

**FIGARO**

an ISO9001 and 14001 company

**Technical Information for the CDM4161A CO<sub>2</sub> Module**

CDM4161A is a highly miniaturized pre-calibrated CO<sub>2</sub> unit which uses TGS4161, Figaro's compact and low-power consumption solid electrolyte CO<sub>2</sub> sensor. Due to Figaro's proprietary idea for signal processing with a microcomputer, no maintenance is required for this module. When compared with traditional CO<sub>2</sub> sensor modules using IR sensors, Figaro's CO<sub>2</sub> module is much more cost effective, making this module the ideal choice for indoor air quality control systems.



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**IMPORTANT NOTE:** OPERATING CONDITIONS IN WHICH FIGARO SENSORS ARE USED WILL VARY WITH EACH CUSTOMER'S SPECIFIC APPLICATIONS. FIGARO STRONGLY RECOMMENDS CONSULTING OUR TECHNICAL STAFF BEFORE DEPLOYING FIGARO SENSORS IN YOUR APPLICATION AND, IN PARTICULAR, WHEN CUSTOMER'S TARGET GASES ARE NOT LISTED HEREIN. FIGARO CANNOT ASSUME ANY RESPONSIBILITY FOR ANY USE OF ITS SENSORS IN A PRODUCT OR APPLICATION FOR WHICH SENSOR HAS NOT BEEN SPECIFICALLY TESTED BY FIGARO.

## 1. Basic Information

### 1-1 Features

- \* Ultra compact size
- \* High selectivity to CO<sub>2</sub>
- \* Maintenance free
- \* Low power consumption
- \* Long life
- \* Pre-calibrated
- \* Low cost

### 1-2 Applications

- \* Indoor air quality control

### 1-3 Specifications

The specifications of CDM4161A are contained in Table 1.

### 1-4 Dimensions (see Fig. 1 below)

## 2. Structure and Functions

### 2-1 Solid electrolyte CO<sub>2</sub> sensor TGS4161

The sensor changes its output voltage in response to exposure to CO<sub>2</sub> gas. The sensor should not be directly connected with low-input impedance equipment. Please refer to *TGS4161 Technical Information* for details as to the characteristics of the sensor.

### 2-2 Input-output signal (CN1)

Please refer to Table 2-Pin Designations and Table 3-

Rated Input and Output Voltages for Rated Values. Also please refer to Fig. 2-Circuit Diagram of Circuit Interface.

#### 2-2-1 Pin No.1 (VIN)

Regulated voltage should be input into this port. The sensor's output may vary according to the sensor's voltage dependency characteristics if the input voltage fluctuates. Please refer to *TGS4161 Technical Information* for details.

#### 2-2-2 Pin No.2 (Concentration output & Trouble signal output)

This port has two roles depending on the output signal: concentration output or trouble signal output. Under normal operating conditions, an analog voltage (CO<sub>2</sub> concentration / 1000) corresponding to CO<sub>2</sub> concentration is output in the range from 0.4 to 4.0V DC. If the sensor's output is abnormal, a LOW signal will be output from this pin.

Pin No.	Name	Description
1	VIN	Power supply input
2	VCONC TRBL	CO <sub>2</sub> concentration output Trouble signal output
3	CTRL	Control signal output
4	RESET	Reset signal input
5	GND	Common ground

Table 2 - CDM4161A Pin Designations of CN1

**NOTE:** CN1 should be MB5P-90S, mfg. by JST.  
Recommended receptacle for connector: 05JQ-BT, mfg. by JST.

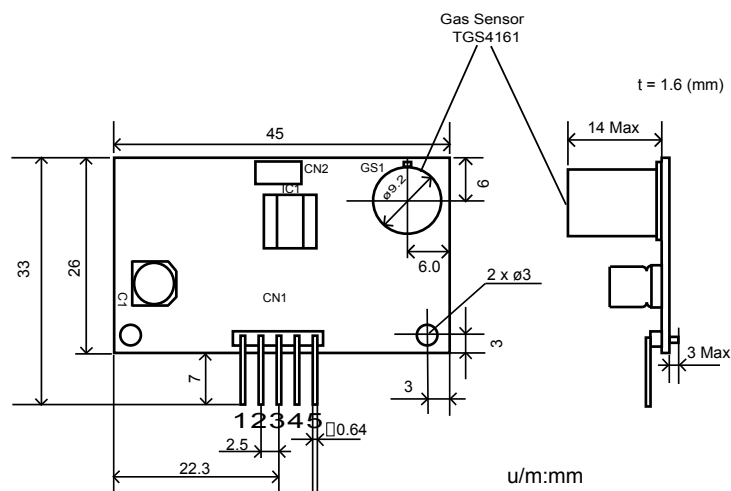


Fig. 1 - CDM4161A Dimensions

Product name	Carbon dioxide (CO <sub>2</sub> ) sensor module
Model No.	CDM4161A
Detection range	400 to 4,000ppm
Sensor (principle)	TGS4161 (solid state electrolyte)
Accuracy (*1)	approx. ±20%
Power supply	DC5.0±0.2V regulated
Power consumption	300mW (typical)
Inrush current	100mA (max)
Operational temperature & humidity range	-10°~+50°C, 5~95%RH (avoid condensation)
Storage temperature & humidity range	-20°~+60°C, 5~90%RH (pack in a moisture proof bag)
Warm up time	2 hours
CO <sub>2</sub> concentration signal (*2)	V <sub>conc</sub> = CO <sub>2</sub> concentration/1,000 (DC 0.4 to 4.0V)
Trouble signal	LOW output
Control signal	ON: HIGH output (when CO <sub>2</sub> conc. exceeds 1000ppm) OFF: LOW output
Reset switch	Establishes the ambient CO <sub>2</sub> concentration as 400ppm by HIGH input signal
Dimensions	45 x 26 x 17mm (45 x 33 x 17mm incl. CN1)
Weight	approx. 6g

Table 1 - Specifications

**Note 1:** Assumes benchmark is set accurately at 400ppm of CO<sub>2</sub>. This value does not contain long term drift.

**Note 2:** In this module, the CO<sub>2</sub> concentration is calculated by measuring the relative change of sensor output at the measuring point from sensor output in clean air (assumed to be 400ppm of CO<sub>2</sub>).

### 2-2-3 Pin No.3 (Control signal output)

When CO<sub>2</sub> concentrations exceed 1000ppm of CO<sub>2</sub>, a HIGH signal will be output from this port.

### 2-2-4 Pin No.4 (Reset signal input)

The baseline value may be reset using this input signal. By HIGH input signal, the sensor's output at that moment is memorized as 400ppm of CO<sub>2</sub> (the baseline value in fresh air). When a HIGH signal is input during warm-up time (within the first two hours after the module is powered on), the baseline voltage is read at that moment and the module immediately goes into operation mode.

**Caution:** If the baseline reset signal is input while in a polluted environment where the actual CO<sub>2</sub> concentration is higher than 400 ppm (ambient levels), the accuracy of readings may become adversely affected.

## 3. Operation modes

### 3-1 Warm up (refer to Table 5-Signal Output in Operation Mode)

The sensor is warmed up for two hours after the module is powered on. A constant voltage (4.5V) is output from the concentration output port during this period.

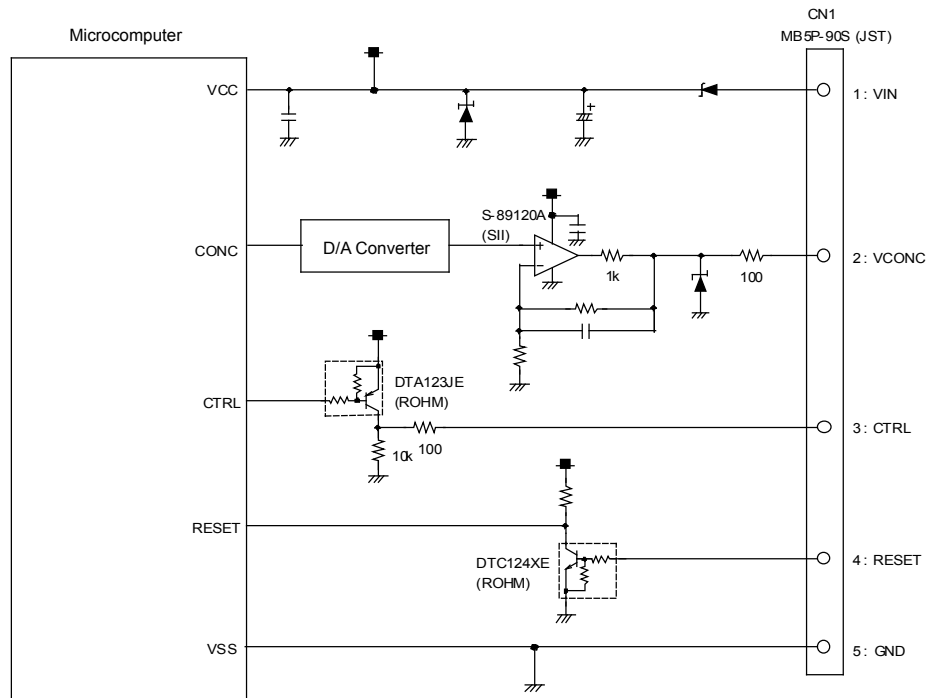


Fig. 2 - Circuit Diagram of Circuit Interface

By HIGH input signal to RESET (pin No. 4), the warm up mode will be terminated. The CO<sub>2</sub> concentration after warm up period is recognized as 400ppm.

### 3-2 Normal operation

After the warm up period, a continuous analog output proportional to CO<sub>2</sub> concentration will be generated. The control signal output will indicate LOW if CO<sub>2</sub> concentration is lower than 1000ppm. When CO<sub>2</sub> concentration exceeds 1000ppm, the control signal output will indicate HIGH. When CO<sub>2</sub> concentration drops to 900ppm, the control signal output will return to LOW.

### 3-3 Trouble (refer to Table 4-CO<sub>2</sub> Threshold Values)

When sensor output is abnormal, LOW signal will be output from pin No.2.

## 4. Cautions

1) By assuming that the baseline level represents fresh air (400ppm of CO<sub>2</sub>), actual CO<sub>2</sub> concentrations are calculated based on the difference between the baseline level and the current sensor output. As a result, the following cautions should be noted:

- a) Accurate readings cannot be expected if an accurate baseline could not be acquired.
- b) The sensor should be exposed to fresh air periodically to properly renew the baseline level. Performance shown in the specifications cannot be

achieved if the module was used in an environment where CO<sub>2</sub> concentrations increased slowly and steadily for a long period of time.

c) The module should be located in fresh air during the warm-up period. Accurate readings cannot be expected until the baseline is acquired in fresh air. If the module is warmed up in an environment where CO<sub>2</sub> concentration is higher than normal fresh air, the baseline will represent a polluted level and the device will not be able to clean the air sufficiently.

d) Power should be on at all times. Since the baseline is memorized in a microcomputer, if the power should be cut off, the memory would be lost and operation would resume from the warm-up process.

e) The module is not intended for usage in life saving equipment. If the module is incorporated into life saving equipment, an alternative and secure measure for calculating CO<sub>2</sub> concentration should be used for the life safety function.

2) This module is designed only for indoor usage. The module should be protected from exposure to rain, wind, sun, heat radiation, etc.

3) Please apply a regulated voltage, otherwise the accurate reading cannot be expected. Application of excessive and/or reverse voltage would cause damage to the module.

4) The module does not include a circuit for protection from excessive current. An excessive current

Pin No.	Item	Minimum	Typical	Maximum	u/m	
1	Power supply input (VIN)	3.5	5.0	5.5	V	
2	CO <sub>2</sub> conc. output (VCONC)	Output voltage (normal operation)	0.2	-	4.2	V
		Output voltage (trouble)	GND	-	0.2	V
		Output voltage (warm up)	4.4	-	4.6	V
3	Control signal output (CTRL)	Output voltage (warm up & normal operation)	GND	-	0.2	V
		Output voltage (trouble)	VIN-0.6	-	VIN	V
		Allowable current	-	-	25	mA
4	Reset signal (RESET)	Allowable voltage	-10	-	40	V
		Allowable current	-	-	50	mA

Table 3 - Rated Input/Output Voltages

Control Signal (CTRL)	Threshold CO <sub>2</sub> Concentration
LOW --> HIGH	1000ppm
HIGH --> LOW	900ppm

Table 4 - CO<sub>2</sub> Threshold Values

protection circuit should be added to a peripheral circuit of the module.

5) The sensor may deteriorate if it is stored without power in a high humidity environment for a long period of time. Please keep the sensor in a humidity-proof bag with a desiccant if the sensor is to be stored without power for a long period of time.

6) The sensor has dependency on oxygen concentration. Under environments where the oxygen concentration varies from ambient conditions (i.e. 21% O<sub>2</sub>), the sensor may not function properly and may not exhibit the characteristics described in this brochure.

7) Please refer to "TGS4161 Technical Information" for other handling precautions of TGS4161.

### 5. Important Notice

Figaro Engineering Inc. (Figaro) reserves the right to

Status	Control Signal (CTRL)	CO <sub>2</sub> Concentration Signal
Warm up period	LOW	4.5V
CO <sub>2</sub> Conc. < Threshold	LOW	CO <sub>2</sub> concentration/1000V
CO <sub>2</sub> Conc. ≥ Threshold	HIGH	CO <sub>2</sub> concentration/1000V
Trouble	HIGH	0V

Table 5 - Signal Output in Operation Mode

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#### **IMPORTANT NOTE**

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#### **FIGARO GROUP**

##### HEAD OFFICE

##### **Figaro Engineering Inc.**

1-5-11 Senba-nishi  
Mino, Osaka 562-8505 JAPAN  
Tel.: (81) 72-728-2561  
Fax: (81) 72-728-0467  
email: figaro@figaro.co.jp  
www.figaro.co.jp

##### OVERSEAS

##### **Figaro USA Inc.**

121 S. Wilke Rd. Suite 300  
Arlington Heights, IL 60005 USA  
Tel.: (1) 847-832-1701  
Fax.: (1) 847-832-1705  
email: figarousa@figarosensor.com  
www.figarosensor.com