

Digital VOC Gas Sensor

Manual



Easy Gas Sensor Solutions



Thank you for using the DS4 Digital VOC Gas Sensor. Please read this product specification carefully before use to ensure correct utilization.

This product specification is primarily designed to guide users in the optimal use of the DS4-PID Digital VOC Gas Sensor.

Warnings

The warning symbol is used to indicate that nonobservance of these instructions may result in equipment damage, false detection or system failure.

EC Sense sensors are designed for use in various environmental conditions. However, due to the principles and characteristics of the sensor, strict adherence to this document and the general application methods of PCB circuit boards is required during storage, assembly, and operation to ensure proper use. Any unauthorized use will not be covered by the warranty. Although our product are highly reliable, we recommend checking the module's reaction to the target gas before use to ensure on-site usability. When the product reaches the end of its service life, please do not dispose of any product components as household waste. Instead, adhere to local government regulations for electronic waste recycling.

Safety Instructions

This product should only be used by technically qualified personnel, following the instructions in this manual and relevant industry standards. In the event of an unresolvable error, usage must be stopped and inadvertent debugging should be prevented.



Product Description

The DS4-PID Digital VOC Gas Sensor is an intelligent gas sensor with a digital output. It utilizes photoionization detection (PID) technology to measure the concentration of volatile organic compounds (VOCs) in the environment.

The DS4-PID sensor is an industrial-grade intelligent VOC gas sensor with a simple and practical design. It features a high-performance microprocessor, high-precision analog-to-digital converter and intelligent algorithm design. It can be easily integrated into instruments, IoT systems and other monitoring systems, making it widely applicable in industrial, commercial, residential and medical fields.

Measurement Principle

The PID sensor is a photoionization sensor consisting of a vacuum ultraviolet lamp, low-noise detection circuit and an ionization chamber. During photoionization, the gas molecules are forced to "split" with an energy that is equal to or greater than that of the gas being measured, whereby exciting the electrons and generating ions, with each part of the "split" carrying a corresponding electrical charge. In a PID sensor, the source of energy that ionizes the gas molecules is the UV lamp in the ionization chamber. Therefore, before using a PID sensor, it is important to understand the energy required for ionization of the measured gas and the output energy provided by the PID sensor itself. The energy required to ionize VOC gas is called the "Ionization Potential" (IP) and is measured in electron volts (eV). In a PID sensor, the ultraviolet lamp serves as the energy source and its output energy is also measured in eV. If the output energy of the ultraviolet lamp is equal to or greater than the IP value of the measured gas, the gas can be ionized and further detected by the sensor. Otherwise, it cannot be ionized. The main components of air, such as N₂, O₂, CO₂, H₂O, have IP values greater than the output energy of the UV lamp. Therefore, the main components of the air are not ionized when detecting VOC leaks.

Functions and Characters

Digitized

The sensor outputs the gas concentration with a digital signal and comes pre-calibrated from the factory for quick installation and use.

Fast response

It features a rapid response time and real-time monitoring of sensor malfunctions.

Wide Applicability

They are widely used in environmental monitoring, petrochemical industry, industrial hygiene, and other application fields.

Long lifetime

It is characterized by long service life, high performance, strong long-term stability, robust environmental adaptability and outstanding resistance to toxic gases.

Wide measurement range

Products are offered with different measurement ranges from 0 to 20000 ppm.

High stability

It is equipped with an integrated temperature and humidity sensor. Combined with EC Sense's advanced compensation algorithms, the accuracy of the measured values is guaranteed both indoors and outdoors.



Technical Parameters

Measurement

Measurement Principle	Photoionization technology
Target Gases	TVOC
Measuring Range	See model selection table
Linearity	Linear
Response Time (T90)*	≤ 30 s

Electrical Parameters

Communication Interface	UART Communication
Communication Protocol	Mobus-RTU Protocol
Supply Voltage	3.2 V - 5.2 V
Current	55 mA (Supply Voltage: 5 V)
Output Signal	0.1 V - 3.0 V
Offset Voltage	100 ± 50 mV

Environmental Parameters

Temperature Range	-20 ℃ to +55 ℃
Humidity Range	15 to 95% RH. non-condensing
Pressure Range	800 to 1200 hPa
Storage Conditions	Stored in original packaging under 0 $^\circ C$ to 30 $^\circ C$ (0 to 30% RH)

Lifetime Parameters

Ideal Lifetime	1 year in the air	
Storage Duration	12 months from the date of delivery	
Warranty	12 months from the date of delivery	
Weight	Typical value: 13.8 g (19.67 g with housing)	
Housing Material	SUS304 & ABS	

Product Structure Diagram (unit: mm)

- Product Diagram
- Front View





38±0.1

• Bottom View



Lead-Out Wiring Diagram







Caution:

- For the first time use of the sensor, it must be preheated for at least half an hour.
- When calibrating, wait for the sensor to stabilize completely before operating. The zero point calibration should be carried out in dry and clean air.
- It is recommended to use isobutylene gas at around 50% of the measurement range as the calibration gas.
- It is prohibited to hot-plug or unplug the sensor while it is powered.
- Do not install the sensor in areas with strong air convection to avoid fluctuations in readings or sensor damage caused by changes in air pressure.
- Do not use or store the sensor for long periods of time in environments exceeding its measurement range.

Stabilization Time Upon the First Power-Up

The stabilization time for the sensor output is normally short at the first power-up. Since the sensor is equipped with a plug-and-play function, the internal circuitry keeps the sensor in a working state, avoiding the long stabilization time typically associated with conventional electrochemical gas sensors. Nevertheless, the sensor and electronic components require a brief start-up and equilibrium period.

If the gas concentration is high due to contamination during storage, transport or in the field environment, a longer stabilization time can be expected. The higher the contamination concentration, the longer the stabilization time required.

The strong air convection in the field environment could cause data fluctuations, especially when detecting low concentrations. It is important to monitor the ambient conditions closely. When the ambient conditions stabilize, without strong convection or air exchange (e.g. opening windows or doors, use of fans, air conditioning, ventilation, purification systems, etc.), and the output signal stabilizes, it indicates that normal detection can commence.

Calibration Conditions

The sensors might need calibration under the following conditions:

- Stored in warehouse for more than 6 months.
- Continuously used for 3-6 months.
- Frequently exposed to high-concentration gases.
- The measurement error exceeds the acceptable range.

Please adhere to the following instructions before calibration:

- Use standard gases with a standard substance certificate which are within the validity period.
- Must perform zero point correction before the sensitivity calibration to ensure calibration accuracy.
- You can calibrate the EC Sense VOC gas sensor individually by using the optional user calibration software provided by EC Sense or by performing a calibration via command operations using the communication protocol.

Before calibrating the sensor, please refer to the wiring diagram provided above and connect the sensor to the PC using a USB-TTL module.



Zero Point Correction

The zero point correction can be performed in clean air or in indoor environments with good air quality (no measured gas or interfering gas).

Ventilation Calibration Steps

Step 1:

Attach the 4S Sensor Flow Cap (optional accessory) or the 25-Channel Evaluation Kit to the DS4 Digital VOC Gas Sensor. Then connect the zero gas outlet pipe to the inlet port of the flow cap or evaluation kit.

Step 2:

Introduce the standard gas into the system. When using the 4S Sensor Flow Cap, introduce clean air at a flow rate of 400 ml/min. When using the 25-Channel Evaluation Kit, introduce clean air at a flow rate of 2000 ml/min.

Step 3:

After continuous ventilation for 3 minutes, click the zero point correction button when the reading of the user software or device is stable. At this point, the current value is reset to 0 and written on the chip inside the gas sensor.

Step 4:

Stop and remove the zero gas supply. Take off the flow cap and place the sensor in the air.

Sensitivity Calibration

During the sensitivity calibration, it is necessary to supply standard gas from a gas cylinder with a known concentration. The gas concentration should be selected to be lower than the maximum detection range of the sensor, typically around 50% to 80%.

Step 1:

Attach the 4S Sensor Flow Cap or the 25-Channel Evaluation Kit to the DS4 Digital VOC Gas Sensor. Then connect the gas outlet pipe of the standard gas to the inlet port of the flow cap or evaluation kit.

Step 2:

Introduce the standard gas into the airflow. When using the 4S Sensor Flow Cap, introduce isobutene standard gas into the airflow at a flow rate of 100 ml ~ 500 ml/min.

Step 3:

After continuous ventilation for 3 minutes, input the standard gas concentration into the user calibration software or device. Once the sensor reading stabilizes, click on the sensitivity calibration button.

Step 4:

Stop and remove the standard gas supply. Remove the flow cap and place the sensor in ambient air to restore the zero point.



Model Selection Table

Product Name	Order Number	Measuring Range	Reading Resolution
Digital VOC Gas Sensor	04-DS4-PID-VOC-10-01	0 - 10 ppm	1 ppb
	04-DS4-PID-VOC-20-01	0 - 20 ppm	2 ppb
	04-DS4-PID-VOC-50-01	0 - 50 ppm	5 ppb
	04-DS4-PID-VOC-100B-01	0 - 100 ppm	0.01 ppm
	04-DS4-PID-VOC-100C-01	0 - 100 ppm	0.01 ppm
	04-DS4-PID-VOC-200-01	0 - 200 ppm	< 0.02 ppm
	04-DS4-PID-VOC-500-01	0 - 500 ppm	0.05 ppm
	04-DS4-PID-VOC-1000-01	0 - 1000 ppm	0.1 ppm
	04-DS4-PID-VOC-2000-01	0 - 2000 ppm	0.2 ppm
	04-DS4-PID-VOC-5000-01	0 - 5000 ppm	0.5 ppm
	04-DS4-PID-VOC-10000-01	0 - 10000 ppm	1 ppm
	04-DS4-PID-VOC-20000-01	0 - 20000 ppm	2 ppm

Storage and Transportation

Please refer to the recommended storage environment conditions and cycles as described above.

Additionally, the storage environment should maintain clean air, free from contaminating gases, high-concentration organic gases, dust and smoke. It is recommended to avoid storing the sensors with high concentrations of alcohol (ethanol), perfume, sodium silicate, polyurethane-based liquids and solids.

Storing the sensors beyond the recommended conditions may lead to damage and prolonged storage or exposure to maximum conditions may affect the sensor reliability. It is recommended to adhere to the recommended storage time.

During transportation, use sealed packaging and provide protection with shock-absorbing bubble wrap or odorless environmentally friendly sponge.

Long exposure to direct sunlight and water penetration should be avoided during transportation.

Pay attention to the height of the product placement to prevent falls, compression and strong vibrations.

Warranty

Disassembly of the sensor or alteration of its appearance, including labels, markings, and structural components, is strictly prohibited. Any such action will result in automatic voiding of the warranty coverage and period.

Disclaimer

The above EC Sense performance data is based on data obtained using EC Sense gas distribution systems and AQS testing software. In order to continuously improve products, EC Sense reserves the right to change design features and specifications without prior notice. We are not responsible for any loss, injury, or damage caused thereby. EC Sense shall not be liable for any indirect loss, injury, or damage caused by the incorrect use of this document, the information contained therein, or any omissions or errors. This document does not constitute an offer for sale. The data contained herein is for reference purposes only and should not be construed as a guarantee. The use of any given data must be evaluated and determined by the user to comply with federal, state, and local laws and regulations. All specifications outlined are subject to change without notice.



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