MODEL: SP2nd
(Portable Single Gas Detector)

Operating Manual

Guarantee and Repair

Senko Co., Ltd. guarantees the products of SP series for 24 months from the shipping date and repairs or replaces the defected product during warranty period at no cost. Nevertheless, Senko is not responsible for the following cases and would not repair or replace the product at no cost, such cases as the product has been purchased through the route that Senko does not approve, or as the product has been damaged or deformed mechanically by misuse of the user, or as the product has not been calibrated or replaced the parts according to processes in the operating manual.

In the event that any defect or issue of the product occurred during warranty period, Senko will cover all the expenses except transportation fee. After the period of warranty, the expenses of repair or replacement of the product and transportation will be in principle borne by the user. Senko will not be responsible for any indirect occurrence or accident and/or damage during the use of the product, and the guarantee shall be limited to the replacement of parts and product. The guarantee is applied only to the users who purchased the product at Senko's authorized dealers or agents, and the guarantied repair is to be performed by the expert engineers of Senko's authorized aftercare center.

Product Introduction

SP2nd is Simple Gas Alarm Detector that is required to protect users' safety at dangerous work environments where an explosion accident can occur. The apparatus can indicate simultaneously the concentration of gases (Oxygen, Carbon Monoxide, Hydrogen Sulfide, Hydrogen, Sulfur Dioxide, Hydrogen Chloride, Ammonia and etc.) on a digital LCD monitor, and the methods of operation and calibration are easy and convenient.

This instrument alerts accurately the alarm circumstances to operators and workers for their safety with its functions of loud alarm sound and vibration, when higher gas concentration than normality is detected. Besides, it is available for users to check upon occasion and adjust the value of alarm to the work environment on demand, since it has the function of indicating minimal and maximal concentration of the gases. It is also possible to prevent in advance workers from the danger of exposing for a definite period of time to such toxic gases as Hydrogen Sulfide (H_2S), Carbon Monoxide (CO) and Sulfur Dioxide (SO_2) by its function of STEL (Short Term Exposure Limit) and TWA (Time Weighted Average).

Contents of Operating Manual

Product Specification

| Model	SP2217	SP2227	SP2257	SP2277	SP2297
Measured Gas	O_2	CO	SO_2	H_2	H_2S
	0~30%	0~500ppm 0~1,000ppm	0~20ppm 0~100ppm	0~20ppm 0~100ppm	0~100ppm 0~200ppm
Measurement Method	Electrochemical Type				
Principle of Measurement	Diffusion Type				
Monitor	Custom-made Digital LCD				
Alarm	90dB				
Alert Lamp	Red LED				
Vibration Alert	Vibration Alarm				
Power Source	CR2				
Applicable Temperature & Humidity	-20℃ ~ +50℃, : 10% ~ 95% RH (non-condensing)				
Explosion-Proof	EEx ia IIC T4 / IP67				
Case	Rubber PC Case				
Standard Accessories	Belt Clip, Calibration Cap				
Optional Accessories	Small-Sized Pump for Sampling				
Exterior	Dimension : 54mm(W) x 91mm(H) x 32 mm(D) Weight :120g (Including)				

Specification of External Pump (Optional)

Power Source	AA Size Alkaline Battery, 1 ea
Continuous Operation Time	Available to Operate for 5 hours or longer
Applicable Temperature & Humidity	-20° C ~ + 50° C, 0 to 95% RH
Exterior	Dimension: 34mm(W) x 270mm(H) x 47 mm(D) Weight: 200g (Including)
Sampling Flux	0.5 liter / minute
Diagnosis Function	Deadlock Alarm, Alert of Insufficient (Red LEC Display)

Names and Functions of Exterior
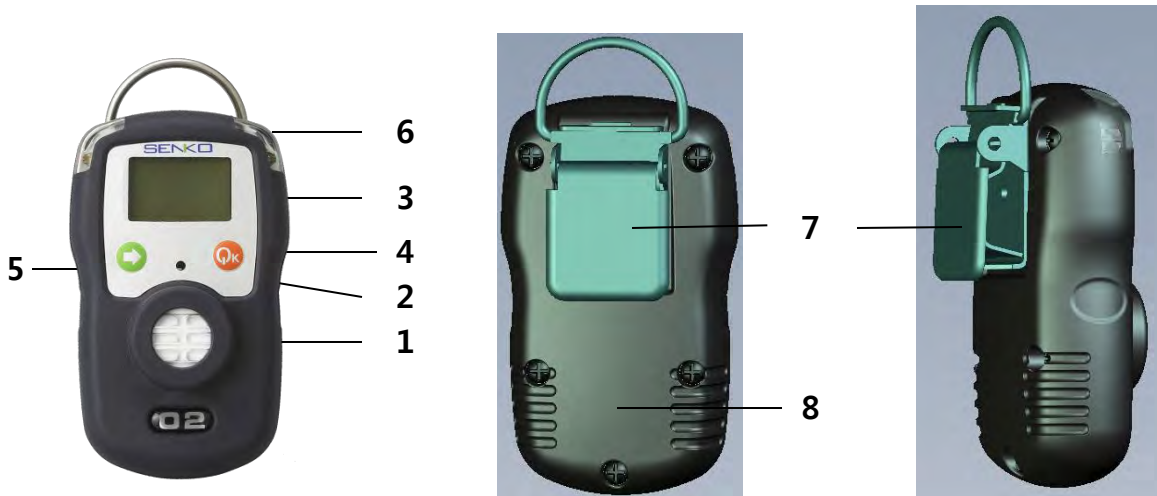
1. **Gas sensor**
2. **Buzzer**
3. **LCD display**
4. **On/Off Key**
5. **⇨ Key**
6. **Alarm LED**
7. **Fastening clip**
8. **Type label**

LCD display symbols
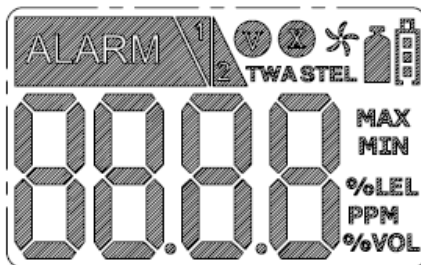
|	
V Safety Area indicator	**TWA STEL** Time average level Alarm
X Test Failure	✕ Fresh air calibration
1 First alarm	Single gas calibration
2 Second alarm	Show Battery
MAX MIN Max or Min Peak value	

Start of Operation

Instrument Power-On

Press Power key for 3 seconds, and power is turned on displaying 3, 2, and 1 in order on the monitor. (Power won't turned on, if pressing the Power key is stopped before 3 seconds)

Afterwards during the instrument is being stabilized, the countdown of 10. 9, 8,…………..2, 1 appears on the screen, and the program is converted to Gas Detection Mode with alarm sound and vibration

When the instrument is stabilized after the display of the above set values, it converts to Gas Detection Mode displaying the mark **V**. At normal status, the mark **V** disappears after blinking 5 times, and the concentration of the gas detected of the moment is indicated. In the event that stabilization of the instrument fails, it would not convert to Gas Detection Mode, blinking the mark **X** with the alarm sound. In this case, calibration of the sensor or aftercare of the instrument is required.
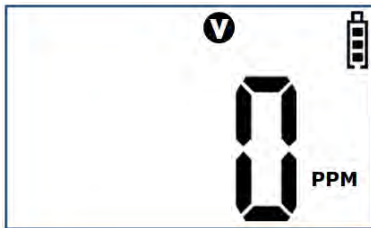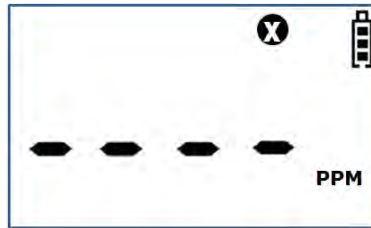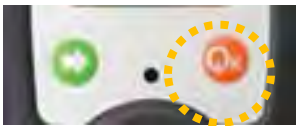
Pass	Fail

Instrument Power-Off

Press Power key for 5 seconds, and power is turned off displaying 5, 4, 3, 2 and 1 in order on the monitor with and the alarm sound.

Caution: Appropriate calibration of the instrument is always required prior to the operation at work sites. Make sure if the instrument makes the proper detection response to the pertinent gas and if the region of the gas detection is not blocked with foreign materials that interfere with the gas detection.

LCD Back Light

At the state of Gas Detection Mode indicating the concentration of gases simultaneously, LED Backlight is turned on by the short press on Arrow key, that enables the operator to view the measured value even at dark atmosphere. It is turned off by pressing again once more. Backlight will be automatically turned off after 30 seconds unless the button works.

Operation Method

Detection Mode

The instrument is converted to Gas Measure Mode as below, when power is turned on.
Gas Measure Mode indicates the concentration of gas and the remained capacity of battery on LCD, and it displays the gas concentration of Oxygen by %, and such toxic gases as H2S, CO and SO2 by ppm units.

In the event that the concentration of gas changes, it indicates the value of concentration in real-time. If it exceeds the 1st Alarm or 2nd Alarm standard (or STEL / TWA), the measured value and icon ▼ or icon ▲ (STEL, TWA icon in case of STEL / TWA) blinks periodically with the alerts by alarm sound and vibration.

When the operator moves to the safe place where the concentration value of the measured gas is the normal state, the concentration value reduces and the alarm stops. (Even if the operator escapes to a safe area after the alarm alerts, the icon of alarm remains on the screen, and it will disappear only after confirming the value by pressing Power key.

When the concentration value of the measured gas exceeds the maximum measuring range, it is indicated as the maximum value. And LED, alarm sound and vibration applicable to 2nd Alarm Standard operate together.

Indication of Peak Value and TWA & STEL Value

At Gas Measure Mode, in case of Oxygen, the measured maximum and minimum values are displayed in order. And in case of Toxic Gases, maximum value, TWA value and STEL value are displayed consecutively.

Example) In case of Oxygen Measure Instrument

Program returns to Measure Mode, when Arrow key is pressed at state displaying Peak, TWA and STEL. If the button is not touched for 10 seconds, the program will return to Gas Measure Mode.
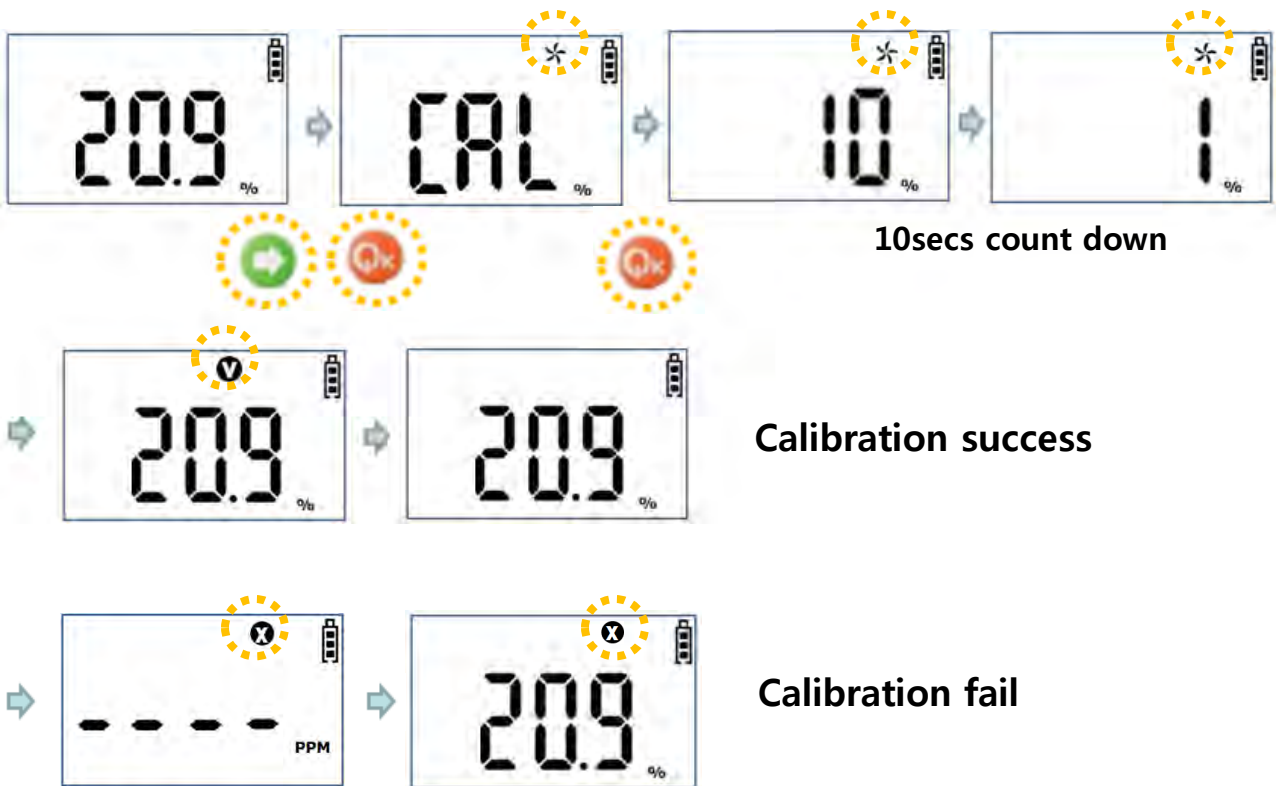
Calibration

Caution: Senko Co., Ltd. performs the initial calibration before the shipment. Incorrectly calibrated value can reduce the accuracy of the product, as the calibrated value is stored in the instrument. Calibration is in general to be performed monthly or quarterly, and can be adjusted according to frequency of the use.

Fresh air Calibration

✳ icon blinks when Power key is pressed for 3 seconds at the state of pressing Arrow key simultaneously.

Program will enter to Calibration Mode of Standby State. When Calibration starts, countdown 10, 9, 8.............3, 2, 1 continues for 10 seconds and Calibration will be completed. If Calibration is completed normally, it returns to Gas Measure Mode after 3 times blinking of icon **V** with alarm sound.
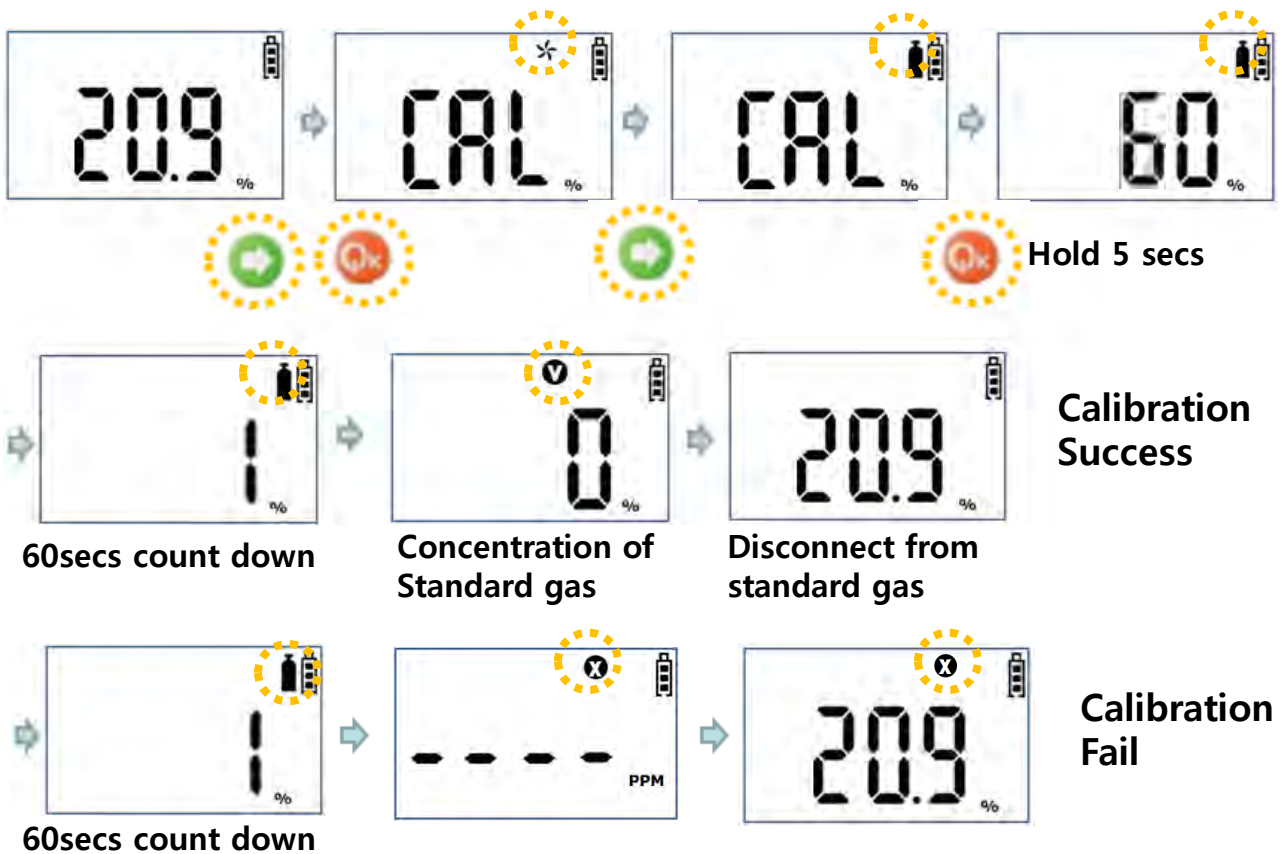
10secs count down

Calibration success

Calibration fail

If Standby State Calibration failed, icon **X** blinks continuously with alarm sound. If this occurrence repeats, please consult a dealer or aftercare center to replace the sensor.

> Caution: Fresh Gas Calibration should be performed at the environment of fresh air without any influence of other gases, since the calibration is performed on the assumption that the concentration of Oxygen is 20.9%, that of Inflammable Gas is 0%LEL, and the concentration of Toxic Gas is 0ppm in the fresh air. Accordingly it is not recommended to perform Fresh Air Calibration at the closed space, and it should be avoided to perform the calibration where gases can be inhaled by operators.

Standard Gas Calibration

Icon ✼ blinks when Power key is pressed for 3 seconds at the state of pushing Arrow key simultaneously. And icon ▮ blinks by input of Arrow key at the state. Standard Gas Calibration starts by pressing Power key for longer than 5 seconds. Be careful not to proceed with Calibration at the state without connecting with Standard Gas.

Hold 5 secs

Calibration Success

60secs count down **Concentration of Standard gas** **Disconnect from standard gas**

Calibration Fail

60secs count down

When Standard Gas Calibration starts, in case of Oxygen, Calibration proceeds by the countdown for 60 seconds. If the Calibration is normally executed, the concentration value of the gas connected at the moment is indicated with blinking of icon Ⓥ and alarm sound. Afterwards, it indicates the concentration value measured at the moment, when Standard Gas is disconnected. If the Calibration fails, program returns to Gas Measure Mode after blinking of icon Ⓧ for 3 seconds with alarm sound. In this case, icon Ⓧ blinks continuously. If this occurrence repeats, please consult a dealer or aftercare center to replace the sensor.
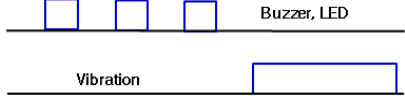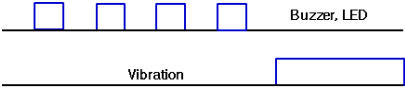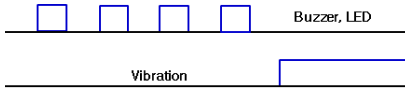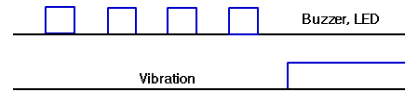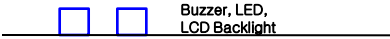
Concentration of Calibration Gas Set to Instrument

Gas	Oxygen	Carbon Monoxide	Hydrogen Sulfide	Hydrogen	Sulfur Dioxide
Concentration	0%	100ppm	50ppm	500ppm	10ppm

Method of Alarm Set up and Display

Caution: The value of alarm of the instrument is set according to the alarm standard of each gas that is required by international standard. Therefore alarm value of the relevant gas can be changed under the responsibility and approval of the administrator of the work site where the instrument is used.

Alarm Display

Alarm	Alarm Standard	LCD Display	Alarm & Vibration Display
1st Alarm	In Exceeding Alarm Value Set Primarily	Displaying Icon & Concentration	Buzzer, LED / Vibration
2nd Alarm	In Exceeding Alarm Value Set Secondarily	Displaying Icon & Concentration	Buzzer, LED / Vibration
TWA	In Exceeding Exposure Concentration for 8 hour	Displaying Icon **TWA** & Concentration	Buzzer, LED / Vibration
STEL	In Exceeding Exposure Concentration for 15 minutes	Displaying Icon **STEL** & Concentration	Buzzer, LED / Vibration
Dead	Battery Capacity is Exhausted.	Blinking of Battery	Buzzer, LED, LCD Backlight
Test Failure	Failure of Sensor Test Failure of Calibration	Displaying Icon	BUZZER, LED

When the 1st alarm occurs, and the operator recognizes it and presses Power key, only the alarm sound stops, remaining LED alarm as the operation stale.

When the 2nd alarm happens, the operator and workers should promptly escape from the work site. The alarm will stop, when power key is pressed at the place where the concentration value of gas is normal (Alarm alerts continuously even if the Power key pressed, when it does not return to the normal status.)

When STEL / TWA alarm occurs, it is indicated with the value of the measured concentration and alerts alarms of the same sound of alarm and vibration as that of the 2nd alarm.

When STEL / TWA alarm occurs, the icon can be deleted only by Power Off.

Primary battery alarm sounds repeatedly at 5 minute intervals when only a bar of battery icon is remained.

Secondary battery alarm starts right before the end of power, and the power source finishes after 10 seconds from the outbreak of alarm.

In the event of failure of test or calibration, the icon ✖ is displayed with the sound of alarm.

Alarm Set Point

Gas	O_2	CO	H_2S	H_2	SO_2
1st	19%	30 ppm	10 ppm	100 ppm	2 ppm
2nd	23%	60 ppm	20 ppm	500 ppm	4 ppm
TWA	N/A	30 ppm	10 ppm	N/A	2 ppm
STEL	N/A	200 ppm	15 ppm	N/A	5 ppm

Alarm Set

When Arrow key is pressed for 3 seconds at the state of power off, program enters to 1st Alarm Set Mode with blinking of icon ◢ . It approaches to 1st Alarm Change Mode by pressing Power key, and moves to 2nd Alarm Set Mode with blinking icon ◢ by pressing Arrow key. If you want to return it to Gas Measure Mode without changing Alarm Set Value, it can move by Arrow key.

Hold 3 secs

10
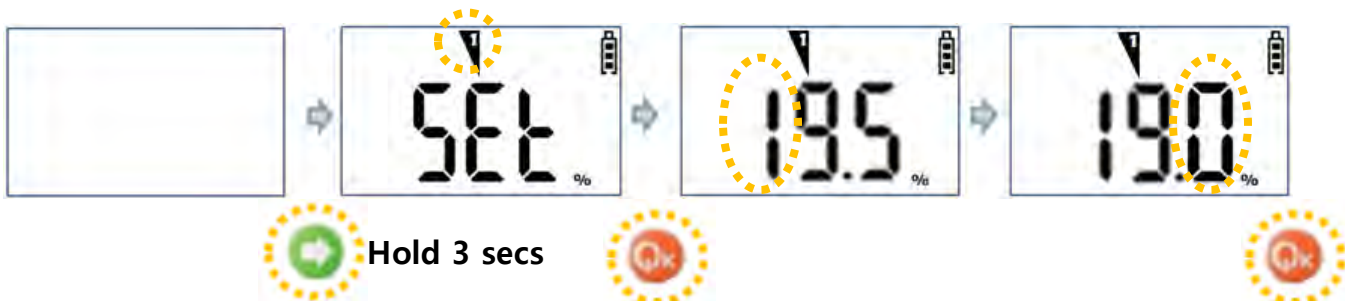
Program returns to 1st Alarm Set Mode that is the initial Alarm Set Mode, after setting up 1st Alarm value. It can approach to 2nd Alarm Set Mode or return to Gas Measure Mode. The way of setting 2nd Alarm is same as the method of setting 1st Alarm.

Hold 3 secs

10 secs count down

When the program returns to Gas Measure Mode after 2nd Alarm Set Mode, 10 seconds countdown proceeds with alarm sound. It will be changed to Gas Measure Mode with alarm sound and vibration, when the countdown finishes.

Method of Alarm Value Input

When Arrow key is pressed after entering to Alarm Value Set Mode, the first digit number will move upward by each 1 step. And blinking 2nd number moves the position by pressing Power key. If you press Arrow key, the number moves upward, and the 3rd number blinks and moves the position by pressing Power key. It returns to Alarm Value Set Mode with alarm sound, when Power key is pressed after changing the last digit is completed.

Example) To change 1st Alarm Value from 19.5% to 19.0%

Applicable Battery

Caution: It is absolutely prohibited to replace battery at potential explosion areas or dangerous regions. Specification of the applicable rechargeable battery and disposable battery is as below.
- Disposable Alkaline Battery: 3V lithium CR2 battery
If the battery of other specification, It is not permitted to use it for the instrument at dangerous regions

Warning: Explosion can occur, when a battery is thrown into fire or disassembled with force. Disposal of the used battery should be performed according to the guide of the pertinent country or the work site.

External Pump (Optional)

key has the function of On/Off, and the state of operation or trouble of the instrument can be recognized by LED lamp.
When the leakage measurement or the measurement of concentration by inhalation of gas is required, it is available to measure gas concentration and leakage at the pertinent place by connecting the pump to the instrument.
Prior to use, make sure that the instrument is tightly attached to the probe cover which is connected to the sensor.
Please note that External Pump is the optional product that can be provided by the separate order.

Battery & Sensor replacement

When you replace the Battery and sensors of SP2nd, you need some instrument and components as below.

- Instrument : + driver
- Battery : 3V lithium CR2 battery
- Sensors for replacement : Senko SS series
- Filters for replacement

Warning : - It is absolutely prohibited to replace battery at potential explosion areas
  or dangerous regions.
  - Replacement of components can be damage to intrinsic safety function.
  - The sensors published by SENKO should be used for replacement. Unsuitable
    function could be shown if another sensors use for replacement..
  - Disassembly should be necessary only for sensors & battery replacement. After
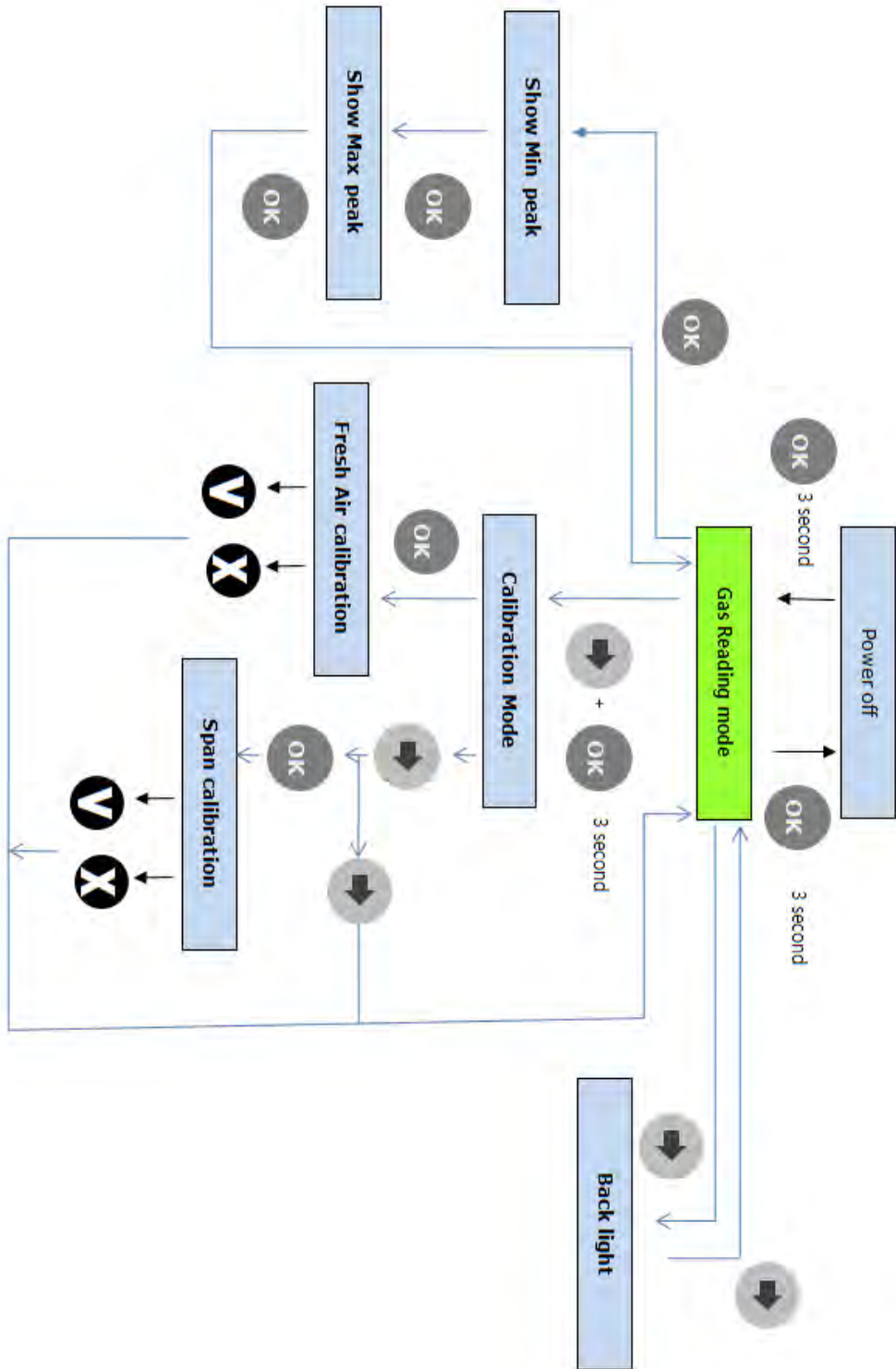   the sensor replacement, the span gas calibration should be done.

Disassembly

- Turn off the power.
- Replace the sensor and battery , please refer to below drawing.
- After replacement, check the sensor fail and battery working.
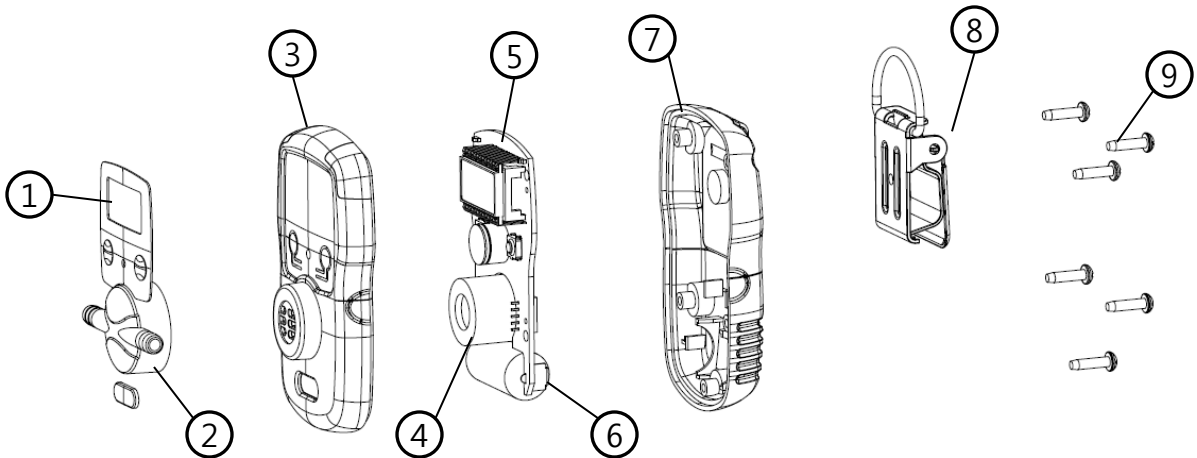
1. Label(Membrane)	6. Battery
2. Calibration Cap	7. Rear Cover
3. Front Cover	8. Belt clip
4. Sensor	9. Machine Screw
5. PCB	

Operation Flow Chart

Notice for User

Please use the instrument in the range of the applicable temperature, humidity and pressure that are appropriate for the specification of the product. Using the instrument beyond this range may cause malfunction or glitch of the instrument. .

Gas concentration measurement value by the sensor or the instrument can vary according to the environment at site (temperature, pressure and humidity). Therefore the calibration of the instrument should be performed at the same or similar environment as that of the instrument use (temperature, pressure and humidity),

If temperature changes sharply during use of the instrument (for instance, using the instrument at places of far different temperatures between indoor and outdoor), the value of the measured gas concentration can be changed suddenly. Please use it after the gas concentration value is stabilized. .

Severe vibration or shock to the instrument may cause the sudden change of value of the measured gas concentration. Please use it after the value of gas concentration is stabilized. Excessive shock to the unit can lead to trouble of the sensor or the instrument.