EC Sense
Easy Gas Sensors

# Digital Combustible Gas Sensor

## Datasheet

DS4-LEL Combustible Gas


Easy Gas Sensor Solutions

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# Product Description

The DS4-LEL Digital Combustible Gas Sensor is an intelligent digital gas sensor which utilizes the catalytic combustion detection principle to measure the concentration of combustible gases in the environment.

It is an industrial-grade gas sensor with a small and compact design. It employs high-performance microprocessors and high-precision analog-to-digital converters, together with an intelligent algorithm design. It can be easily integrated into instruments, IoT systems, and other monitoring systems. It is widely used in industrial, commercial, civil, and medical fields.

# Product Features

## Standard Industrial Dimensions

The standard industrial 4-series dimensions feature a cylindrical housing measuring 20*16.6 mm, allowing users to easily iterate on new product designs. This size is suitable for fixed gas detectors, portable detection instruments, and saves on the costs associated with designing new housings for product upgrades. It adheres to standard three-electrode pin dimensions (VCC_power positive, GND_power negative, IO_data sending/receiving).

## User-Defined Encryption Code Functionality

Users can customize their own user codes for identification. When inserting other types of sensors, the device can automatically verify whether the user code is correct. In case of an incorrect user code, the device can display an error message, reminding the user to insert the correct sensor.

## Low Power Consumption Sleep Functionality

The sensor features a sleep function, allowing users to customize sleep and wake-up modes, suitable for low-power battery or IoT applications.

## Self-Identification Feature

The DS4 sensor outputs identity information such as “gas type” and “detection range”, which facilitates the design of self-identification functions for greater flexibility.

# Features

## Use without Preheating

The intelligent hardware design allows the gas sensor to remain operational even without a power supply, ensuring that gas detection can be initiated immediately upon power-up anytime, anywhere. In IoT or battery-powered applications, there is no need to worry about long preheating or waiting times thanks to energy-saving and low-power design, which ensures fast data acquisition.

## Precision Factory Pre-Calibration

Each DS4 smart gas sensor undergoes professional gas calibration at the factory and the calibration information is stored in the internal chip of the product. This allows users to use the sensor directly without the need for additional calibration. The factory calibration includes a diffusion gas calibration and an analog climate calibration, which is closer to the user's real application environment and enhances the accuracy of the data measured by gas detectors with diffusion measurement. (A secondary calibration based on the design parameters of the device system is required for gas detectors using pump suction measurement).

## Life and Performance Monitoring

The intelligent gas sensor carries out regular self-checks of its performance and service life, regardless of the presence of measured gases. It issues warning signals as a reminder for maintenance or replacement. This function provides reliable baseline data for the development of intelligent instruments, ensuring excellent safety and reliability and enabling remote maintenance. Users can obtain information, such as normal operation, weakened performance, sensor failure or replacement through commands, providing early warning of sensor failure and significantly enhancing safety.

## Convenient Maintenance

The sensor supports hot-swappable plug-and-play functionality. The open calibration protocol enables secondary offline calibration during after-sales service, as well as a one-click factory calibration reset design. The plug-and-play feature enables offline calibration, eliminating the need to introduce hazardous gases into the detection environment, thus avoiding safety risks and environmental contamination, making maintenance safer, more convenient, and simpler.

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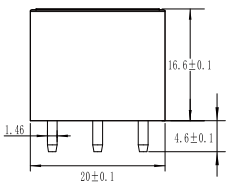
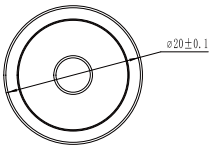
# Product Structure Diagram (unit: mm)

- Product Diagram

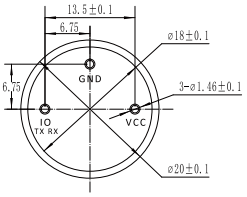
- Front View




- Top View



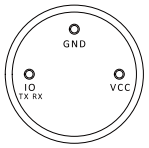

- Bottom View




The sensor provides a digital output without the need for any additional analog signal conditioning circuits. It can be connected directly to the microcontroller interface via a UART 3.3V half-duplex single bus signal. The permissible supply voltage range is from 3.3V to 12V DC, whereby 5V DC is recommended. An operating voltage beyond this range may result in malfunction or sensor failure.

Please adhere closely to all wiring instructions, as incorrect wiring may result in a permanent damage to the sensor.

Pin Definitions:




## Pin Description

| Pin Definition | Pin Description | Min Value | Typical Value | Max Value |
|---|---|---|---|---|
| VCC | Power Positive | 3.3 V | 3.3 V | 3.5 V |
| IO | Serial Data Sending and Receiving | 0 V | - | 3.3 V |
| GND | Power Ground | - | 0 V | - |

# Technical Specifications

| Measurement | |
|---|---|
| Measurement Principle | Catalytic combustion gas detection technology |
| Target Gases | Combustible gases (methane, ethane, etc.) |
| Measuring Range | 3% vol to 100% vol |
| Linearity | Linear |
| Response Time (T90)* | ≤ 30 s |

| Environmental Parameters | |
|---|---|
| Temperature Range | -20 ℃ to +55 ℃ |
| Humidity Range | 15 to 95% RH. non-condensing |
| Pressure Range | 800 to 1200 hPa |
| Recommended Storage Conditions | Stored in original packaging under 0 ℃ to 30 ℃ (0 to 30% RH) |

| Electrical Parameters | |
|---|---|
| Communication Interface | UART Communication |
| Communication Protocol | Attachment |
| Supply Voltage | 3.3 V- 5 V |
| Current | 200 mA |
| Output Signal | UART single-wire half-duplex 3.3 V, baud rate 9600 |

| Lifetime Parameters | |
|---|---|
| Ideal Lifetime | 2 years in the air |
| Storage Duration | 12 months from the date of delivery |
| Warranty | 12 months from the date of delivery |
| Weight | Typical value: 5.5 g |
| Housing Material | PPO |

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**Product List**

| Product Name | Order Number | Range | Response Time (T90)* | Notes |
|---|---|---|---|---|
| Digital Combustible Gas Sensor | 04-DS4-LEL-100%-01 | 3% - 100% | ≤ 30 s | / |
| | 04-DS4-LEL-100%-PR-01 | 3% - 100% | ≤ 30 s | PR: Poison Resistant |
| | 04-DS4-LEL-100%-LP-01 | 3% - 100% | ≤ 30 s | LP: Lower Power |

## Cross Sensitivity

| Gas | Formula | LEL (% vol) | Relative Sensitivity |
|---|---|---|---|
| Methanee | $CH_4$ | 5 | 100 |
| Propane | $C_3H_8$ | 2.1 | 58 |
| Isobutane | $C_4H_{10}$ | 1.8 | 48 |
| n-Heptane | $C_7H_{16}$ | 1.1 | 28 |
| Xylene | $C_8H_{10}$ | 1 | 17 |
| Methanol | $CH_3OH$ | 5.5 | 18 |
| Acetic Acid | $CH_3COOH$ | 4 | 3 |
| n-Pentane | $C_5H_{12}$ | 1.7 | 47 |
| Phenylethane | $C_8H_8$ | 1.1 | 14 |
| Methylbenzene | $C_7H_8$ | 1.2 | 37 |
| Acetone | $C_3H_6O$ | 2.5 | 9 |
| Ethanol | $C_2H_5OH$ | 3.3 | 11 |
| Ethyl Acetate | $C_4H_8O_2$ | 2 | 9 |
| Hydrogen | $H_2$ | 4 | 74 |
| n-Hexane | $C_6H_{14}$ | 1.2 | 42 |
| Isopropanol | $C_3H_8O$ | 2 | 31 |
| Cyclohexane | $C_6H_{12}$ | 1.3 | 42 |

Note: The relative cross sensitivity is provided for reference only. Calibration with the target gas is recommended. We do not guarantee the accuracy of the calibration and measurement if the sensor is calibrated with cross-sensitive gases.

1. All above performances are measured at 20 °C, 50% relative humidity and atmospheric pressure.
2. It is recommended to calibrate the sensor with the target gas. We do not guarantee the accuracy of the calibration and measurement if the sensor is calibrated with cross-sensitive gases.
3. The cross sensitivity may fluctuate by up to ± 30% and may vary with different production batches and the sensor lifetime.
4. The above cross sensitivity includes, but is not limited to, the gases mentioned. The sensor may also respond to other gases.

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## 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.

## Warning

EC Sense sensors are designed for use in various environmental conditions. However, due to the principles and characteristics of catalytic combustion sensors, it is essential for users to strictly adhere to the instructions provided in this document during the storage, assembly, and operation of the modules to ensure proper use. Avoid cleaning the sensor with alcohol, acetone, or other strong solvents. Damage caused by the illegal application and modification of PCB circuit boards will not be covered under warranty. While our products are highly reliable, we recommend checking the module's response to target gases 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.

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**Business Centre**
**Europe and the Rest of the World**
EC Sense GmbH
Wangener Weg 3
82069 Hohenschäftlarn, Germany
Tel: +49(0)8178-9999-210 Fax: +49(0)8178-9999-211
Email: office@ecsense.com
www.ecsense.com

**Business Centre**
**Asia**
Ningbo AQSystems Technology Co., Ltd.
6 Building, Zhong Wu Technology Park No.228,
Jin Gu Bei Road, Yinzhou District NingBo,
Zhejiang Provence, P.R. China Post Code: 315100
Tel: +86(0)574 88097236, 88096372
Email: info@aqs-de.com
www.ecsense.cn

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