

# OPERATION MANUAL

## PORTABLE CO<sub>2</sub> METER



Model:  pSENSE  
 pSENSE RH

## INTRODUCTION

Thank you for purchasing this portable CO<sub>2</sub> meter. The meter measures CO<sub>2</sub> level, air temp., dew point, wet bulb temp. and humidity(DP, WB, RH are for model pSENSE RH) and is an ideal instrument for indoor air quality (IAQ) diagnosis.

Poor indoor air quality is considered unhealthy because it causes tiredness, loss of ability to concentrate, and even illness(ex. Sick Building Syndrome). IAQ monitoring and survey, especially on CO<sub>2</sub> level and air ventilation become widely applied in public areas such as offices, classrooms, factories, hospitals and hotels. It is also suggested in regulations of industrial hygiene in some countries. (Appendix)

The portable CO<sub>2</sub> meter uses NDIR (non-dispersive infrared) technology to ensure the reliability and long term stability. It's useful in verifying HVAC system performance and air ventilation control.

### **Features:**

- Triple displays of CO<sub>2</sub> level, temp. and humidity (pSENSE RH).
- Stable NDIR sensor for CO<sub>2</sub> detection
- Statistics of weighted averages  
TWA (8 hours weighted average)  
STEL(15 minutes weighted average)
- Backlight for working in dark area
- Audible CO<sub>2</sub> warning alarm
- Battery and adaptor power supply
- Easy manual calibration on CO<sub>2</sub> and humidity (RH for pSENSE RH only)
- PC connect via RS232 interface

## MATERIAL SUPPLIED

This package contains:

- ✓ Meter
- ✓ 4pcs AA batteries
- ✓ Operation manual
- ✓ Hard carrying case



Optional accessory:

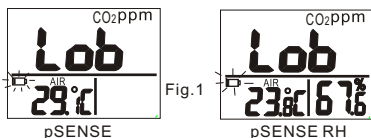
- ✓ Calibration kit 33% and 75% (00-0-0017)
- ✓ Adaptor (9V/100~240Vac)
- ✓ RS232 cable and software(00-0-0018)

## POWER SUPPLY

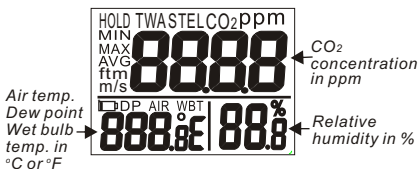
The meter is powered by either 4 AA batteries or a DC adaptor(9V/1A output).

Install the batteries into the battery compartment on the rear and make sure they are in correct polarity and good contact. When an adaptor is used, it will cut off the power supply from batteries. The adaptor can't be used as a battery charger.

When battery voltage gets low,  and "Lob" will appear on the LCD (Fig.1). And beeper sounds. The CO<sub>2</sub> sensor can't work under low voltage, so it beeps to indicate failed CO<sub>2</sub> measurement (press any key but  to stop the beeps) and the readings won't be displayed. Please replace with fresh batteries or connect with an adaptor.



## LCD DISPLAY



## Symbols

|          |  |
|----------|--|
| TWA      | Time weighted average( 8 hours)                            |
| STEL     | Short-term exposure limit<br>(15 minutes weighted average) |
| HOLD     | Readings are freezed unchanged                             |
| MIN/MAX  | Minimum/Maximun readings                                   |
|          | Low battery indicator                                      |
| DP       | Dew point temperature(pSENSE RH)                           |
| AIR      | Air temperature  |
| WBT      | Wet bulb temperature(pSENSE RH)                            |
| %        | Unit of relative humidity                                  |
| °E (C/F) | Celsius/Fahrenheit   |

## KEYPAD

- Turns on and off the meter.  
Enters setup mode.  
Sets as non-sleep mode with .
- Exits setup page/mode.  
Enters CO<sub>2</sub> calibration with .  
Enters RH calibration with .
- Freezes the current readings.  
Cancels data hold function.
- Activates or cancels the backlight.  
Selects unit or increases value in setup.
- Selects AIR, DP, WBT temps display.  
(PSENSE RH only)  
Selects unit or decreases value in setup.
- Activates MIN,MAX,STEL,TWA function.  
Saves and finishes settings.

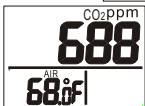
## OPERATION

### POWER ON/OFF

Press  $\text{①}_{\text{SET}}$  to turn the meter on and off. At power up, it emits a short beep and performs 30 seconds countdown (Fig.2) for meter warm up, then enters normal mode with current  $\text{CO}_2$ , temperatures, and humidity (pSENSE RH) readings displayed (Fig.3).



Fig. 2



Model pSENSE



Model pSENSE RH

Fig 3

### TAKING MEASUREMENT

The meter starts measurement when power on and update readings every second. In the condition of operating environment change (ex. from high to low temp.), it takes 30 sec to respond for  $\text{CO}_2$  sensor and 30 minutes for RH.

**NOTE:** Do not hold the meter close to faces in case exhalation affects  $\text{CO}_2$  levels.

### AIR(all models),DP,WBT(pSENSE RH)

Press  $\text{DP/WBT}$  to switch temperatures display. The lower left display will cycle from air temperature, dew point temp. (Fig.4), and wet bulb temp. (Fig.5).

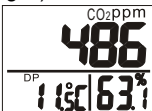


Fig.4



Fig.5

## DATA HOLD

Press **HOLD** to freeze the readings, "HOLD" icon is displayed on the left top of LCD(Fig.6). All current readings are kept unchanged, except STEL and TWA. Press **HOLD** again to cancel the hold function.

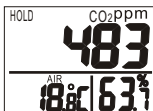


Fig.6

## BACKLIGHT

Hold down **MODE** for more than 1 second to activate and cancel backlight function.

## MIN,MAX,STEL,TWA

Under normal mode, press **M<sup>IN</sup>/A<sup>V</sup>** to see the minimum, maximum, and weighted average readings. Each press of **M<sup>IN</sup>/A<sup>V</sup>**, it displays MIN, MAX, STEL, TWA in sequence and returns to normal mode.

In MIN and MAX modes, it shows the minimum and maximum readings of CO<sub>2</sub> on main display and of AIR or Dp or WB temperatures and humidity (pSENSE RH) on the lower displays. (Fig.7)

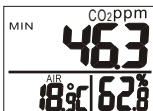


Fig.7

In STEL and TWA modes, the main display shows the weighted average of CO<sub>2</sub> readings for the past 15 minutes (STEL) and 8 hours(TWA). The lower displays are the current AIR, DP/WB temperatures and humidity (pSENSE RH). (Fig.8)

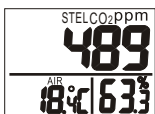


Fig.8

**NOTE:**

- 1.If the meter is turned on for shorter than 15 minutes, the STEL value will be the weighted average of readings taken since power on. Same for TWA values appear before 8 hours.
- 2.It takes at least 5 minutes to calculate STEL and TWA. The display shows "----" (Fig.9) during the first 5 minutes from power on.

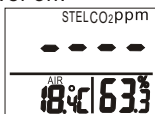


Fig. 9

- 3.While all readings are held unchanged, STEL and TWA will keep updating every 5 minutes.

**ALARM**

The meter features audible alarm to give warnings when CO<sub>2</sub> concentration exceeds the limit. (See P1.0 in setup for setting alarm threshold). It emits beeps (Abt.80dB) when CO<sub>2</sub> level goes over the set value and stops when any key (but **SET**) was pressed or readings fall below the set value. It beeps again when value goes over the limit. Restart the meter if beeper can't be stopped.

**AUTO POWER OFF**

The meter turns off automatically after 20 minutes of inactivity. To override the function, hold down **SET** and **HOLD** for 2 seconds to turn on the meter until "n" appears. **NOTE:** Auto sleep function will be disabled during calibration mode.

## SETUP

Hold down  $\text{SET}$  under normal mode for more than 1 sec to enter setup mode. To exit setup, press  $\text{CAL Esc}$  in P1.0 or P3.0 and it returns to normal mode.

**Note:** P2.0 is not applicable in these models but for future model with CO and CO<sub>2</sub> measurement.

### P1.0 CO<sub>2</sub> ALARM

When entering setup mode, P1.0 and "AL" (Fig. 10) are displayed on the LCD. Press  $\text{Mx/AV}$  to go into P1.1 for setting CO<sub>2</sub> alarm threshold. The current set value will be blinking on LCD (Fig. 11).

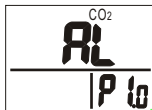


Fig. 10



Fig. 11

Press  $\text{MODE}$  to increase the value or  $\text{DP/WBT}$  to decrease. Each press tunes 100 ppm and the alarm range is from 100 to 9900ppm. When the preferred alarm value is set, press  $\text{Mx/AV}$  to save the setting or  $\text{CAL Esc}$  without saving and return to P1.0.

### P3.0 TEMPERATURE SCALE

Press  $\text{MODE}$  or  $\text{DP/WBT}$  in P1.0 to access P3.0 for setting up temperature scale (Fig. 12). Press  $\text{Mx/AV}$  and it goes into P3.1 with blinking °C or °F current set (Fig. 13) on the lower left display. To switch °C or °F, press  $\text{MODE}$  and  $\text{DP/WBT}$ . Then press  $\text{Mx/AV}$  to save the setting or  $\text{CAL Esc}$  without saving and return to P3.0.



Fig. 12



Fig. 13



## CO<sub>2</sub> CALIBRATION

The meter defaults to be calibrated manually in the ambient air where CO<sub>2</sub> concentration is around 400ppm.

### **CAUTION:**

Do not calibrate the meter in the air with unknown CO<sub>2</sub> concentration. Otherwise, it will be calibrated as 400ppm by default and leads to inaccurate measurements.

### **Calibration site**

It is suggested to calibrate the CO<sub>2</sub> sensor in fresh outdoor air that is well ventilated and better in sunny weather. Do not calibrate the meter in places crowded with people or close to where with high CO<sub>2</sub> concentration such as ventilating outlets or fireplaces.

### **Procedure**



Place the meter in the calibration site. Turn on the meter and hold down  and  simultaneously to enter CO<sub>2</sub> calibration mode (Fig.14). 400ppm and "CAL" are blinking on the LCD while performing calibration.



Fig. 14

Wait about 10 minutes until the blinking stops and the calibration is completed automatically and back to normal mode.

To abort the calibration, turn off the meter at any time.

### **NOTE:**

Ensure the batteries are with full voltage during the calibration to prevent from interruption or failed calibration.

## RH CALIBRATION (pSENSE RH)

The meter defaults to be calibrated the humidity with 33% and 75% salt solution. The ambient condition is recommended to be at 25°C and stable humidity (better to be close to the calibrating value). To abort calibration, just turn off the meter.

### **CAUTION:**

Do not calibrate the humidity without the default calibration salt. Otherwise, it will cause permanent damage. Contact the dealer for calibration salt or services.

### **33% calibration**

Plug the sensor probe into 33% salt bottle. Hold down **CAL Esc** and **DP/WBT** under normal mode to enter 33% calibration (Fig.15). "CAL" and calibrating value (32.7% if at 25°C) are blinking on the LCD with current temperature at the left.

Meter is now calibrating, and will finish in about 60 minutes when "CAL" and humidity stop blinking. (Fig.16)



Fig. 15

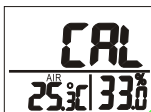


Fig. 16

### **75% calibration**




After 33% calibration, plug the sensor probe into 75% salt bottle, then press **MV/AV** to enter 75% calibration (Fig.17).



Fig.17


“CAL” and calibrating value (75.2% if at 25°C) are blinking on the LCD with current temperature at the left. Meter is now calibrating. Wait about 60 minutes until blinking stops, then calibration is completed and it returns to normal mode.

**NOTE:**

Users can also calibrate either point. To calibrate 33% only, press  and exit when 33% calibration is completed. To calibrate 75% only, press  or  within the 5 minutes while initializing 33% calibration.

## TROUBLESHOOTING

**Can't power on**

Press  for more than 0.3 seconds and try again. Check whether batteries are in good contact and correct polarity, or the adaptor is well plugged.

**Fixed readings**

Check whether data hold function was activated. (HOLD icon at the left top)

**Slow response**

Check whether the air flow channels on the rear were blocked.

**Error messages**

- E01: CO<sub>2</sub> sensor damaged.
- E02: The value is under range.
- E03: The value is over range.
- E04: The original data error results in this error (DP, WB)
- E07: Too low voltage to measure CO<sub>2</sub>.  
Replace batteries or use an adaptor.
- E11: Retry humidity calibration.
- E17: Retry CO<sub>2</sub> calibration.
- E31: Temperature sensor damaged.
- E34: Humidity sensor damaged.

## PC CONNECTION

The meter can do PC link for on-line logging and data analysis via RS232 interface and software.

The protocol is as follows.

**A.** 9600 bps, 8 data bits, no parity.

**B.** Format (ASCII)

### Model pSENSE

Cxxxxppm:Txxx.xC(F) LRC CRLF

Description: \$CO<sub>2</sub>:Air LRC CRLF

### Model pSENSE RH

Cxxxxppm:Txxx.xC(F):Hxx.x%:

dxxx.xC(F):wxxx.xC(F) LRC CRLF

Description: \$CO<sub>2</sub>:Air:RH:DP:WBT LRC CRLF

## SPECIFICATION

|                       | pSENSE   | pSENSE RH  |
|-----------------------|--|--|
| <b>CO<sub>2</sub></b> |  |  |
| Range                 | 0~2000ppm<br>2001~9999(out of scale)                         | 0~5000ppm<br>5001~9999(out of scale)                   |
| Resolution            | 1 ppm  | 1 ppm  |
| Accuracy              | ±50ppm±5%rdg(0~2000)<br>Not specified for out of scale       | ±30ppm±5%rdg(0~5000)<br>Not specified for out of scale |
| Pressure Dependence   | +1.6% reading per kPa deviation from normal pressure, 100kPa |  |
| <b>Temp.</b>          |  |  |
| Range                 | -10.0~60.0°C (14~140°F)                                      |  |
| Resolution            | 0.1°C/0.1°F  |  |
| Accuracy              | ±0.6°C/ ±0.9°F   |  |
| <b>Humidity</b>       |  |  |
| Range                 | N/A  | 0.0~99.9%  |
| Resolution            |  | 0.1%   |
| Accuracy              |  | ±3%(10~90%)<br>±5%(others)                             |
| <b>Warm up</b>        | 30 seconds   |  |
| <b>Operating</b>      | 0~50°C, 0~95%RH (avoid condensation)                         |  |
| <b>Storage</b>        | -20~60°C, 0~99%RH (avoid condensation)                       |  |
| <b>Power</b>          | 4pcs AA batteries, DC adaptor                                |  |
| <b>Battery life</b>   | 24 hours (Alkaline)  |  |

## **CO<sub>2</sub> LEVELS AND GUIDELINES**

The following are excerpts from **ANSI/ASHRAE** addendum standard 62.1-2004:

Enforceable and/or regulatory levels:

**OSHA** -5000ppm

The Occupational Safety and Health Administration

**MAK** -5000ppm or 10000ppm(1h)

German institution

Non-Enforced Guidelines and Reference levels:

**Canadian** - 3500ppm (Long-term)

**NIOSH**-5000ppm or 30000ppm(15 min)

The U.S.National Institutes of Health

**ACGIH**-5000ppm or 30000ppm(15min)

The American Conference of Governmental Industrial Hygienists (ACGIH)

### **NOTES :**

**TWA**(Time Weighted Average) value stands for the average carbon dioxide level exposure during 8 hours(working day) is 5000ppm/5 days.

**STEL**(Short-Term Exposure Limit) value shows the last 15 minutes CO<sub>2</sub> concentration is 30,000ppm.

**ASHARE** Standard 62–1989,Sec.6.1.3 :Comfort (odor) criteria are likely to be satisfied if the ventilation rate is set so that 1,000 ppm of CO<sub>2</sub> is not exceeded.

## **WARRANTY**

The meter is warranted to be free from defects in material and workmanship for a period of two years from the date of purchase. This warranty covers normal operation and does not cover misuse, abuse, alteration, neglect, improper maintenance, or damage resulting from leaking batteries. Proof of purchase is required for warranty repairs. Warranty is void if the meter has been opened.

## **RETURN AUTHORIZATION**

Authorization must be obtained from the supplier before returning items for any reason. When requiring a RA (Return Authorization), please include data regarding the defective reason, the meters are to be returned along with good packing to prevent any damage in delivery and insured against possible damage or loss.

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