EST-1000

Handheld Intelligent Toxic Gas Detector

User Manual

（Please read this manual carefully before using）

ENVIRONMENTAL SENSOR TECHNOLOGY CO.INC.

Contents

I. Product Overview

EST-1000 series handheld intelligent toxic gas detector is an intelligent hand-held alarm that detects the concentration of toxic gas in the target gas with high precision and low power consumption by an advanced electrochemical technology.
EST-1000 series adopt a natural gas diffusion testing method (external handheld pump for option). The sensor is the advanced electrochemical toxic gas ones, which are of high sensitivity and excellent repeatability. It is equipped with a LCD liquid crystal display, which can observe the concentration of the target gas online, check the time, date and week, It has two levels of alarm output. When it exceeds the pre-set alarm point, the sound and light alarm signal will be started immediately. It has two kinds of calibration methods, i.e. the software and hardware. The calibration can be finished without opening the cover.

This instrument has the following features:

1. Advanced electrochemical sensor makes the performance stable and reliable.
2. External power supply of DC5V, a rechargeable 3.7V lithium battery built inside and chargeableness upon connected to the external power supply are all provided.
3. Large-screen LCD can display various parameters, with two methods of viewing, i.e. with data and curves.
4. The time, date and week can be set and displayed. All the time information can be checked by a.
5. It is of the intelligent design, full functions, zero setting, alarm settings and convenient calibration.
6. The shell is compact and lightweight, which can be put in the pocket or bag and also can be hung on the body and is easy to carry.
7. Two levels of the sound and light alarm are available. The four bright LEDs alert the user when alarming.

II. Product Description

There are five functions, an LCD display and 4 LED lights in the front of the product, which is shown as follows:

Among them, the LCD screen is used to display the gas concentration, time and various information parameters. The two LED lights on the top are alarm lamps, which flash alternately when the gas alarms. The LED at the left side of the bottom of the LCD is the power light, which is green and lights when the battery voltage is not enough. While the LED at the right side is the communication light that becomes red and flashes once when communicating one set of the data (applicable for EST-2000 series only).

The five buttons on the panel respectively are Power/Confirm, Menu/Shift, Back, Plus/Up and Minus/Up.

1. Power/Confirm: long press (for about 3 seconds) facilitates the power and the instrument switches the on-and-off machine. Short press facilitates the Confirm.
2. Menu/Shift: after booting, long press (for about 3 seconds) facilitates the menu to enter the menu mode. Short press facilitates the shift.
3. Back: long/short press will both facilitate the Back and it will return to the last menu or exit the menu mode.
4. Plus/Up: add a displayed unit to the value or turn upward for an option. Long press facilitates the continuous operation.
5. Minus/Up: reduce a displayed unit to turn downward for an option. Long press facilitates the continuous operation

In addition, there is a power connector on the left side of the product and the battery is installed in the back cover of the product. The parts and names of the products are shown in the following figure.

III. Performance Parameters

Product name	Gas detection alarm	Sensor name	Optional (electrochemical sensor)
Type of product	EST-2000	Type of sensor	Optional
External power supply	5VDC/500mA	Detecting target	Toxic gas (optional)
Type of battery	Lithium ion battery	Detection principle	Electrochemical
Battery voltage	3.7V (charge limitation 4.2V)	Detection method	Diffusion
Battery capacity	800mAh	Detection range	Optional
Shutdown current	< 0.1mA	Accuracy	±5%FS
Startup current	< 10mA	Resolution	Optional
Alarm current	< 50mA	Operating temperature	-10℃-40℃
Protection class	IP65 dustproof and waterproof	Humidity	0-95%RH
Way of display	LCD liquid crystal display	Pressure range	860-1060hpa
Way of alarm	Two levels of the sound and light alarm	Preheat time	60 seconds
Alarm error	≤±10% alarm set value	Response time	T90≤30S (most)
Data storage	N/A	Service life	2 years (in the air)
Signal output	N/A	Zero drift	≤±2%FS/6h
Dimensions of appearance	120*60*35mm	Span drift	≤±5%FS/6h
Weight of machine	≤ 250g (including batteries)	Repeatability	≤±2%FS

Note: Please refer to the corresponding sensor technical manual for the sensor parameters.

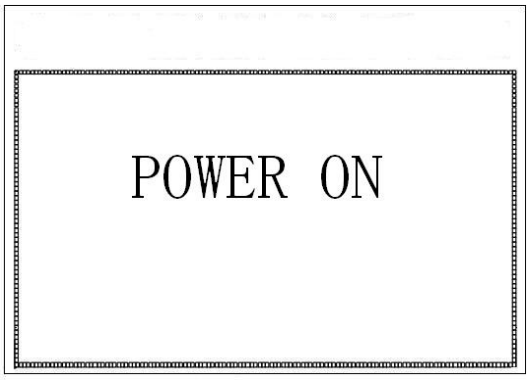
IV. Notes

The use, maintenance and calibration of the instrument shall be taken by special people.
1. Both of the zero point and full scale shall be calibrated once every three months;
2. The detection probe shall be cleaned on a regular basis. Otherwise, the dust and impurities will plug into the gas hole, which will make the sensitivity of the sensor decreased.
3. Since the date of the delivery to the user, if the instrument fails to operate normally within a year due to the quality problems, our company will repair or replace it for the user for free. If it is over a year, the labor cost will be charged.
4. Since there is the acid solution in the electrochemical sensor, the users shall not disassemble it by themselves. Be careful not to damage the film. If the acid solution contacts the skin, the users shall wash immediately with water in 10 minutes and then go to a doctor.

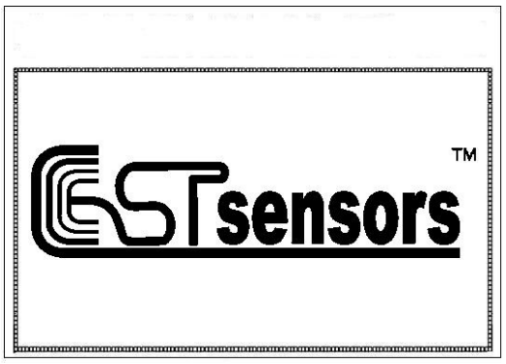
V. Operational Processes

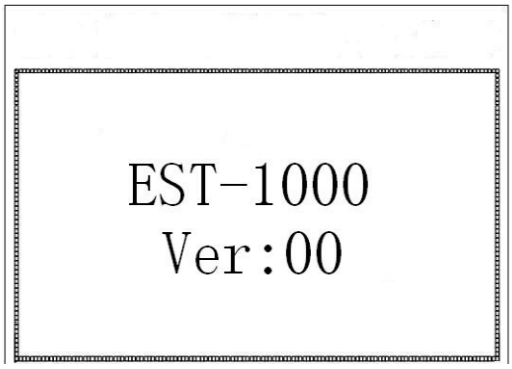
1. Instrument Booting

Connect to the battery (if it is connected, long press the Power/Confirm for about 3 seconds) and the alarm light is on, as well as the buzzer sounds, which means the instrument boots successfully. The LCD shows "POWER ON" for about 0.5 seconds, which is shown as follows. (The display is for reference only. Please be subject to the actual object. The same below)

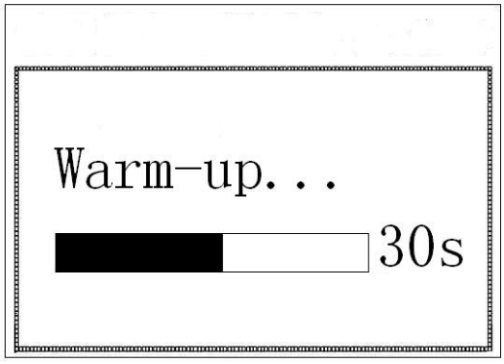


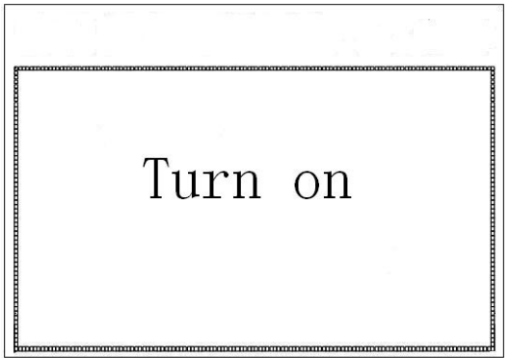
Then the LCD shows the company LOGO "ESTsensors™" for about 0.5 seconds, which is shown as follows. And then it shows the type of the instrument and the program version for about 0.5 seconds, which is shown as follows:





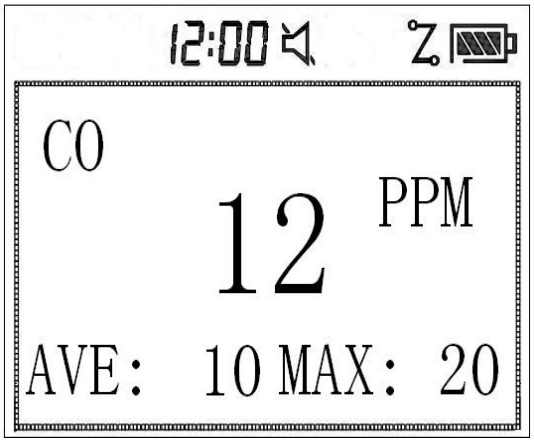
Next, enter the sensor and wait for the warm-up for about 60 seconds. Accompanied by the sound of the buzzer, the LCD shows the countdown time, which is shown as the following left picture. After the completion (it shows 00 seconds), the LCD shows “Turn on” for about 1 second, the alarm light is on, the buzzer sounds and it waits for the completion, which is shown as the following right picture.





2. Detection Status

After the successful booting, the instrument enters the detection status automatically and the LCD shows all kinds of information at real time, which is shown as follows:



The top of the LCD shows the time, battery capacity and other signs at real time, such as the alarm status, buzzer status and link status of the communication.

The left side of the LCD shows the types of gases.

The right side of the LCD shows the measurement unit.

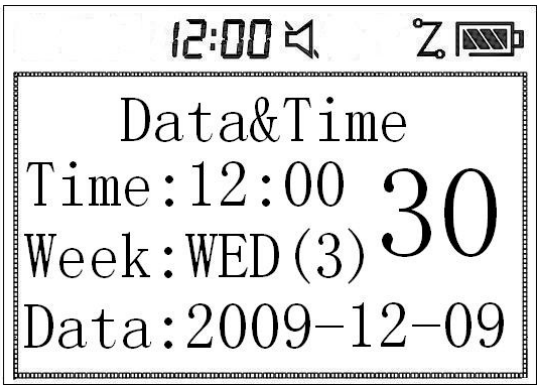
The large figure in the middle of the LCD is the real-time gas concentration.

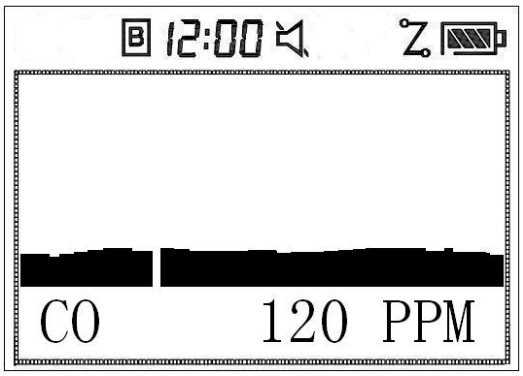
The lowest line of the LCD shows the average and maximum value measured since this booting.

3. Time Check and Graphics Status:

In the detection state, press the Confirm (shortly press “Power/Confirm”) to enter the state of checking the time and date. The LCD shows as the following left picture shows. Then press the Back and exit and return to the detection state;

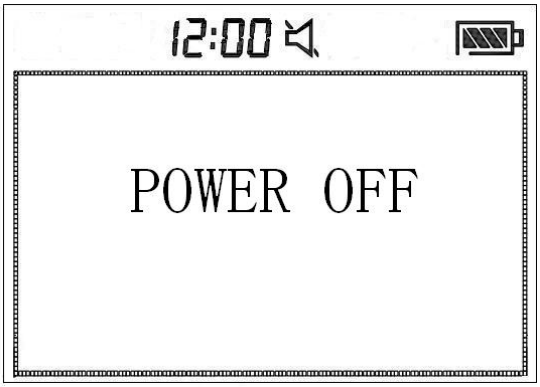
In the detection state, press the shift (shortly press “Menu/Shift”) to enter the state of checking the graphics. The LCD shows the gas concentration at real time in the curve. The types of the gases and concentration value are shown beneath the curve. Then press the Back to exit and return to the detection state, which is shown as the following right picture.

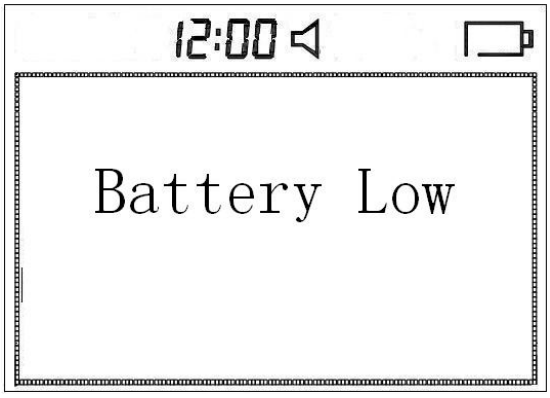




4. Instrument Shutdown

There are three ways of shutting down the instrument, which are the automatic shutdown when the battery capacity is too low, the automatic shutdown when the set time is up and the manual shutdown when pressing the power (long press the "Power/Confirm" for about 3 seconds). The buzzer sounds when shutting down, the LCD shows the "POWER OFF" for about 0.5 seconds (shown as the following left picture) and then all are off. The instrument is shut successfully and enters the low power consumption standby mode. If it automatically shuts down because the power capacity is too low, it will show "Battery Low" first before showing "POWER OFF", which is shown as the following right picture.

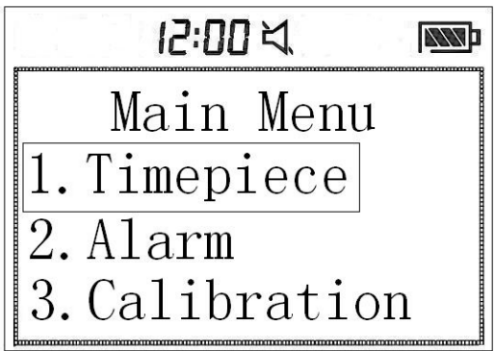


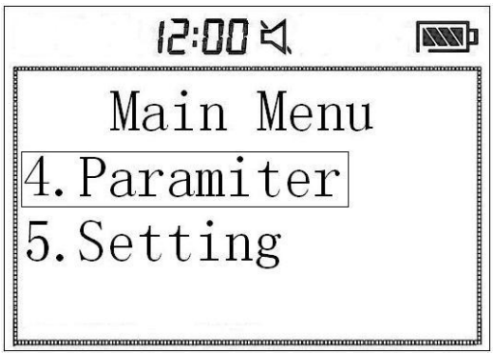


VI. Menu Description

1. Main Menu

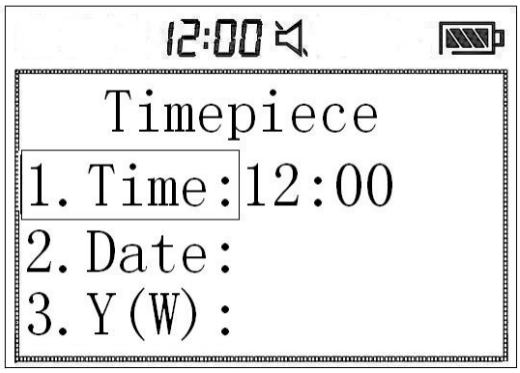
In the detection state, press the Menu (long press "Menu/Shift" for about 3 seconds) to enter the Main Menu. LCD shows the "Main Menu" and six options divided by two screens. Use the Up/Down to scroll through the options and the two screens will be switched automatically. The highlighted option is the current selected option as bellow:

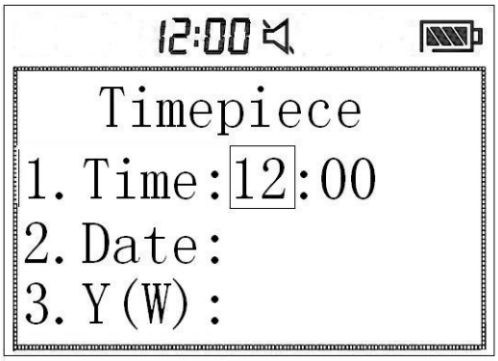




2. Timepiece Setting

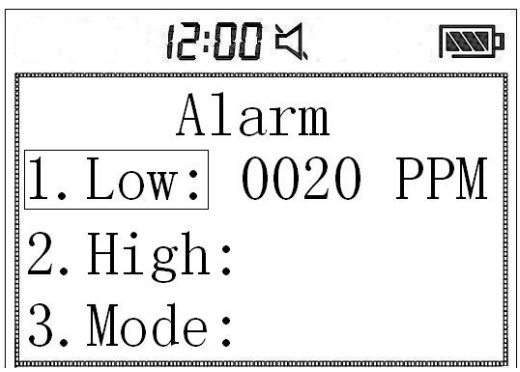
Select the first option “1. Timepiece” in the Main Menu and then press the Confirm to enter the setting of timepiece. There are three options in the sub-menu of Timepiece: “1. Time:”, “2. Date:” and “3. Y (W):” the first option is to set the hour and the minute, the second option to set the month and the date and the third option to set the year and the week. Press the Up/Down to scroll through the options and press the Back to return to the Main Menu and pressing the Confirm again could enter the parameter altering status. Press the Shift to select the parameter to be altered and press the Plus and Minus to make the alteration and then press the Confirm to save it and return to the Main Menu. Pressing the Back will not save the alteration but return directly. The highlighted option is the current selected option as bellow:

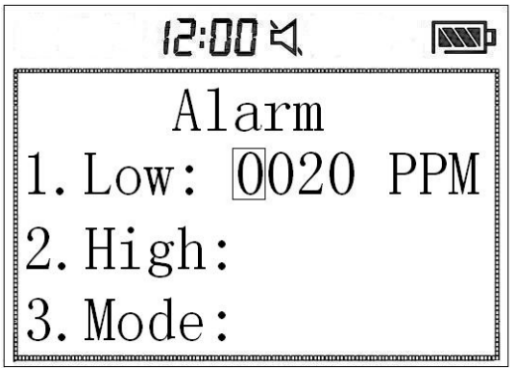




3. Alarm Setting:

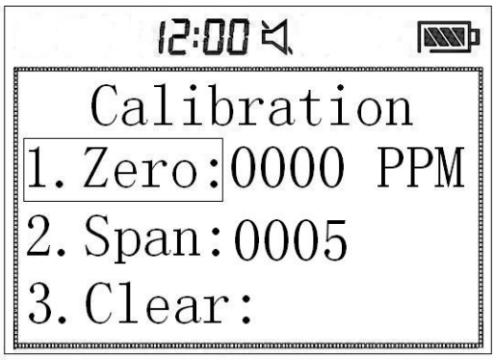
Select the second option “2. Alarm” in the Main Menu and then press the Confirm to enter the setting of alarm. There are three options in the sub-menu of Alarm: “1. Low:”, “2. High:” and “3. Mode:”; the first option is to set the low value, the second option to set the high value and the third option to set the mode of the alarm. Press the Up/Down to scroll through the options and press the Back to return to the Main Menu and pressing the Confirm again could enter the parameter altering status. Press the Shift to select the value to be altered and press the Plus and Minus to make the alteration and then press the Confirm to save it and return to the Main Menu. Pressing the Back will not save the alteration but return directly. The highlighted option is the current selected option as bellow:

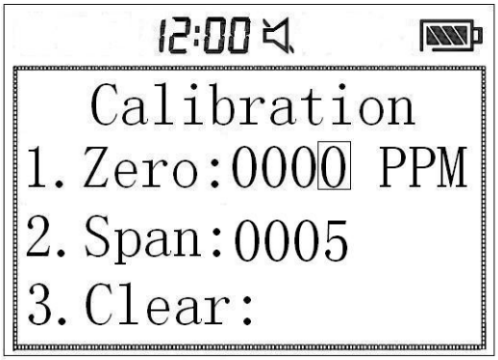




4. Software Calibration:

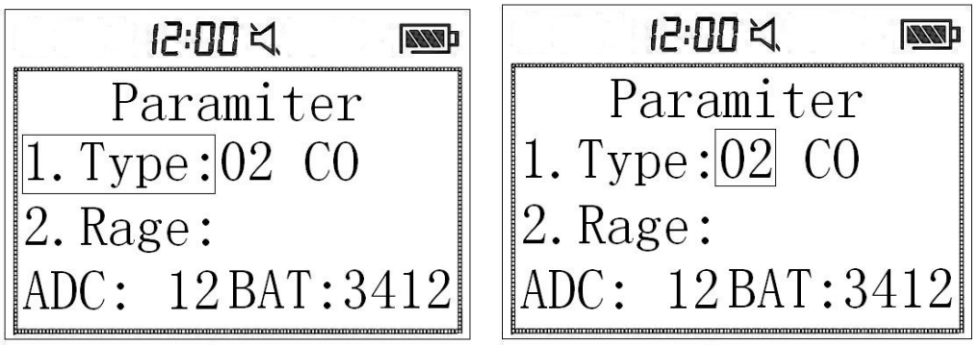
Select the third option "3. Calibration" in the Main Menu and then press the Confirm to enter software calibration. There are three options in the sub-menu of Calibration: "1. Zero:", "2. Span:" and "3. Clear:"; the first option is to set zero calibration, the second option to set gain calibration and the third option to clear the parameter of the calibration. Press the Up/Down to scroll through the options and press the Back to return to the Main Menu and pressing the Confirm again could enter the altering status. Press the Shift to select the value to be altered and press the Plus and Minus to make the alteration and then press the Confirm to confirm the calibration or the clearing and return to the Main Menu. Pressing the Back will not calibrate or clear the value but return directly. The highlighted option is the current selected option as bellow (the 4-digit data with the unit is the value after calibration and the 4-digit data without the unit is current concentration value):





5. Parameter Setting:

Select the fourth option "4. Parameter" in the Main Menu and there are only two options in the sub-menu of Parameter: "1. Type:" and "2. Rage:"; the first option is to set the type of the gas and the second option to set the sensor; the last line indicates the ADC value of the gas and the amount of the battery level and is for reference only. Press the Up/Down to scroll through the list of the options (the last line could not be selected) and press the Back to return to the Main Menu and pressing the Confirm again could enter the altering status. Press the Shift to select the value to be altered and press the Plus and Minus to make the alteration and then press the Confirm to confirm the alteration or the clearing and return to the Main Menu. Pressing the Back will not alter or clear the value but return directly. The highlighted option is the current selected option as bellow:



6. Instrument Setting:

Select the fifth option "5. Setting" in the Main Menu and there are six options in the sub-menu of Setting: "1.BLT:", "2. AOT:", "3. AOV:", "4. MAD:", "5. LRV:" and "6. Reset:"; the first option is backlight time, the second option auto power off time, the third option the voltage of auto power off, the fourth option the communication address of the module, the fifth option the reference voltage of LCD (LCD grey scale) and the sixth option resetting (restoring to the default values). Press the Up/Down to scroll through the list of the options and press the Back to return to the Main Menu and pressing the Confirm again could enter the parameter altering status. Press the Shift to select the value to be altered and press the Plus and Minus to make the alteration and then press the Confirm to confirm the alteration or the clearing and return to the Main Menu. Pressing the Back will not save the alteration or the clearing but return directly. The highlighted option is the current selected option as bellow:

(Note: if the BLT is 0, it indicates the backlight is not turned off; if the AOT is 0, it indicates non-auto power off)

VII. Calibration Method

To ensure the measurement accuracy of the instrument, calibration should be conducted on a regular basis (it is recommended to calibrate once every three months) and recorded strictly. **During calibration, calibration cap should be added to the sensor (except for zero calibration). After installing the calibration cap, import the standard gas through the end of standard gas cap of the gas pipe and the other end of the gas pipe is connected with a safe place.** The instrument could be calibrated in 2 methods: the soft and hard. If hardware calibration required the opening of battery cap of the instrument, use a small slotted screwdriver to rotate the knob of calibration potentiometer (to avoid shock resulting in the knob loosening which will bring errors to the measurement, the knob should be fixed by soft

silicone gel; when using it, you should only take the soft silicone and please apply silicone gel on it after the calibration). If you don't want hardware calibration, you could press the relevant button to enter the menu-calibration mode in the detection state to realize the calibration of the concentration of the gas with software.

1. Hardware Zero Calibration

Power on the instrument for 30 minutes in clean air or pure nitrogen (the power on time of polarization during the first use of the instrument should be over 2 hours). After the display is stable, open the battery cap and adjust the zero calibration potentiometer in the instrument with the screwdriver to make the value displayed on the LCD to be 0, which means that the calibration is succeeded.

2. Hardware Gain Calibration

Import the standard gas of known concentration through the flow-meter, reducing the voltage to 1.1 times of the normal atmospheric pressure and controlling the flow rate within the range of 300ml/min to 500ml/min, and then direct the gas to the sensor through gas pipe and standard gas covering. After the display of the instrument is stable (in about 3-5 minutes), check whether the displayed value is in conformity with the concentration of the standard gas passed. If not, open the upper covering and adjust the span potentiometer of the outer covering of the instrument to make the displayed value in the panel to be in conformity with the concentration of the standard gas. After the adjustment, the gas could be stopped. Then see whether the value of the instrument could be returned to zero quickly in clean air. Repeat the above action and contrast the result with the last one. If the results are pretty much the same (within the basic error range), the adjustment could be stopped and the standard gas could be turned off and the calibration is ended. If not, the above calibration should be repeated again till the result is satisfied.

3. Software Zero Calibration

The calibration condition is same with that of hardware zero calibration. Press the relevant button to adjust the instrument to zero calibration condition (please refer to the 4th point of the 6th section for detailed method). After the display is stable, if the value displayed on the LCD is not 0, adjust the instrument till it is 0. Press the Confirm to save the data and then complete software zero calibration.

4. Software Gain Calibration

The calibration condition is same with that of hardware gain calibration. Press the relevant button to adjust the instrument to gain calibration condition (please refer to the 4th point of the 6th section for the detailed method). After the display is stable (in about 3-5 minutes after importing the gas), if the value displayed on the LCD is not in conformity with the standard gas, adjust the value till it is in conformity with the concentration of the standard gas. Press the OK to save the data. After the data is saved, the gas could be stopped. And then see whether the value of the instrument could be returned to zero quickly in clean air. Repeat the above action once and contrast the result with the last one. If the results are pretty much the same (within the basic error range), the adjustment could be stopped and the standard gas could be turned off and the calibration is ended. If not, the above calibration should be repeated again till the result is satisfied and then software zero calibration is completed.

Remark: the calibration is of great importance and non-professional technicians should not operate at random.

VIII. Troubleshooting

Troubles	Reasons	Treatment
Can not Start	Insufficient battery level Circuit faults	Recharge or change the battery Send it back to the factory to repair
High/Low Readings	Zero point or high/low gain calibration Disabled sensor	Re-calibrate Change the sensor
Unstable Readings	Not enough polarization time Disabled sensor Circuit faults Self-excitation generated in the circuit AC interference	Keep polarizing Change the sensor Send it back to the factory to repair Adjust Span potentiometer to reduce the gain Turn off high-frequency devices around (such as frequency converter and interphone)
Slow Response Time	Probe clogged with dust Disabled sensor Circuit faults	Clean up the dust on the protective covering Change the sensor Send it back to the factory to repair

IX. Instrument Supporting

1. One set of EST-1000 Hand-held Intelligent Toxic Gas Detector
2. One General 5V Power Adaptor
3. One Standard 3.7V Rechargeable Lithium Battery
4. One copy of EST-1000 Instructions for Use
5. One copy of Verification Certificate
6. One package of the product

Statement:

The parameters described in the Instruction may change in subsequent versions. Please take the actual object as the standard.

Appendix Type & Specification of the Sensor