

# EM26AQS - Evaluation Module for TGS26 Series Air Quality Sensors Instruction Manual

## Table of Contents

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### 1. Overview

### 2. Functions and Settings of Each Part

- 2-1) Pin Connections
- 2-2) Switch setting for Power input
- 2-3) Switch settings for gas sensor models
- 2-4) Reset function
- 2-5) Air quality level output and LED indication
- 2-6) Load resistance RL setting
- 2-7) Notes about sensor output (VOUT)

### 3. How to use EM26AQS

- 3-1) Warm-up period
- 3-2) Normal operation mode
- 3-3) Reset function
- 3-4) Sensor mounting

### 4. Specifications

### 5. Extension Function

### 6. Troubleshooting

## 1. Overview

The **EM26AQS** is a multifunctional evaluation module with built-in signal processing software for the dynamic benchmark renewal algorithm, which is required when incorporating semiconductor-type air quality gas sensors (TGS2600, 2602, 2603) into air purifiers, among other applications.

The module carries out signal processing on the voltage output of the gas sensor to output the Indoor Air Quality Level (VAQL) as a voltage with 5 levels. Furthermore, the degree of indoor air pollution can be monitored visually by 5 LEDs of different colors which correspond to the air quality levels (VAQL).

## 2. Functions and Settings of Each Part

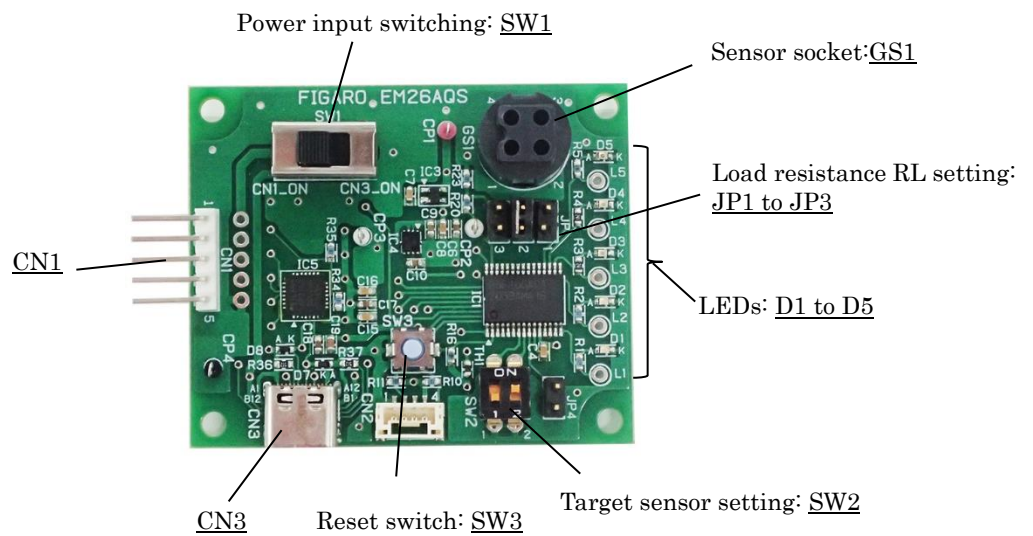


Fig 1. Name of each part

### 2-1) Pin Connections: CN1

Pin No.	Name	Description
1	VC	Circuit voltage
2	VOUT	Sensor output
3	VAQL	Indoor air quality level output
4	NC	No connection
5	GND	Ground

Suggested female connectors for mating with the 5-pin connector (JST:MB5P-90S):  
 JST: XHP-5P or 05JQ-BT

## **2-2) Switch setting for Power input: SW1**

There are two connectors available for the power input: a 5-pin connector or a USB-Type C connector. When using the 5-pin connector (CN1), switch SW1 to the "CN1\_ON" side. When using the USB-Type C connector (CN3), switch SW1 to the "CN3\_ON" side.

\* The function of the USB-Type C connector is currently limited to power supply only.

## **2-3) Switch settings for gas sensor models: SW2**

Before turning on the power, set the DIP switch according to the gas sensor to be evaluated. Both SW2-1 and SW2-2 are set to OFF at the factory.

**\* The DIP switch setting is read in the microcontroller only when the power is turned on. It is necessary to turn the module on again after making any changes of SW2 settings.**

Target sensor	SW2-1 setting	SW2-2 setting
TGS2600	OFF	OFF
TGS2602	OFF	ON
TGS2603	ON	OFF

## **2-4) Reset function: SW3**

The reset switch is functional only in the normal mode. For more details, please refer to "3-3) Reset function".

## **2-5) Air quality level output and LED indication: D1 to D5**

The blue LED blinks during the 2-minute warm-up period after the power is turned on, and the module returns to normal mode once the warm-up is finished. In normal mode, the air quality level is output using the 5 voltage levels shown in the table below, and the LED with the color corresponding to each air quality level will come on.

\* Air quality level output (VAQL) can be measured from the pin 3 of CN1.

\* The assessment of air pollution levels is a subjective one and may vary from person to person.

Level	VAQL*	LED color	Degree of air pollution*
1	Approx. 1V	D1: Blue	Clean
2	Approx. 2V	D2: Green	Mildly polluted
3	Approx. 3V	D3: Yellow-green	Moderately polluted
4	Approx. 4V	D4: Orange	Heavily polluted
5	Approx. 5V	D5: Red	Extremely polluted



Fig 2. Image of LED lighting (when LED D4 is on.)

### **2-6) Load resistance RL setting: JP1-JP3**

The proper load resistance (RL) setting is required to measure the sensor output (VOUT) as follows. The factory setting of the jumper pin JP is 10kΩ as a recommended value. Choose 51kΩ if VOUT value is too small, or 2kΩ if it is too large for easy measurement of sensor output voltage VOUT.

- \* If RL is not selected, approx. 5V will be output from the pin 2 of CN1.
- \* When changing the jumper pin JP setting, turn the power off, change the pin setting, and then turn the power back on.

Load resistance	Setting
2kΩ	JP1
10kΩ	JP2
51kΩ	JP3

Sensor resistance (Rs) in kΩ is calculated from the sensor output VOUT using the following formula:

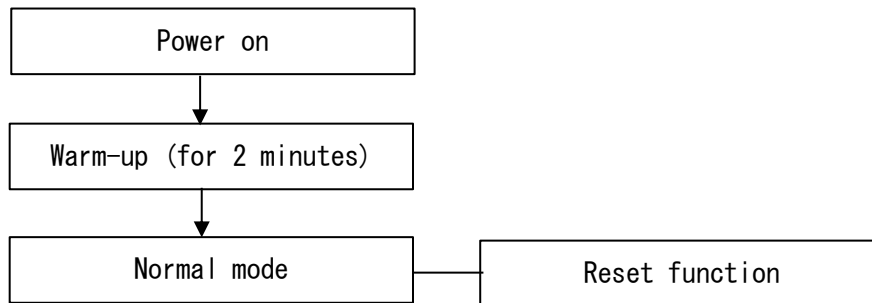
$$R_s = (V_C / V_{OUT} - 1) \times R_L$$

### **2-7) Notes about sensor output (VOUT)**

The sensor output voltage (VOUT) may vary even among the same sensor models due to individual differences in sensor resistance. Also, VOUT can be varied by changing the load resistance (RL).

### 3. How to use EM26AQS

EM26AQS operates as shown in the follow chart:



#### **3-1) Warm-up period**

For 2 minutes after turning on the power, the AQ Level 1 (clean) indication will be displayed regardless of the degree of air pollution, and the blue LED will blink at 0.5 second interval. After the warm-up period, the blue LED will stop blinking and go on. At the same time, the resistance value of the sensor (Rs) in the air pollution level at that time will be recorded in the microcontroller as the initial reference value under the clean air.

#### **3-2) Normal mode**

The module will switch to normal mode once the warm-up is finished. One of the LEDs with five different colors will illuminate, and a different air quality level output (VAQL) will be produced from the 3 pin of CN1, which corresponds to each level of air pollution. During the normal mode, the reference value of the sensor resistance in the microcontroller is successively updated according to changes in the degree of air pollution, and the microcontroller will continue to evaluate the degree of air pollution in 5 levels by comparing the current sensor resistance value to the updated reference value.

#### **3-3) Reset function**

When the tactile switch (SW3) is pressed for 4 seconds or more during normal operation mode, the reference value will be forced to update to the sensor resistance value in the ambient air conditions at that moment. The air quality level around the sensor at that time will be regarded as clean, and the air quality level output (VAQL) will be reset (\*) to 1V (i.e. Clean).

(\*) If the delay function (\*\*) is activated, the reset function will not automatically cause transition to AQL = 1 (clean) after the switch (SW3) is turned on. Instead, it will gradually decrease the level.

VAQL = 5   →   4   →   3   →   2   →   1 (Clean)  
           1 min    1 min    1 min    1 min

(\*\*) For details of the delay function, please refer to the product technical document.

We recommend performing the reset function in clean air as possible.

**3-4) Sensor mounting**

When mounting a gas sensor in its socket, ensure proper sensor orientation.  
(Mounting the sensor incorrectly will result in inaccurate output.)

**4. Specifications**

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Model No.:	EM26AQS
Product Name:	Evaluation Module for Air Quality Sensors
Compatible gas sensors:	TGS2600, TGS2602, TGS2603 (TGS2660 optional)
Input voltage:	5.0 ± 0.2VDC
Sensor output voltage:	Max. 5V (depending on input voltage)
Quality level output:	1 to 5V
Operating temperature and humidity conditions:	-10°C to 50°C, 0% to 95%RH (no condensation)
Dimensions:	Approx. 45 x 55 x 17 (mm) excluding gas sensor
Weight:	Approx. 15g (excluding gas sensor)

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**5. Extension Function**

As an extension function, the EM26AQS has a dedicated TGS2660 mode that facilitates the evaluation of the ventilation index sensor TGS2660.

The TGS2660 mode enables to provide 5 levels of the Ventilation Index Output (VIO) as an indication of low-concentration indoor air pollution caused by room occupants using TGS2660 sensor.

**5-1) Switch settings for TGS2660 Mode: SW2**

Before turning on the power, set the Dip switch (SW2) as shown in the table below.

Target Sensor	SW2-1 Setting	SW2-2 Setting
TGS2660	ON	ON

**5-2) Ventilation Index Output and LED Indication: D1 to D5**

As with the evaluation of TGS2600, 2602, and 2603 sensors, when used with TGS2660, the Ventilation Index Output (VIO) is output using the five voltage levels and LED indication with different colors corresponding to each ventilation index level.

The LED color corresponding to the Ventilation Index Output (VIO) and the state of air pollution are shown in the table below. The Ventilation Index Output (VIO) can be measured from pin 3 of CN1.

Level	VIO	Color of LED	Indoor Air Pollution Levels	Approximately corresponding CO2 concentration ranges*
1	approx.1V	D1 : Blue	Clean indoor air level	400~800ppm
2	approx.2V	D2 : Green	Stale air	800~1500ppm
3	approx.3V	D3 : Greenish yellow	Level associated with complaints of drowsiness and poor air.	1500~2500ppm
4	approx.4V	D4 : Orange	Stagnant, stale, stuffy air, level associated with sleepiness	2500~5000ppm
5	approx.5V	D5 : Red	Very strong discomfort	5000ppm or over

\* The corresponding CO2 concentration ranges are for reference purposes only. The information contained in the table shall not be construed as a correlation between ventilation index levels and indoor CO2 concentrations.

### **5-3) Operation in TGS2660 mode**

As with the evaluation of the other TGS260x series air quality sensors, the extension function includes warm-up, normal mode, and reset functions. Please refer to "3. How to use EM26AQS " for details. When the tactile switch (SW3) is pressed for **4** seconds or more during normal operation mode, the reference value will be forced to update to the sensor resistance value in the ambient air conditions at that moment. The air quality level around the sensor at that time is regarded as clean, and the Ventilation Index Output (VIO) will be reset (\*) to 1V (i.e. clean air).

## 6. Troubleshooting

The following are the possible causes and suggested actions to take when an abnormality occurs:

Fault conditions	Possible causes	Suggested actions
None of the LEDs are lit.	- Low power supply voltage - Power supply voltage is not input.	Please check the power supply.
	Failure of this module (Due to electrostatic damage to electronic components, etc.)	-
The red LED is blinking.	Fault determination by the microcontroller	* To reset the fault condition, please turn the power off and then turn it back on.
	Sensor failure	Please replace the sensor.
Others	Microcontroller runaway due to external noise	Please turn the power off and then turn it back on.
	Other faults	Please contact the manufacturer.

\* This module is designed for the evaluation of TGS26-series air quality sensors only and not for other purposes or applications.

For any product-related inquiries, please contact us using the information provided below.

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