

**General**

Version 1.1

C3H8-LF-3V is world's lowest concentration detectable small size flow through type propane sensor module. Its persistent accuracy and stability through the life cycle, and Temperature Effect Compensation are incomparably favored by industrial field experts carrying various flammable, explosive, and hazard gases.

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## Datasheet for C3H8-LF-3V

**Features**

- NDIR Technology to measure propane gas level.
- Excellent compensation of Temperature Effect.
- Diffusion Type
- Output : TTL-UART, I2C

(Analog Voltage is option)

- Easy Calibration with Non-Periodic Manual Calibration (MCDL : CAL1) and Periodic Automatic Calibration (ACDL : CAL2).
- Size : 40mmx38mmx18.5mm
- Weight : 17 grams

※ Specification of C3H8-LF-3V could be changed without notice.

## C3H8-LF-3V Specifications

### Applications

C3H8-LF-3V expands the application category to even Homes and Offices as well as industrial gas dealing factories as Gas leakage alarming detector for Propane, LNG or combustible gases in Mine, metallurgy, liquefied gas station, petroleum, fuel gas ,etc.

### General Performance

**Operating Temperature** : -20 ~ 50°C, **Storage Temperature** : -30°C ~70°C

**Operating Humidity** : 0 ~ 95% RH (Non-condensing), 'G' type: 0 ~ 99% RH (Non-condensing)

### CO<sub>2</sub> Measurement

**Sensing Method** : NDIR (Non-dispersive Infrared)

**Output unit** : 'ppm' as default ('LEL %' is optional)

**Measurement Range** : 0~5,000ppm(0~10% LEL) is default , 0~21,000ppm(0~100% LEL) is optional.

**Accuracy** : ±3% of F.S. <sup>(1),(2),(3)</sup>

**Detection Resolution** : 50ppm(=0.3% LEL), **Lowest Detection limit** : 100ppm(=0.5% LEL)

**Step Response Time (90%, 1/e)** : 120 seconds (90%), 70 seconds (1/e) for Flow-Through type

**Sampling Interval** : 3 seconds, **Gas injection speed** : 50cc ~ 150cc (50~150ml/min.)

**Gas injection diameter**: 3.3mm (φ), **Tube diameter** : 2.5~3mm(φ)

**Warming-up Time** : 6 seconds (for Detection), 1 minutes (for Accuracy)

### Electrical Data

**Power Input** : 3.2V ~3.6VDC

**Current Consumption** : Normal mode : 14mA, Peak/Typical : 270mA, <sup>(4)</sup>

### Product Derivatives and Relative Functions

| Products    | Feature  |
|-------------|--|
| C3H8-LF-3VG | Resistant up to 99% humidity                       |
| C3H8-LF-3V  | Flow through type                                  |
| C3H8-LFG-3V | Resistant up to 99% humidity for Flow through type |

<sup>(1)</sup>DC Supply should be regulated without ripple < 100mV, low noise power source is needed for best accuracy

<sup>(2)</sup> If sensor is affected by the shock, may need field calibration before installation.

<sup>(3)</sup> Air pressure is assumed as 101.3 kPa..

<sup>(4)</sup> Current Capacity should 2~3 times of Peak Current.

C3H8-LF-3VG and C3H8-LFG have 'G' suffix which could resistant to 99% humidity. C3H8-LF and C3H8-LFG has 'F' option which has two tube inlets for 'Flow Through' instead of white colored filter for 'Diffusion'.

### Pin Map with J1&J2 Connectors

| J-1 | C3H8-LF-3V    |  |
|-----|---------------|--|
| 1/3 | VDD (+3.3VDC) |  |
| 2/4 | GND           |  |

| J-2 | C3H8-LF-3V   | C3H8-LF-3V (Analog Voltage Option) |
|-----|--|------------------------------------|
| 1   | TTL RXD (← CPU of Master Board )   |                                    |
| 2   | TTL TXD (→ CPU of Master Board)  |                                    |
| 3   | I2C SCL  |                                    |
| 4   | I2C SDA  |                                    |
| 5   | GND  |                                    |
| 6   | Reserved   | Analog Voltage Output (0.5~3V)     |
| 7   | CAL2-pin : ACDL (for every 7 days ACDL with periodic C3H8-'0'ppm circumstance) |                                    |
| 8   | Reserved   |                                    |
| 9   | CAL1-pin : MCDL (for 1 minute MCDL with C3H8-'0'ppm- C3H8-'0'ppm circumstance) |                                    |
| 10  | Reset (Low Active)   |                                    |

### Pin Map with JP-1 Connectors

| JP-1 | C3H8-LF-3V  |
|------|-------------|
| 1    | N (Normal)  |
| 2    | CAL1 (MCDL) |
| 3    | CAL2 (ACDL) |

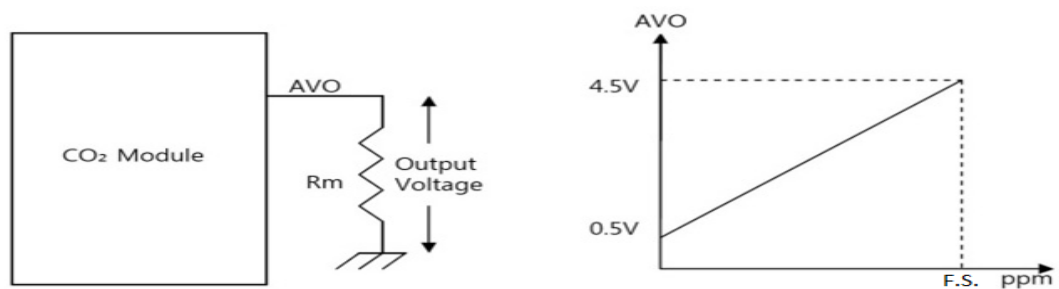
**UART** 38,400BPS, 8bit, No parity, 1 stop bit

9,600 or 19,200 BPS can selectable through command sets or EK-100SL.

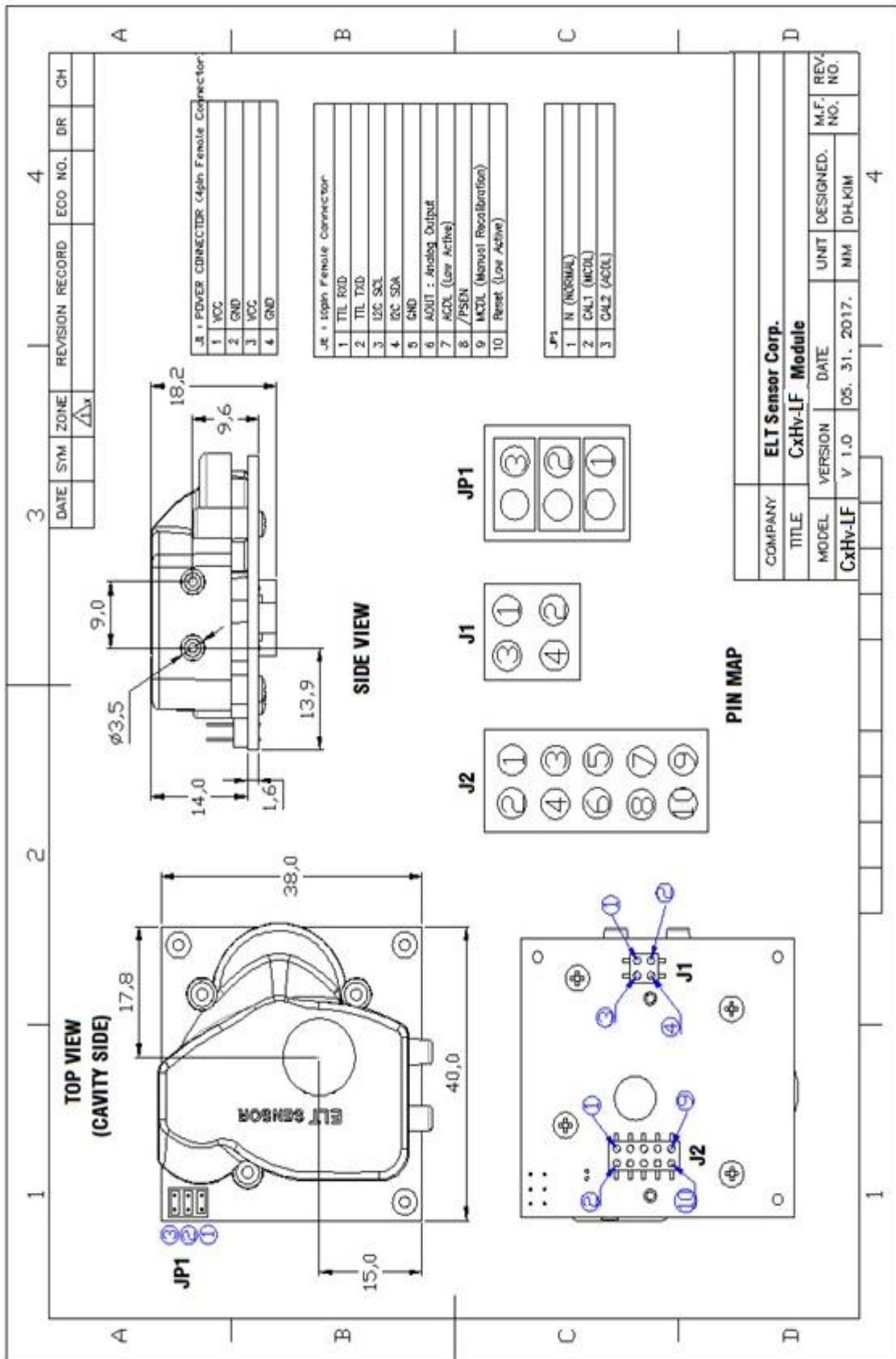
**I2C** Slave mode only, Internal pull up resistor 10kΩ

TTL Level Voltage :  $0 \leq V_{IL} \leq 0.4$ ,  $2 \leq V_{IH} \leq V_{DD}$ ,  $0 \leq V_{OL} \leq 0.4$ ,  $2.4 \leq V_{OH} \leq V_{DD}$  (Volt)

**Analog Voltage (option) : 0.5~3V**



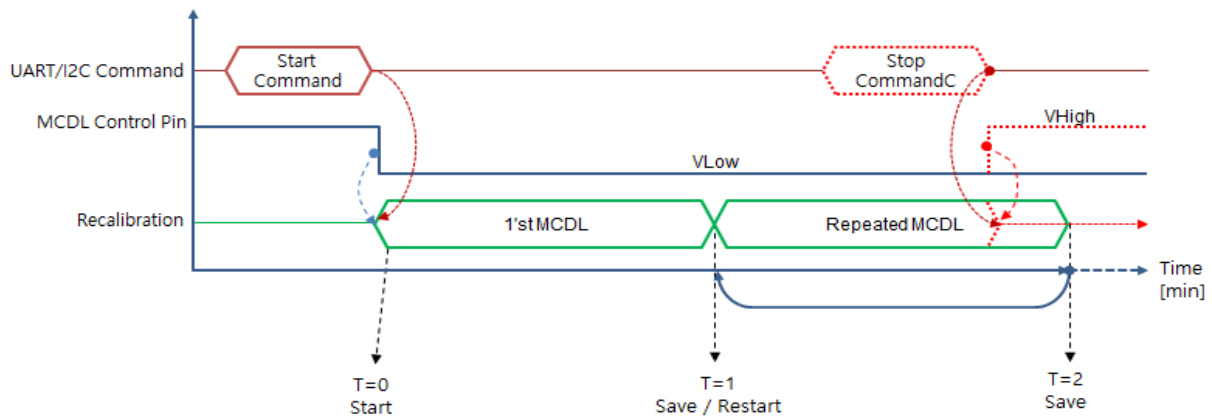
Cavity Dimensions (unit : mm)



## MCDL and ACDL Calibration.

### ✚ MCDL (1 minutes Manual Calibration)

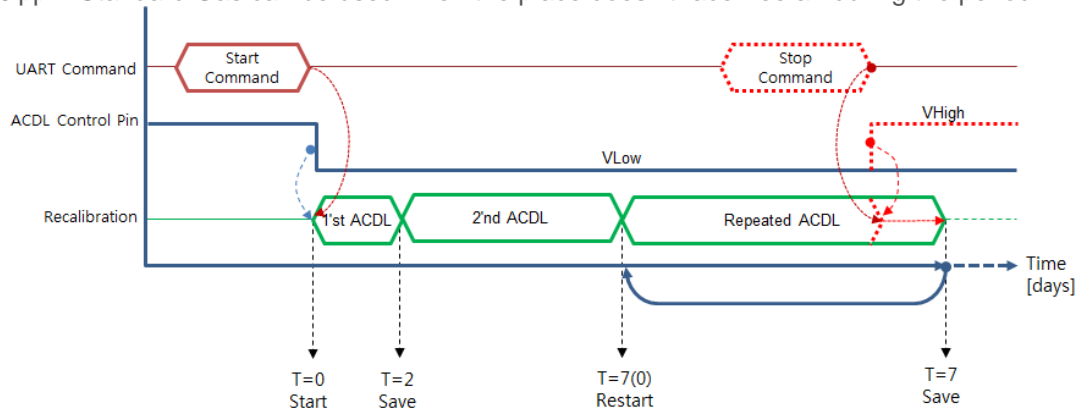
'0' ppm Manual Calibration can be done by giving start command or low signal to CAL1-pin at least more than 1 minute since the fresh air is fully balanced near sensor.



### ✚ ACDL (Periodic Automatic Calibration)

Periodic Automatic Calibration can be used by giving start command or low signal to CAL2-pin. The sensor calibrate automatically first in 2 days, seconds 5 days and every week.

'0'ppm Standard Gas can be used when the place doesn't face free air during the period.



Method 1. Commands set for MCDL or ACDL Calibrations for is available. **EK-100SL (Evaluation kit, with Emulation program 'ELTWSO')** is purchasable for user's convenience.

UART/I2C Command Sets are available at J12 pin-1,2 (RX, TX) / J12 pin-3/4 (SCL,SDA).

Method 2. MCDL/ACDL Control pins are available. **TRB-100ST (Test and Recalibration Board) JIG-Board** at ambient air-flow condition or with 0'ppm Standard Gas and execute by moving jumper following Manual on the website.

CAL1 / CAL2 control pins are available at J12 pin-9/ pin-7 or JP1 pin-2/pin-3

| CAL1<br>MCDL | CAL 2<br>ACDL | Function | Process   |
|--------------|---------------|----------|---|
| <b>Low</b>   | High          | H/W MCDL | Let C3H8-LD-3V-3V sensor be located at ambient place where no propane gas exist and wait 1 minute. '0'ppm Standard gas can be used when '0'ppm is not guaranteed. |
| High         | <b>Low</b>    | H/W ACDL | Automatic Calibration can be used where C3H8 meet the clear air more than 3 minutes per week.   |
| High         | High          | Normal   | Operate with Factory Calibrated or previously set status  |

※ CAL-1pin and CAL-2pin shouldn't have 'Low' at the same time.

## Output Descriptions

### UART Descriptions

Data Format

|    |    |    |    |    |     |    |     |     |     |    |    |
|----|----|----|----|----|-----|----|-----|-----|-----|----|----|
| SP | SP | SP | D2 | D1 | '%' | SP | 'L' | 'E' | 'L' | CR | LF |
|----|----|----|----|----|-----|----|-----|-----|-----|----|----|

|         |                            |
|---------|----------------------------|
| SP x 3  | Space: 0x20                |
| D2 ~ D1 | 2 byte C3H8 density string |
| %       | 0x25                       |
| SP      | Space: 0x20                |
| 'LEL'   | 'LEL' string               |
| CR      | Carriage return : 0x0D     |
| LF      | Line feed : 0x0A           |

Above 12byte consist by 6 byte hexadecimal digits, <SP>,<SP>,<SP>,0x70 0x70 0x6D, <CR><LF> , where decimal '0' (corresponds to hexadecimal digit '0x30') is replaced by space (corresponds to hexadecimal digit '0x20'),

EX) 7% LEL (= 3,500 ppm) string is '0x20 0x20 0x20 0x20 0x37 0x25 0x20 0x4C 0x45 0x4C, 0x0D 0x0A',, of which display on the screen is ' \_\_\_\_7%\_LEL<CR><LF>'.

'ppm' display is Option on sale, which D6~D1 string display the C3H8 concentration of

|    |    |    |    |    |    |    |     |     |     |    |    |
|----|----|----|----|----|----|----|-----|-----|-----|----|----|
| D6 | D5 | D4 | D3 | D2 | D1 | SP | 'p' | 'p' | 'm' | CR | LF |
|----|----|----|----|----|----|----|-----|-----|-----|----|----|

EX) 3,500 ppm string is '0x20 0x20 0x33 0x35 0x30 0x30 0x20 0x70 0x70 0x6D 0x0D 0x0A', of which display on the screen is '\_3500\_ppm<CR><LF>'.

### I2C Communication (Only Slave Mode Operation)

Internal pull up resister 10kΩ

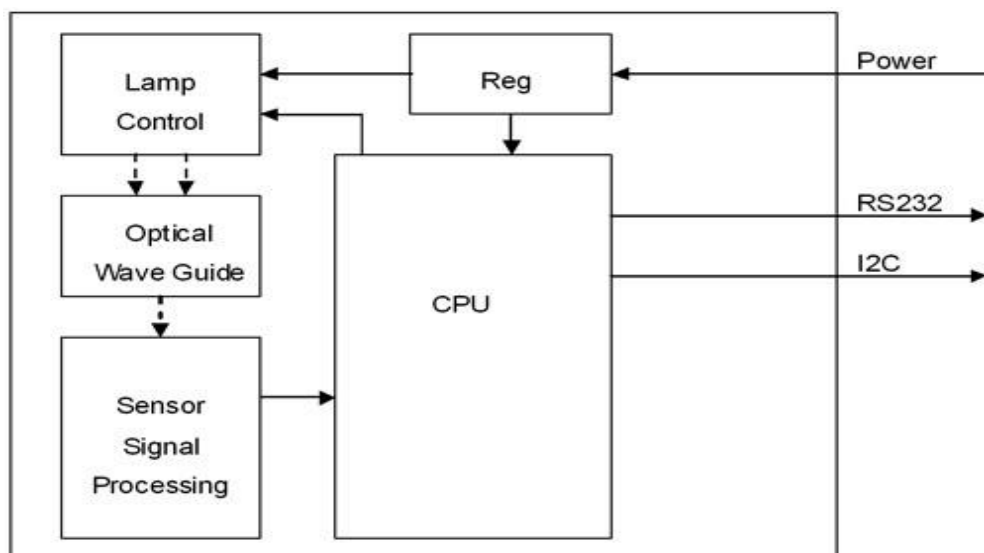
Slave Address: 0x31, Slave Address Byte: Slave Address(0x31) 7 Bit + R/W 1 Bit

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0    |
|------|------|------|------|------|------|------|---------|
| 0    | 1    | 1    | 0    | 0    | 0    | 1    | R/W Bit |

R/W Bit : Read = 1/Write = 0

When reading the data, Slave Address Byte is 0x63, When writing the data, Slave Address Byte is 0x62.

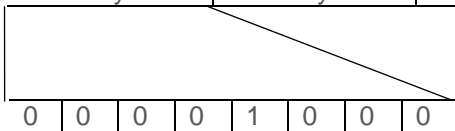
### Block Diagram



**Transmission Sequence in Master**

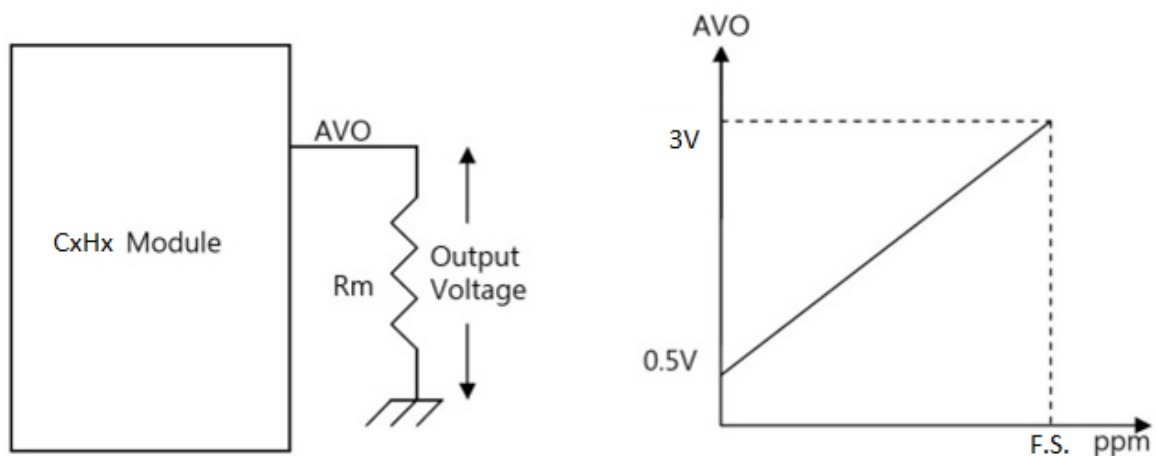
- 1) I2C Start Condition
- 2) Write Command(Slave Address + R/W Bit(0) = 0x62) Transmission and Check Acknowledge
- 3) Write Command(ASCII 'R' : 0x52) Transmission and Check Acknowledge
- 4) I2C Stop Command
- 5) I2C Start Command
- 6) Read Command(Slave Address + R/W Bit(1) = 0x63) Transmission and Check Acknowledge
- 7) Read 7 Byte Receiving Data from Module and Send Acknowledge  
(Delay at least 1ms for reading each byte)

|               |                 |          |          |          |          |
|---------------|-----------------|----------|----------|----------|----------|
| Configuration | CO <sub>2</sub> | reserved | reserved | Reserved | reserved |
| 1 Byte        | 2 Byte          | 0x00     | 0x00     | 0x00     | 0x00     |



In need of detail protocol specification and time sequence, 'I2C programming guide' could be provided by contacting Sales Rep.

**Analog Voltage Output Descriptions : Optional**



Measured Voltage 0.5V~4.5V match proportionally to 0 ~ 5,000ppm.

\* C3H8 Measurement (ppm) =  $\frac{\text{Output Voltage} - 0.5}{(4.5 - 0.5) \text{ Voltage}} \times 5,000\text{ppm}$ .

cf. F.S. (ppm) : 2,000/3,000/5,000/10,000 ppm (20,000/30,000/50,000/100,000 is optional.)

EX) if the Output Voltage is 2.5V in LEL 0~5,000 range,  
 $\text{C3H8 ppm} = \frac{(2.5 - 0.5) \text{ V}}{(4.5 - 0.5) \text{ V}} \times 5,000\text{ppm}$   
 $= 0.5 \times 5,000\text{ppm LEL} = 2,500\text{ppm}$



※ **Caution**

1. Please use only 'PCB' of sensor to avoid the physical shock on sensor without holding Cavity directly. Rough handling or Transportation could result in inaccurate reading..  
But, 0\_MCDL with CAL1 or 0\_ACDL with CAL2 are available to correct the sensor to normal status.
2. Proper ESD protection during handling is important to avoid electrostatic defect occurrence. The storage of sensor should be insulated as well

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