when powered on. The hardware circuit adopts an intelligent design to ensure that the sensor remains in operation after power off and can start detection instantly after power on.

## Small Size

Small size of 26 x 26mm, which is conducive to flexible use. The output signal cable is an easy to connect flexible wire.

## Pre-Calibration

Each DGM10 Sensor Module has been professionally calibrated with the gas. It can be used immediately without any warm-up time and the calibration information is stored in the flash chip. The gas sensor module can be Recalibration through the calibration command in the UART Modbus-RTU communication protocol. Try to avoid misoperation, the Pre-calibration data can be reset by command, even recalibrated the sensor module but the Pre-calibration data still in flash chip.

## Sensor Lifetesting

The intelligent Gas Sensor Module provides a self-test that evaluates the sensor performance without a gas measurement. Therefore, it is the excellent solution for smart home and IoT applications. The data is put out through the transmission command, which makes it easy and convenient to detect the right time to perform maintenance and replacement.

## Wide working Temperature and Humidity Range

DGM10 has strong environmental adaptability and is suitable for indoor and outdoor environments. The working temperature ranges from -40°C to 55°C and it has excellent resistance to high humidity applications. It can be used, transported and stored under different climatic conditions.

## Long Lifetime

The expected working lifetime is > 3 years, and the expected lifetime of carbon monoxide used in fire applications can reach 10 years. Ammonia gas detection uses a non-consumable, long-life sensor suitable for environmental monitoring wherever higher background ammonia concentrations are present.

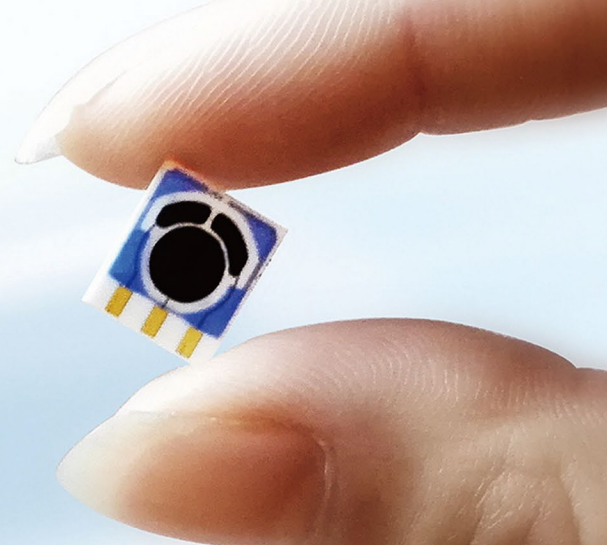
## Protection Design

The electronic circuit board of the DGM10 intelligent Dual Gas Sensor Module is protected by a dust-proof and corrosion-free coating suitable for indoor and outdoor industrial environments to prevent the ingress of corrosive gases and ensure product longevity.

## RoHS Approved

## Principle

# Solid Polymer Electrochemical Gas Sensing Technology



The DGM10 Sensor Module uses the Solid Polymer Electrochemical Sensing Technology. It employs a three-electrode arrangement- the working, the counter and the reference electrodes- in which concentration measurements can be performed continuously and the sensor operates at a fixed potential. The gas of interest (target gas) diffuses through a diffusion barrier, such as a capillary, into the cell to the working electrode where an electrochemical reaction occurs. Oxidation and reduction reactions are happening simultaneously. The current flowing through the cell is direct proportional to the concentration of the target gas. A reference electrode keeps the potential constant together with a potentiostat.

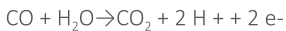
Expressed by the first Fick's law:

$$i = nFDC$$

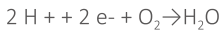
Therefore, the current flowing is proportional to the concentration of the target gas, and the reference electrode and potentiostat keep the potential constant.

For example:

In a carbon monoxide (CO) sensor, the following chemical reactions:

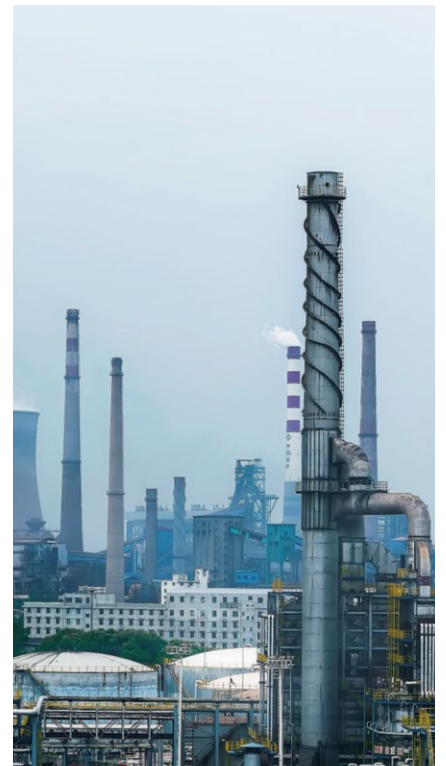


Protons diffuse to the counter electrode where oxygen is reduced to water:



## Applications

- Industrial Safety Gas Detection
- Indoor Air Quality Monitoring
- Outdoor Environmental Pollution Monitoring
- Air Exchange System and Air Purifier
- Livestock Farm and Food Industry
- Medical & Health Care
- Professional Gas Detection Instrument





## Gas Sensor Module Evaluation Kit

The DGM10-EVAL-KIT Gas Sensor Module Evaluation Kit consists of a set of UART to USB modules and test software. The system connects the DGM10 smart Dual Gas Sensor Module with the UART to USB module (the module with 1m cable, the outer diameter is 4mm), directly to the PC. The DGM10 smart Double Gas Sensor Module is powered by the PC and the data information of the gas sensor module is read by the DGM10 testing software. The measurement data can be stored and analyzed. The testing software supports Windows10 systems.

### Gas sensor module performance evaluation

Easy to use and quick to evaluate the performance of the gas sensor module or the application environment.

### Faster development

In the development process, the evaluation kit can be used as a reference product and the new products can be tested comparatively. It will help solve any problems during the new product development process.

### Gas sensor performance evaluation

The evaluation kit can help to understand the performance of the gas sensor in the early stage of the development process and evaluate the performance of the gas sensor quickly, which is more convenient for the selection of the gas sensor. It can help solve any problems that occur during the research and development process. In addition, it can be used for sensor failure testing.

### Part Number

- |                       |  |
|-----------------------|--|
| 02-EVAL-KIT-1M-10P-01 | Include UART to USB Module, Testing Software   |
| 02-UART-USB-1M-10P-01 | UART to USB Module, 10Pin Cable with 1m length |

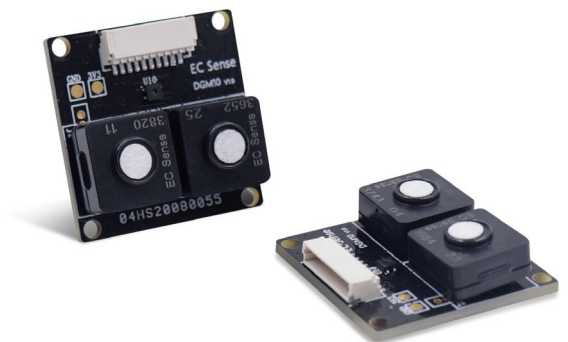


Partnumber	Sensor Position	Gas	Gas Formula	Range	Resolution	Response Time
04-DGM10-TVOC-HCHO-10-1-01	S0	Organic Volatiles	TVOC	0-10ppm	0.01ppm	< 3s (T90 < 15s)
	S1	Formaldehyde	HCHO	0-1ppm	0.01ppm	< 3s (T90 < 80s)
04-DGM10-TVOC-CO-10-1000-01	S0	Organic Volatiles	TVOC	0-10ppm	0.01ppm	< 3s (T90 < 15s)
	S1	Carbon Monoxide	CO	0-1000ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-TVOC-O <sub>3</sub> -10-5-01	S0	Organic Volatiles	TVOC	0-10ppm	0.01ppm	< 3s (T90 < 15s)
	S1	Ozone	O <sub>3</sub>	0-5ppm	0.01ppm	< 3s (T90 < 80s)
04-DGM10-TVOC-CO-10-01	S0	Organic Volatiles	TVOC	0-10ppm	0.01ppm	< 3s (T90 < 15s)
	S1	Carbon Monoxide	CO	0-10ppm	0.01ppm	< 3s (T90 < 30s)
04-DGM10-TVOC-H <sub>2</sub> S-10-100-01	S0	Organic Volatiles	TVOC	0-10ppm	0.01ppm	< 3s (T90 < 15s)
	S1	Sulfur Hydrogen	H <sub>2</sub> S	0-100ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-SO <sub>2</sub> -NO <sub>2</sub> -5-01	S0	Sulfur Dioxide	SO <sub>2</sub>	0-5ppm	0.01ppm	< 3s (T90 < 80s)
	S1	Nitrogen Dioxide	NO <sub>2</sub>	0-5ppm	0.01ppm	< 3s (T90 < 80s)
04-DGM10-O <sub>3</sub> -HCHO-5-01	S0	Ozone	O <sub>3</sub>	0-5ppm	0.01ppm	< 3s (T90 < 80s)
	S1	Formaldehyde	HCHO	0-5ppm	0.01ppm	< 3s (T90 < 80s)
04-DGM10-TVOC-CO-100-01	S0	Organic Volatiles	TVOC	0-100ppm	0.1ppm	< 3s (T90 < 15s)
	S1	Carbon Monoxide	CO	0-100ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-O <sub>3</sub> -HCHO-100-50-01	S0	Ozone	O <sub>3</sub>	0-100ppm	0.1ppm	< 3s (T90 < 80s)
	S1	Carbon Monoxide	HCHO	0-50ppm	0.1ppm	< 3s (T90 < 80s)
04-DGM10-SO <sub>2</sub> -NO <sub>2</sub> -50-01	S0	Sulfur Dioxide	SO <sub>2</sub>	0-50ppm	0.1ppm	< 3s (T90 < 30s)
	S1	Nitrogen Dioxide	NO <sub>2</sub>	0-50ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-SMELL-NH <sub>3</sub> -5-100-01	S0	Stench Gas	SMELL	0-5ppm	0.01ppm	< 3s (T90 < 30s)
	S1	Ammonia	NH <sub>3</sub>	0-100ppm	0.1ppm	< 3s
04-DGM10-SMELL-TVOC-5-10-01	S0	Stench Gas	SMELL	0-5ppm	0.01ppm	< 3s (T90 < 30s)
	S1	Organic Volatiles	TVOC	0-10ppm	0.01ppm	< 3s (T90 < 15s)
04-DGM10-SMELL-TVOC-200-01	S0	Stench Gas	SMELL	0-200ppm	0.1ppm	< 3s (T90 < 15s)
	S1	Organic Volatiles	TVOC	0-200ppm	0.1ppm	< 3s (T90 < 15s)
04-DGM10-NH <sub>3</sub> -H <sub>2</sub> S-100-10-01	S0	Ammonia	NH <sub>3</sub>	0-100ppm	0.1ppm	< 3s
	S1	Sulfur Hydrogen	H <sub>2</sub> S	0-10ppm	0.01ppm	< 3s (T90 < 30s)
04-DGM10-SMELL-H <sub>2</sub> S-200-100-01	S0	Stench Gas	SMELL	0-200ppm	0.1ppm	< 3s (T90 < 30s)
	S1	Sulfur Hydrogen	H <sub>2</sub> S	0-100ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-NH <sub>3</sub> -H <sub>2</sub> S-100-01	S0	Ammonia	NH <sub>3</sub>	0-100ppm	0.1ppm	< 3s
	S1	Sulfur Hydrogen	H <sub>2</sub> S	0-100ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-ETO-O <sub>2</sub> -100-25%-01	S0	Ethylene Oxide	C <sub>2</sub> H <sub>4</sub> O	0-100ppm	0.1ppm	< 3s (T90 < 30s)
	S1	Oxygen	O <sub>2</sub>	0-25%vol	0.01%vol	< 3s (T90 < 30s)
04-DGM10-ETO-O <sub>2</sub> -10-25%-01	S0	Ethylene Oxide	C <sub>2</sub> H <sub>4</sub> O	0-10ppm	0.01ppm	< 3s (T90 < 80s)
	S1	Oxygen	O <sub>2</sub>	0-25%vol	0.01%vol	< 3s (T90 < 30s)
04-DGM10-PH <sub>3</sub> -20-2000-01	S0	Phosphine	PH <sub>3</sub>	0-20ppm	0.1ppm	< 3s (T90 < 30s)
	S1	Phosphine	PH <sub>3</sub>	0-2000ppm	1ppm	< 3s (T90 < 30s)

Partnumber	Sensor Position	Gas	Gas Formula	Range	Resolution	Response Time
04-DGM10-H <sub>2</sub> -CO-4%-1000-01	S0	Hydrogen	H <sub>2</sub>	0-4%vol	0.01%vol	< 3s (T90 < 30s)
	S1	Carbon Monoxide	CO	0-1000ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-H <sub>2</sub> -CO-1000-01	S0	Hydrogen	H <sub>2</sub>	0-1000ppm	1ppm	< 3s (T90 < 30s)
	S1	Carbon Monoxide	CO	0-1000ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-O <sub>2</sub> -CO-25%-1000-01	S0	Oxygen	O <sub>2</sub>	0-25%vol	0.01%vol	< 3s (T90 < 30s)
	S1	Carbon Monoxide	CO	0-1000ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-O <sub>2</sub> -H <sub>2</sub> S-25%-100-01	S0	Oxygen	O <sub>2</sub>	0-25%vol	0.01%vol	< 3s (T90 < 30s)
	S1	Sulfur Hydrogen	H <sub>2</sub> S	0-100ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-O <sub>2</sub> -CO-25%-10000-01	S0	Oxygen	O <sub>2</sub>	0-25%vol	0.01%vol	< 3s (T90 < 30s)
	S1	Carbon Monoxide	CO	0-10000ppm	1ppm	< 3s (T90 < 30s)
04-DGM10-H <sub>2</sub> S-CO-100-1000-01	S0	Sulfur Hydrogen	H <sub>2</sub> S	0-100ppm	0.1ppm	< 3s (T90 < 30s)
	S1	Carbon Monoxide	CO	0-1000ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-TVOC-CO-200-1000-01	S0	Organic Volatiles	TVOC	0-200ppm	0.1ppm	< 3s (T90 < 15s)
	S1	Carbon Monoxide	CO	0-1000ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-O <sub>3</sub> -CO-5-10-01	S0	Ozone	O <sub>3</sub>	0-5ppm	0.01ppm	< 3s (T90 < 80s)
	S1	Carbon Monoxide	CO	0-10ppm	0.01ppm	< 3s (T90 < 80s)
04-DGM10-NO <sub>2</sub> -CO-100-1000-01	S0	Nitrogen Dioxide	NO <sub>2</sub>	0-100ppm	0.1ppm	< 3s (T90 < 30s)
	S1	Carbon Monoxide	CO	0-1000ppm	0.1ppm	< 3s (T90 < 30s)
04-DGM10-SMELL-NH <sub>3</sub> -5-10-01	S0	Stench Gas	SMELL	0-5ppm	0.01ppm	< 3s (T90 < 30s)
	S1	Ammonia	NH <sub>3</sub>	0-10ppm	0.01ppm	< 3s
04-DGM10-NH <sub>3</sub> -H <sub>2</sub> S-10-5-01	S0	Ammonia	NH <sub>3</sub>	0-10ppm	0.01ppm	< 3s
	S1	Phosphine	H <sub>2</sub> S	0-5ppm	0.01ppm	< 3s (T90 < 30s)
04-DGM10-PH <sub>3</sub> -O <sub>2</sub> -20-25%-01	S0	Phosphine	PH <sub>3</sub>	0-20ppm	0.1ppm	< 3s (T90 < 30s)
	S1	Oxygen	O <sub>2</sub>	0-25%vol	0.01%vol	< 3s (T90 < 30s)

Note: 1) If there is a gas or range not to be found in the above list please contact us.

2) After taking a sensor out of the circuit board please follow the above "sensor position" to reinstall the sensor on the board. The wrong position will result in incorrect measurement results.





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