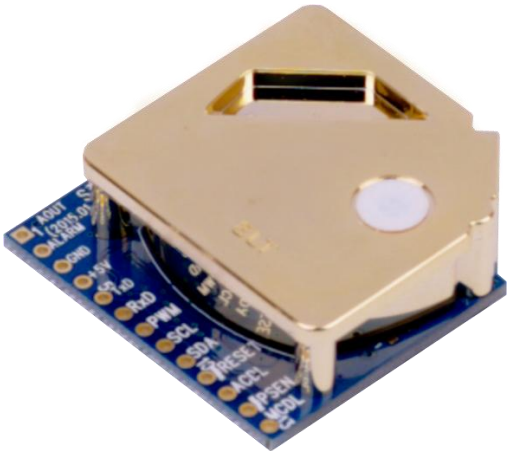
General

Version 1.32

S-300L-3V is one of the world's lightest and smallest CO_2 sensor modules. Its easy management besides Persistent Stability and Temperature Effect Resistance are much favored by mobile application which needs 3.3Voltage input and sleep mode support so on.

ELT Sensor
Data Sheet for S-300L-3V



Features

• Non-Dispersive Infrared (NDIR) technology used to measure CO_2 levels.

• Pre-calibrated

• Available output : TTL-UART, I2C, Alarm (PWM/AVO option)

• Gold-plated sensor provides long-term calibration stability.

• Installed re-calibration function

•Non-Periodic Manual Re-Calibration (MCDL) are available.

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• ROHS Directive- 2011/65/EU, [EN50581 : 2012,IEC 62321-3-1 : 2013].

• Size : 33mmx33mmx13.1mm

• Weight : 10 grams

S-300L-3V Specifications

General Performance

Operating Temperature : -10℃ ~ 60℃

Operating Humidity : 0 ~ 95% RH (Non-condensing)

Operating Environment : Residential, Commercial spaces, 'G' : Agricultural use

Storage Temperature : -30℃ ~70℃

CO_2 Measurement

Sensing Method : NDIR (Non-dispersive Infrared)

Measurement Range : 0 ~ 2,000 ppm (0 ~ 3,000/5,000/10,000ppm extended model is available)

Accuracy : ±30ppm ±3% of reading [(1)(2)(3)]

Sampling Interval: 3 seconds

Warming-up Time : < 6 seconds (for Operation), 5 minutes (for Accuracy)

Electrical Data

Power Input : 3.2V ~ 3.6V [(4)]

Current Consumption : **I**normal < 12mA, **I**peak : 180mA (150mA typical)

Product Derivatives and Relative Functions

Products	Option List
S-300**L**-3V	UART,I2C,1st ALARM, 10'MCDL, Sleep mode support (< 0.3mA)
S-300**LA**-3V	Initiate as Sleep mode and operate with ACDL mode since the wake-up
S-300**AL-**3V	Initiate as normal mode, which Calibrate Sensor every week
S-300**LG**-3V	Initiate as Sleep mode and sensor resists up to 99% Humidity

S-300L-3V has various output TTL-UART, I2C, Alarm and 2.54pitch 13pin side hole connector besides 2mm pitch 10 and 4pin 2 row header connectors. S-300L-3V has ACDL logic besides Sleep and wake-up change periodically (30 seconds is default).

(1) Accuracy is defined after minimum after 3 times calibration for 3 weeks

(2) +/- 2% is added for absolute measurements for uncertainty of calibration gas mixture unless the measurement is done with certified calibration

(3) Air pressure is assumed as 101.3 kPa

(4) DC Supply should be regulated , low noise power source for best accuracy

Pin Map with J11&J12 Connectors

J-11	Description
1/3	VDD (+3.3V VCC)
2/4	GND

J-12	S-300L-3V	S-300L-3V (Analog 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) option
7	ACDL(Automatic Calibration)	
8	Reserved	
9	MCDL(10 min. Manual Calibration)	
10	Reset (Low Active)	

UART (J-12:P1&P2) : 38,400BPS, 8bit, No parity, 1 stop bit

I2C (J-12:P3&P4) : Slave mode only, Internal pull up resister (10kΩ)
TTL Level Voltage : : $0 \le V_{IL} \le 0.4$, $2 \le V_{IH} \le VDD$, $0 \le V_{OL} \le 0.4$, $2.4 \le V_{OH} \le VDD$ (Volt)

ALARM (1st Alarm **:** Open Collector type)
1,000 ppm ≤ Alarm ON, 800 ppm ≥ Alarm OFF and alarming range can be change by EK-100SL with connection to PC.

Option 1 : Analog Voltage(J-12:pin-6, J-13:pin-1) **:** 0.5~3.0 V.

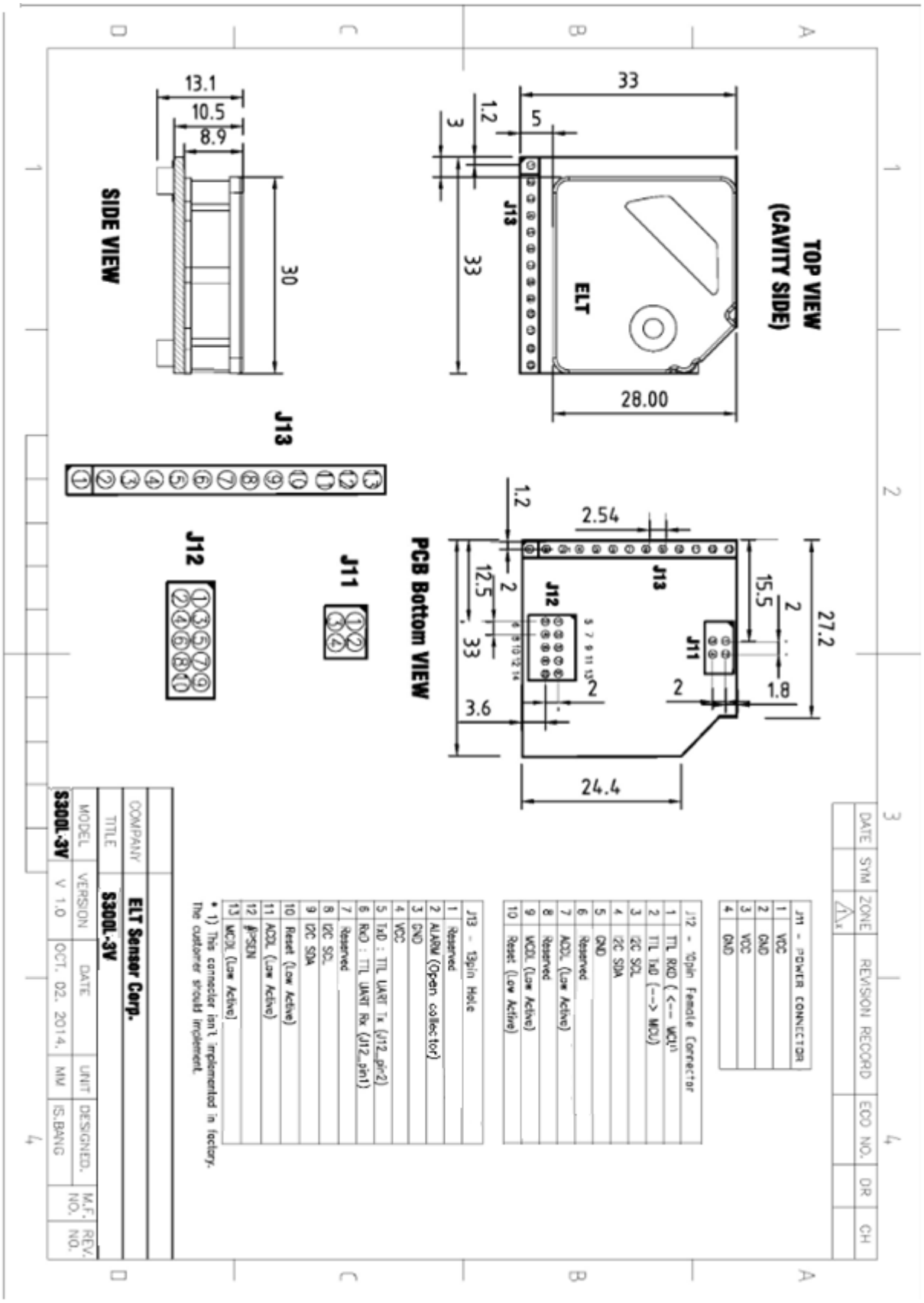
Option 2 : PWM (J-13:pin-7 is available) In case the PWM option is chosen,

t_H = 2 msec (Start) + 1,000 msec x (Measurement$_{(ppm)}$ / Range$_{(ppm)}$), T_L= 2,000 ms - t_H ,

Pin Map with J13 Connectors

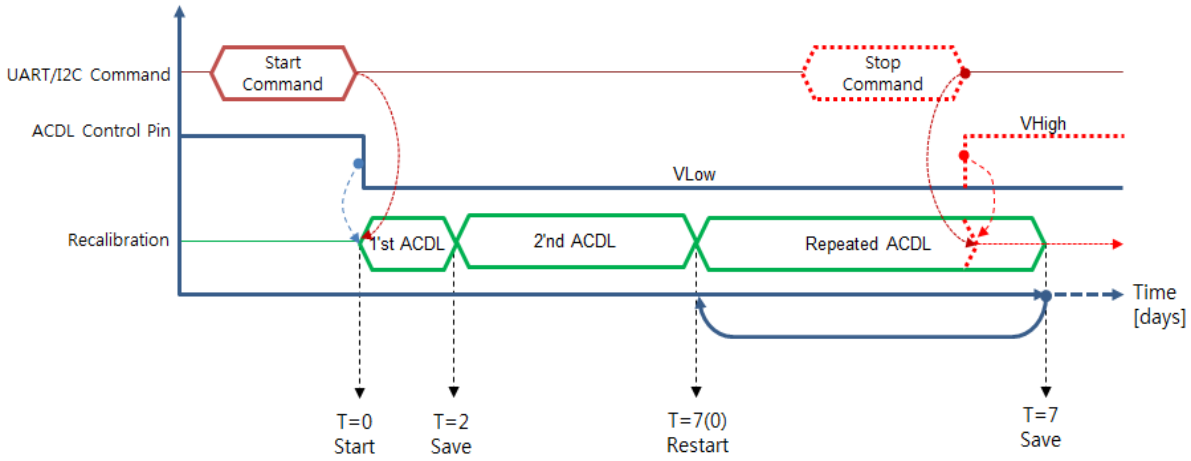
J-13	S-300L-3V	S-300L-3V (PWM or AVO Option)
1	Reserved	Analog Voltage Output (Option)
2	Alarm (Open Collector)	
3	GND	
4	VDD (+3.3V VCC)	
5	TTL TXD (→ CPU of Master Board)	
6	TTL RXD (← CPU of Master Board)	
7	Reserved	PWM Output (Option)
8	I2C SCL	
9	I2C SDA	
10	Reset (Low Active)	
11	ACDL(Automatic Calibration)	
12	Reserved	
13	MCDL(10 min. Manual Calibration)	

Cavity Dimensions (unit : mm)



ACDL function (Automatic Calibration Function in Dimming light with period)

ACDL is executed only when sensor is kept during the period except for sleep mode.



Time Diagram of ACDL

Method 1. For Digital output (U-ART or I2C), Command Sets for ACDL is available.

UART Command Set ; J12: pin-1 (UART-RX) and pin-2 (UART-TX) to Main-Board.
(J13: pin-6 and pin-5 are available as well)

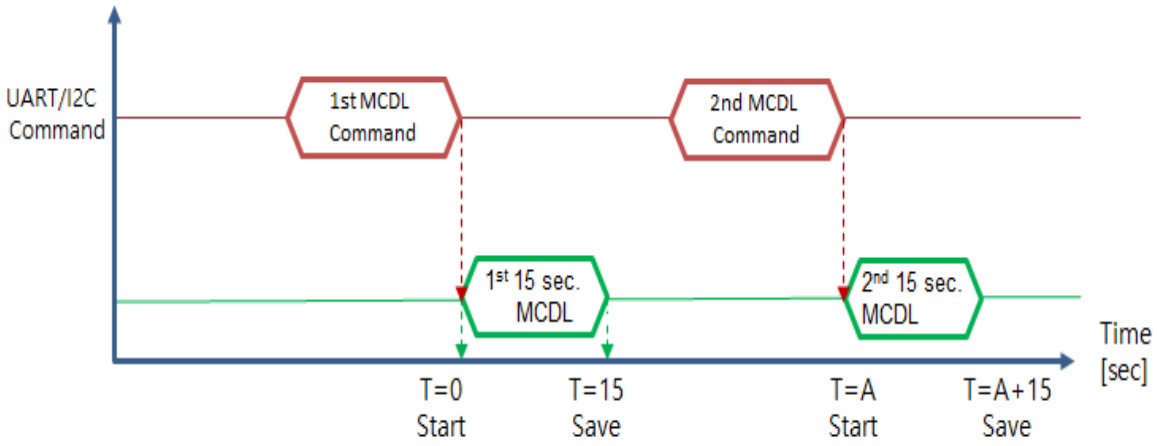
I2C Command Set; J12: pin-3 (SCL) and pin-4 (SDA) to Main-Board.
(J13: pin-8 and pin-9 are available as well)

Method 2**.** Let Sensor install on Jig Board, **TRB-100ST (Test and Recalibration Board)** with ambient air-flow condition and execute by moving jumper following Manual on the website.

Method 3. **EK-100SL (Evaluation kit, with Emulation program 'ELTWSD')** is available, which display and save data on PC through USB connection.

MCDL function (Manual Calibration Function in Dimming light).

MCDL-command or MCDL-Control signal make reserve MCDL function, which takes 15 seconds, just after the next Reading is finished.



Time Diagram of MCDL

Method 1. For Digital output (U-ART or I2C), Command Sets for ACDL is available.

UART Command Set ; J12: pin-1 (UART-RX) and pin-2 (UART-TX) to Main-Board.
(J13: pin-6 and pin-5 are available as well)

I2C Command Set; J12: pin-3 (SCL) and pin-4 (SDA) to Main-Board.
(J13: pin-8 and pin-9 are available as well)

Method 2**.** Let Sensor install on Jig Board, **TRB-100ST (Test and Recalibration Board)** with ambient air-flow condition and execute by moving jumper following Manual on the website.

Method 2. **EK-100SL (Evaluation kit, with Emulation program 'ELTWSD')** is available, which displays and save data on PC through USB connection.

Sleep / Wake-up Mode Time diagram and I2C/U-ART commands

In need of detail specification and time sequence, the technical guide is providable by contacting Sales Rep.

Output Descriptions

UART Descriptions

Data Transmit
Interval : 3 seconds
Handshake protocol : None (Data is transmitted to outer device periodically)

Data Format

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

D6 ~ D1	6 byte CO2 density string
SP	Space: 0x20
'ppm'	'ppm' string
CR	Carriage return : 0x0D
LF	Line feed : 0x0A

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

EX) 1,255 ppm, results '0x20 0x20 0x31 0x32 0x35 0x35 0x20 0x70 0x70 0x6D 0x0D 0x0A', which displays '__1255_ppm<CR><LF>'on screen.

I2C Communication (Only Slave Mode Operation)

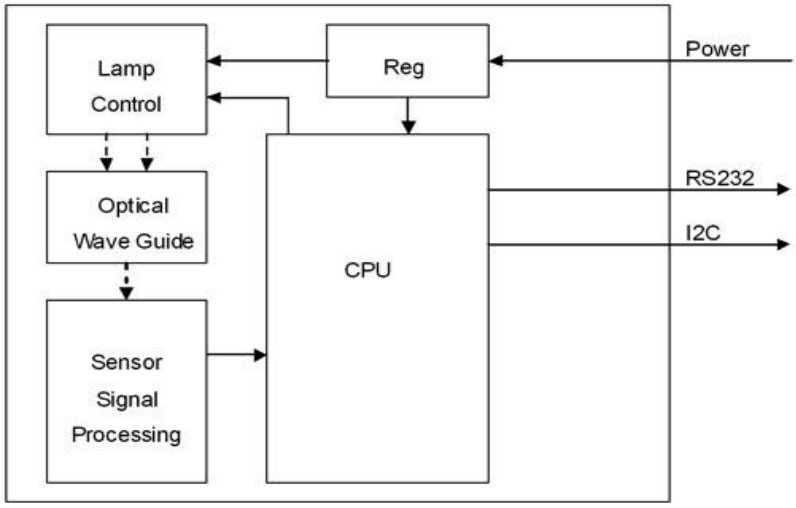
Internal pull up resister
Slave Address: 0x31, Slave Address Byte: Slave Address(0x31) 7 Bit + R/W 1 Bit

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_2	reserved	reserved	reserved	reserved
1 Byte	2 Byte	0x00	0x00	0x00	0x00

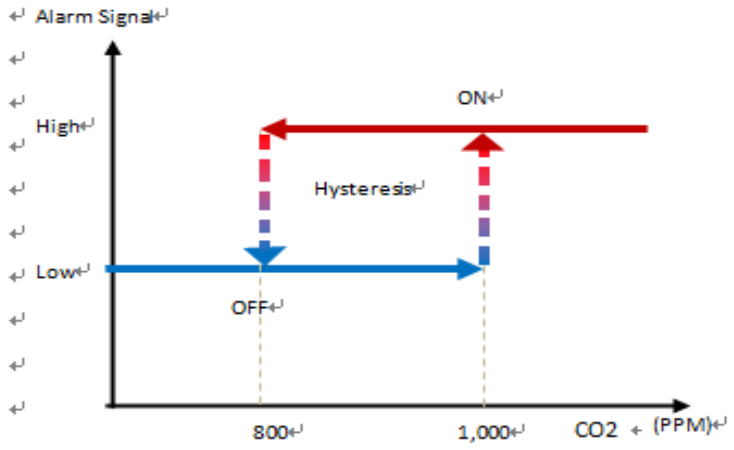
0	0	0	0	1	0	0	0

In need of detail protocol specification and time sequence, I2C programming guide is providable by contacting Sales Rep.

Alarm Descriptions (option)

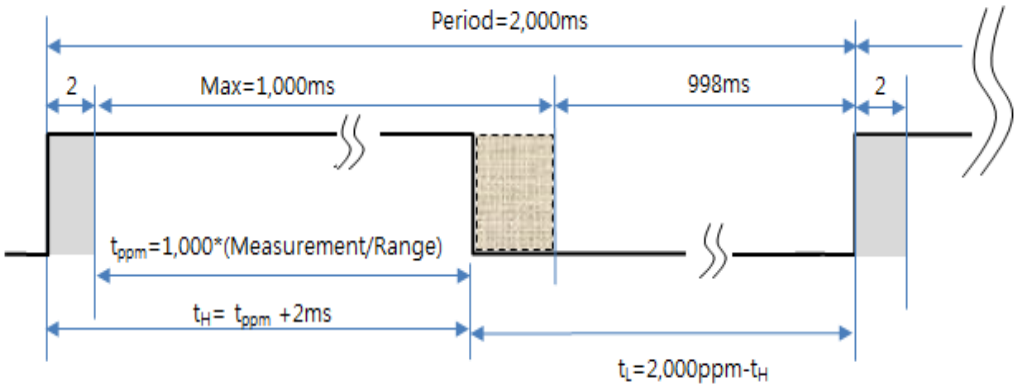
Alarm is Open Collector type which work SPST (Single Pole Single Throw) Alarm is 'OFF ' status at first and turn to 'ON' status since CO2 value go beyond 1,000 ppm until it go down to 800 ppm to avoid unwanted rapid switching by hysteresis effect.

1,000 ppm ≤ Alarm ON, 800 ppm ≥ Alarm OFF



PWM Descriptions ; Option

* Measurement$_{(ppm)}$ = (t_H-2msec)/1000msec x Range$_{(ppm)}$ (t_H : High Pulse Width)
* Range$_{(ppm)}$: 2,000/3,000/5,000/10,000 ppm (20,000/30,000/50,000/100,000 is optional.)



EX) t_H (High Pulse Width) calculation for 400 ppm in 2,000 ppm Range.

*Measurement$_{(ppm)}$ = 400 ppm = (t_H-2ms)/2,000msec x Range$_{(ppm)}$,

*t_H= 1,000 msec * (400 ppm / 2,000 ppm) + 2msec = 202msec

(cf: T_L= Period - t_H = 2,000 ppm – 202 msec = 1,798 msec.)

AVO Description ; Option

* Measurement$_{(ppm)}$: 0.5~3.0V

Measured Voltage 0.5V~3.0V matches proportionally to 0 ~ 2,000/3,000/5,000/10,000 ppm or 2%/3%/5%. ppm

* CO2 Measurement$_{(ppm)}$ = ((Output $_{Voltage}$ – 0.5)/ (3.0 – 0.5) $_{Voltage}$)x F.S. $_{ppm}$,
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 2,000 ppm (F.S. of Reading range)
CO2 Measurement $_{ppm}$ = (2.5 – 0.5) V ÷ (3.0 – 0.5) V x 2,000. $_{ppm}$
= 2 ÷ 2.5 x 2,000 $_{ppm}$ = 1,600 $_{ppm}$

※ Caution

1. Please hold only 'PCB' of sensor without holding Cavity directly to avoid the physical shock on sensor.
Rough handling or Transportation could result in inaccurate reading.
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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