麦芽传感
MaiYaSensorTech

MST410P

Portable pumping multi-gas detector

(Ver.1.0)

The manual is subject to change without prior notice

User's Manual

Catalog

I. Overview of product

MST 410P Portable Multi-Gas Detector is a pumping gas detector for personal protection that continuously detects the concentration of multiple gases. The colour TFT display shows the concentration of the detected gases and other information. A buzzer with a high decibel level, the alarm indicator, and a vibrator work together to alert the user that the current gas concentration has exceeded the limit alarm point. The detector uses smart sensors, which are easy to maintain. It has built-in program to reach many functions. The detector has data storage and Bluetooth data transfer for optional. The gas detector is widely used in ferrous metallurgy, petrochemical, emergency rescue, chemical production to improve life safety.

II. Features

1. The pump can be turned off and started quickly in order to save electricity during use.
2. Blocking pump detection. The detector alerts the user when the pump is blocked in use.
3. It has visual dust filter, easy to observe it's dirty and replace it.
4. It supports up to 5 gases (CO/H2S must be selected in this case of 5 gases).
5. The detector uses smart sensors. The smart sensor can be installed at will and the detector will automatically identify it. This make it to detect any gas by simply replacing the smart sensor.
6. Optional data storage(event recording and data recording) and Bluetooth data transfer.
7. Fall alarm, SOS buttern.
8. Gas concentration units can be selected, LEL%, vol%, ppm or mg/m3.

9. The detector can monitor its own working state, alarm and indication when it fails.
10. Calibration date countdown can be viewed. Calibration overdue reminder.
11. It displays sensors temperature, sensor has temperature compensation.
12. Color TFT display, it shows real-time data clearly and inimitably.
13. Display follows gravity, the screen is always positive when the meter is turned upside down.
14. Detector has rubber antistatic shell, durable, anti-static.

III. Specifications

1. Gases and measuring range: (Please contact us for other customized gases or ranges)

No.	Gas type	Range
1.	carbon monoxide(CO)	（0～2000）ppm
2.	hydrogen sulfide(H_2S)	（0～100）ppm
3.	oxygen(O_2)	（0～30.0）%
4.	combustible gas(Ex)	（0～100）%LEL
5.	methane (IR-CH4)	（0～5/20/100）%VOL
6.	carbon dioxide(CO2)	（0～5/20/100）%VOL
7.	ammonia(NH_3)	（0～100 ）ppm
8.	chlorine(CL_2)	（0～10.0 ）ppm

9.	hydrocyanic acid(HCN)	（0～30.0 ）ppm
10.	nitrogen dioxide(NO_2)	（0～100.0）ppm
11.	phosphine(PH_3)	（0～10.0）ppm
12.	hydrogen(H_2)	（0～1000）ppm
13.	sulfur dioxide(SO_2)	（0～100 ）ppm
14.	hydrogen fluoride(HF)	（0～10.0 ）ppm
15.	hydrogen chloride(HCL)	（0～20.0 ）ppm

Table 1

2. Rechargeable polymer lithium-ion battery: rated voltage 3.7V, nominal capacity 5200mAh

3. Working current:

Normal current: ≤150mA (when the screen is off)

Alarm current: ≤270mA

4. Explosion-proof grade: Ex ib IIC T4 Gb(CLEx), II 1G Ex ia IIC T4 Ga(ATEX)
5. Sensor type:

   Combustible gas: catalytic combustion, or infrared(NDIR)

   CO,H2S,NH3,CL2,NO2,HCN,PH3,O2,HCL,HF,SO2 and etc.

   Toxic gas: electrochemistry
6. Sampling method: pump sampling
7. Response time:

   Combustible gas:T_{90}<30s

   Oxygen:T_{90}<30s

   Toxic gas:ammonia, hydrocyanic acid within 120s, phosphine within 60s, other toxic gas response time within 30s
8. Continuous working time of full charge: ≥15h
9. Accuracy:

CO: ±10%

H2S: ±10%

LEL: ±5%FS

O2: ±3.0%FS

Other toxic gases: ±10% (displayed value) or ±5% (full scale) within the maximum

10. Working Environment:

Temp.: -20℃~ 55℃

Humidity: 0% ~ 95%RH, no condensation

11. Storage Conditions:

Temperature: -40℃~ 55℃

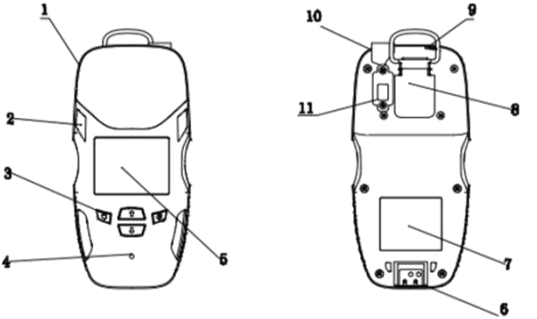
Relative humidity ≤90%RH, no condensation

12. Charging temperature range: 0℃~ 40℃

13. Carried Stard:GB12358-2006,GB/T3836.1-2021,GB/T3836.4-2021
14. Case material: ABS, PC, antistatic TPE
15. Overall size: 161mm×76mm×57mm (including back clip thickness)
16. Weight: About 450 g

IV. System structure and working principle

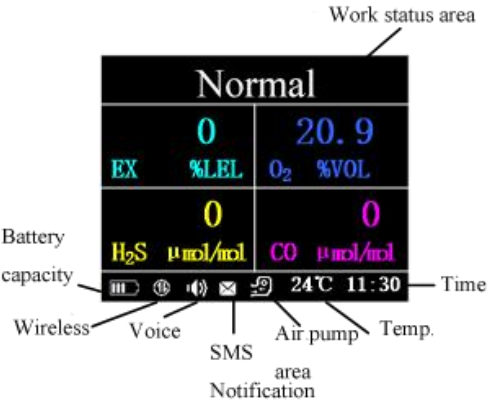
1 . Appearance structure drawing



1. Air baffle	2. 4 alarm lights	3. 4 buttons
4. Buzzer	5. Display	6. Charging port
7. Nameplate	8. Clip	9. SOS button
10. Air inlet	11. Dust filter	

Figure 1

2. Description of main display interface



(1) Working status area: Display the working status of detector. Normal is white, failure is yellow, alarm is red.

(2) Battery capacity: Shows the amount of battery left.

(3) Wireless: Icon indicates detector has wireless,otherwise not.

(4) Voice: means the sound is off, means the sound is on.

(5) SMS : It shows that there are new messages unread.

(6) Air pump : means working normal, means pump blockage.

(7) Temp.: It shows the current temperature.

(8) Time:It shows the current time.

3. The description of the light indicates

(1) Green light: It sparkles: Alarm is working properly.

(2) Yellow light: It sparkles: Alarm is faulty.

(3) Red light: If it is in low alarm state, the red light flashes once every 1 second. If it is in high alarm state, the red light blinks twice per second.

4. Description of the button

Detector has 5 buttons, ON/OFF button ⏻, SET button ◯, UP button ⇧, Down button ⇩, and Emergency help button SOS.

1) On/Off button ⏻ :

- In the off state, press and hold button for about 3 seconds to turn on the detector.
- In the on state, press and hold button for about 5 seconds to power off the detector.
- On the settings interface, press it to confirm.
- For alarm and fault status, press it to mute or unmute.

2) Set button ◯ :

- It can works with on/off button, it can be used for detector self-test.
- On the normal interface, hold it for 3s to enter the password menu.
- On settings interface, press it to return to the previous menu.

- When the pump is not detected at detector's startup, hold it for 3s to turn off the pump.

3) Up button ⇧:

- On normal screen, press it to view sensor info and STEL/TWA value.
- On settings interface, press it to scroll up or increase the digits.
- On normal screen, hold it for 3s to pause the pump or run the pump.

4) Down button ⇩:

- On normal screen, press it to view sensor info and STEL/TWA value.
- On settings interface, press it to scroll down or decrease the digits.

5) SOS emergency help button:

- Press it, the detector emits sound and light vibration alarm, prompting nearby people to rescue.
- For the detector with 4G communication function, it will also send a distress signal to the data platform to remind managers to arrange rescue.

5. Working principle

The sensor reacts with the target gas to produce a voltage or current signal. After the signal is amplified by circuit, the single chip microcomputer samples and calculates the measured concentration. If the measured concentration exceeds the alarm concentration setting value, alarm signals such as sound, light and vibration are sent out. If the detector has optional 4G wireless remote transmission module, managers can view the data of the detector and the location of the detector(wearer) on the PC or mobile data platform.

V. Operation instructions

1. Power on and self test

1) Power on: When the detector is off, press and hold the On/Off button for 3s,and the detector will start up and show start screen.On start screen, the company name "MST", model "MST 410P", and user name "master" are displayed. The 4G-wireless detector supports name changes.

Figure 3

Figure 4

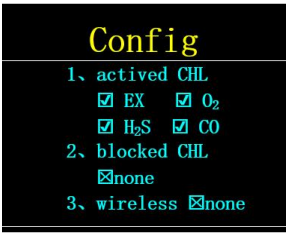


Figure 5

2) Self test:

- After the start up screen, the internal circuit, light, vibration and sound are tested successively,as shown in Figure 4:
- After self test screen, the detector configuration info will be displayed, as shown in Figure 5:
- After configuration screen, it performs pump test function:
- Please block the air inlet when it shows as Figure 6. After 1s the pump test ok and is shows as Figure 7. If the pump is damaged or pump function is weak,

and there is no any operation under the interface of Figure 6 lasted 40s, the detector will display the following interface:

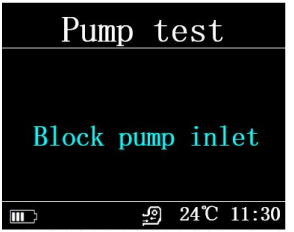


Figure 6

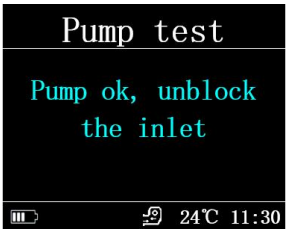


Figure 7

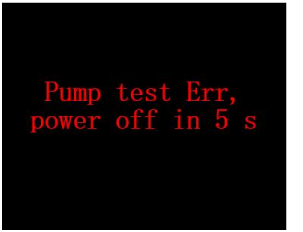


Figure 8

At this time of Figure 8, the user has two choices:

1) Without any operation and the detector will power off. After power off, the user need to check whether the pump has insufficient suction or has been damaged, and carries out maintenance and processing in time.
2) If the user wants to use the detector as a diffused device, please hold the set button for 3s to turn off the pump. At this point, please remove the sensor

cover and the detector becomes a diffused gas detector.

- After the pump test OK, it will display the information of each sensor, as shown in Figure 9:

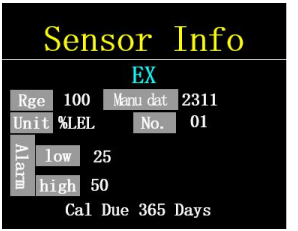


Figure 9

- If the zero-calibration function is turned on, detector will perform zero calibration after 5s. User can cancel it during 5s. After zero calibration, it displays Pass or Error.

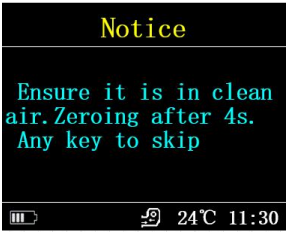


Figure 10

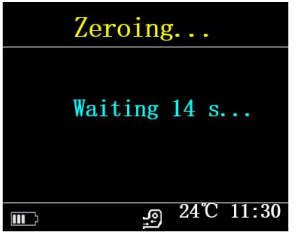


Figure 11

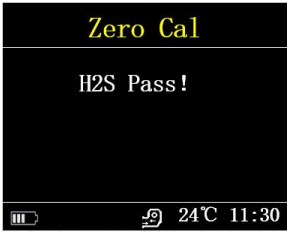


Figure 12

2. Power off

Ensure that the detector is in normal screen. Press and hold the On/Off button for 5s, and it will show as in Figure 13. Continue to hold the button until it powers off. If you release the On/Off button during the process, the detector will return to the normal screen.

Figure 13

3. Working state

1) Normal working

When the detector is working, it shows the Normal screen as Figure 13. The green light flashes once /5s. If power-saving mode is on, the screen turns off after 1 min to save power. Any keystrokes or alarms will light up the screen.

2) Alarm

When it alarms, the red light flashes. The alarm information is displayed on the screen. The red flashing sign ❤ is displayed in the alarm gas area. Red light

blinks once / 1sec at low alarm, the red light blinks twice/1sec at hight alarm. The buzzer made a clear sound. The detector vibrates rhythmically.

3) Fault state:

When the detector is in the fault state, the sound rings once /5 sec, the yellow light flashes, and the fault type is displayed on the screen.

4) Mute:

When there's an alarm, users can press the on/off button to stop or start the sound and vibration alarm, with displayed  or  on screen.

5) Sensor information:

Press the ⇧ or ⇩ key, the display will switch between the normal interface (Figure 14) and the sensor information interface (Figure 9).

Figure 14

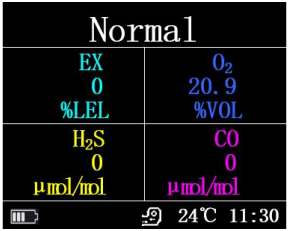


Figure 15

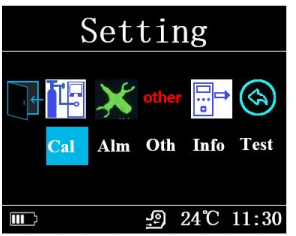
4. Password to enter the settings: the password is 2008.

1) Into the password interface: When the detector is at normal screen, hold the setting key and the red light will be steady on. Hold about 5 seconds, it will enter the password interface, as shown in Figure 15.
2) Input password: The password consists of 4 digits. Press the ⇧ or ⇩ button to increase or decrease the digit of blue cursor. Press the On/Off button to ensure the digit and move cursor right to the next position. After entering the correct

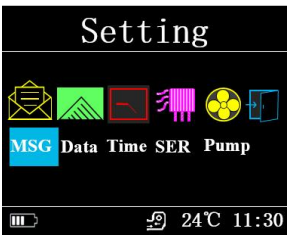
password, the Settings menu will be displayed as Figure 16. If the password is incorrect, it will return to the password interface. Please re-enter the password.

5. Setting:

The Settings menu comprises Short message(MSG), Data recorded, Time, Sensor settings, Pump settings, Calibration (Cal), Alarm (Alm), Other (Oth) and Information (Info), as shown in Figures 16 and 17.



Figures 16



Figures 17

1) MSG

   The 4G wireless detector has this function. Here users can view the short message sent by the data platform to the detector. For example, Evacuate quickly. Move on to the next position.

2) Data

   The detector recorded real-time data (20s/ piece) and events. Users can choose to turn logging on or off in Settings.

3) Time

   The detector has a time display. Users can change the date and time here.

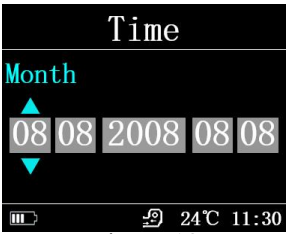


Figure 18

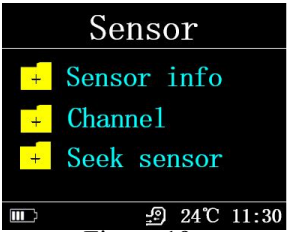


Figure 19

4) Sensor

It contains three options: Sensor information, Channel and Seek sensor, as shown in Figure 19.

a. Sensor info

It contains sensors' position, gas type, range, and unit, as shown in Figure 20.

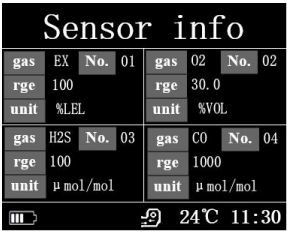


Figure 20

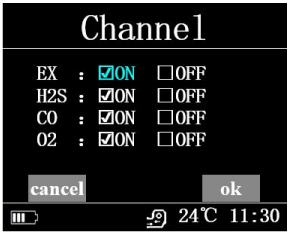


Figure 21

b. Channel

By selecting ON or OFF, the user can turn on or turn off the corresponding sensor channel, as shown in Figure 21.

c. Seek sensor

After replacing the sensor, detector need to re-identify the sensor. When detector seeking sensor, it will scan positions 01-04 successively. After scanning, the information of the sensors found will be displayed, as shown in Figures 22 and 23. If it is correct, press OK to save it.

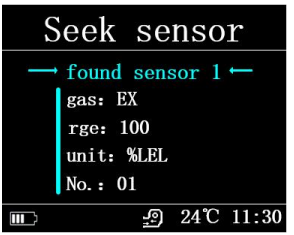


Figure 22

Figure 23

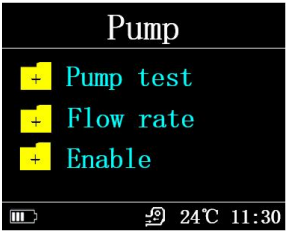


Figure 24

5) Pump

It contains three options: Pump test, Flow rate, and Enable, as shown in Figure 24.

a. Pump test

Users can chose ON or OFF, as shown in Figure 25. If it's ON, detector performs a pump blocking test when it is start up.

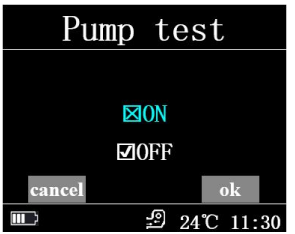


Figure 25

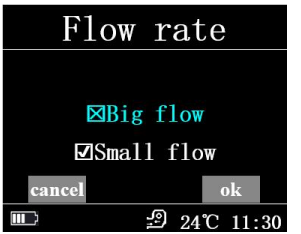


Figure 26

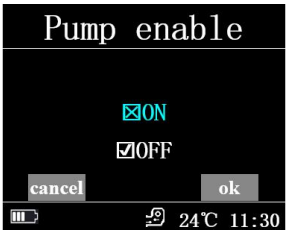


Figure 27

b. Flow rate

There are big flow and small flow options, as shown in Figure 26. Big means about 500ml/min, small means about 400ml/min.

c. Pump enable

User can turn off or on the pump, as shown in Figure 27. When it is turned off,

the sensor cover of the detector can be removed and used detector as a diffused device.

6) Calibration (Cal)

It contains zero calibration and span gas calibration, as shown in Figure 28.

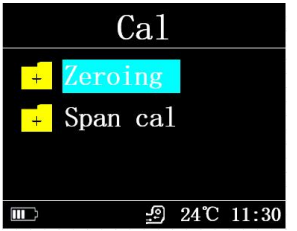


Figure 28

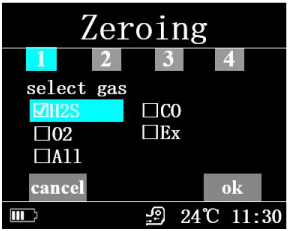


Figure 29

a. Zeroing

i. In zeroing users can select a single sensor, or select several sensors for simultaneous calibration. Press Ok to next step.

ii. Zeroing calibration should be performed in clean air or by passing in the zero-gas. (Oxygen sensor can be calibrate as 20.9%vol in air automatically by the internal circuitry.) Press Ok to next step.

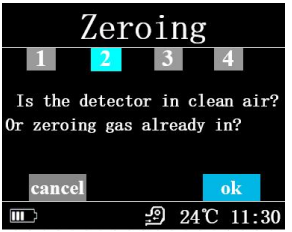


Figure 30

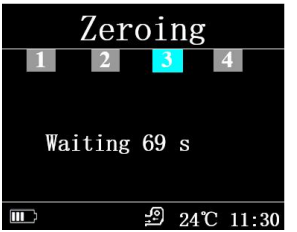


Figure 31

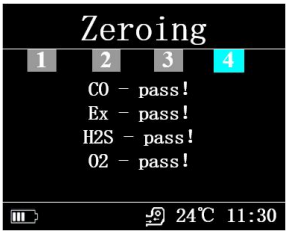


Figure 32

iii. Wait for the countdown and the detector will automatically proceed to step 4.

iv. The detector enters step 4, it shows pass or error. If error, please check air and recalibrate it.

b. Span Calibration(Span cal)

i. The sensors can only be calibrated one by one. Select the sensor to be calibrated, press ok to next step, as show Figure 33.

ii. Enter the correct span value according to the cylinder info, press ok to next step, as show Figure 34.

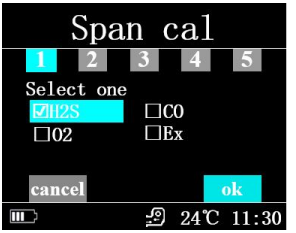


Figure 33

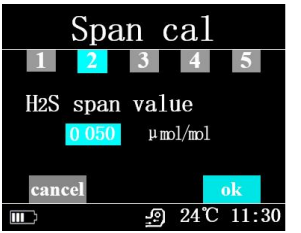


Figure 34

iii. Feed the detector with span gas, and press ok to next step, as show Figure 35.

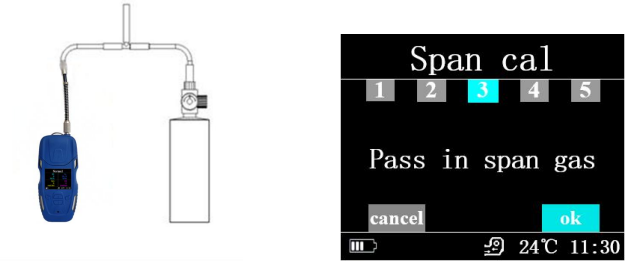


Figure 35

iv. Keep the span gas into and wait for the countdown to end and it automatically goes to the next step,as show Figure 36.

v. The detector enters step 5, it shows pass or error. If error, please check the process and recalibrate it,as show Figure 37.

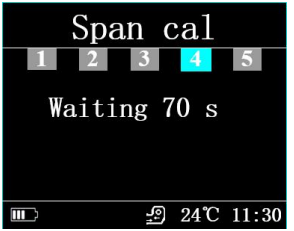


Figure 36

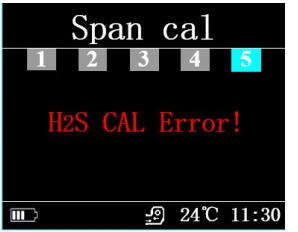


Figure 37

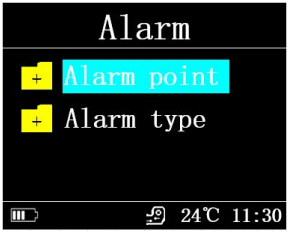


Figure 38

7) Alarm

Users can choose to set alarm point and alarm type,as show Figure 38.

a. Alarm point

Users can select the corresponding gas and set the alarm threshold according to the demand,as show Figure 39.

i. For combustible gas and oxygen, there are low and high alarm point can be set,as show Figure 40.

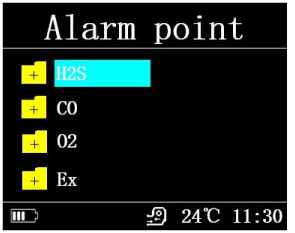


Figure 39

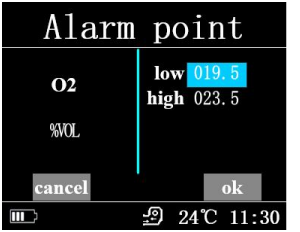


Figure 40

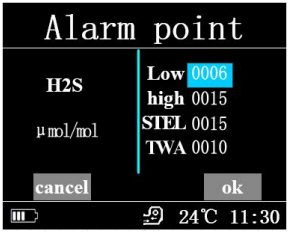


Figure 41

ii.For toxic gases, such as H2S,CO,NH3, etc, there are Low,High,STEL,TWAL thresholds can be set,as show Figure 41.

Figure 42

b. In alarm type, users can choose light, sound and vibration alarm models, as show in Figure 42.

c. 3.2. Default alarm point are as follows:

NO.	Gases	Low Alarm	High Alarm	STEL	TWA
1	CO	24μmol/mol	100 μmol/mol	200 μmol/mol	24μmol/mol
2	H_2S	10μmol/mol	15μmol/mol	15μmol/mol	10μmol/mol
3	O_2	19.5%	23.5%	---	---
4	EX	25%LEL	50%LEL	---	---
5	NH_3	25μmol/mol	50μmol/mol	30μmol/mol	25μmol/mol
6	CL_2	0.5μmol/mol	1μmol/mol	1μmol/mol	0.5μmol/mol
7	HCN	4.7μmol/mol	10.0μmol/mol	10.0μmol/mol	4.7μmol/mol
8	NO_2	3.0μmol/mol	5.0μmol/mol	3.0μmol/mol	5.0μmol/mol
9	PH_3	1.0μmol/mol	2.0μmol/mol	2.0μmol/mol	1.0μmol/mol
10	H_2	100μmol/mol	200μmol/mol	200μmol/mol	100μmol/mol

11	SO_2	2.0μmol/mol	5.0μmol/mol	5.0μmol/mol	2.0μmol/mol
12	HF	2.0μmol/mol	4.0μmol/mol	4.0μmol/mol	2.0μmol/mol
13	HCL	4.6μmol/mol	9.2μmol/mol	9.2μmol/mol	4.6μmol/mol

Table 2

8) Other settings(Oth)

Other settings include auto-cal, gc mode, unit, cal due warn, screen and wireless.

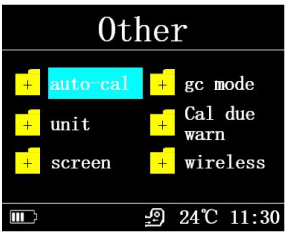


Figure 43

a. Auto-cal(auto-calibration)

If it is ON, the detector will automatically calibrate the zero point when it is

starting up.

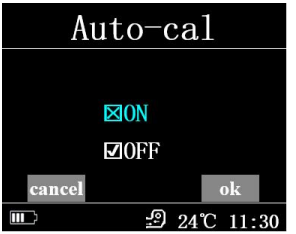


Figure 44

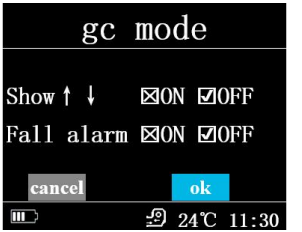


Figure 45

b. gc mode

The options for rotating the screen show and enable/disable the Fall alarm can be set.

i. Rotating the screen show: If the detector is turned upside down, the screen automatically flips so that the user always sees the upright image.

Note: This founction does not apply to the menu interface.

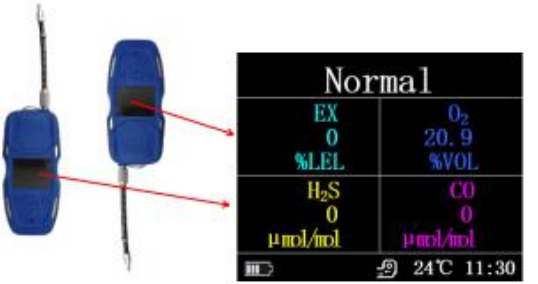


Figure 46

ii. Fall Alarm: If the detector is stationary for 25 seconds, a reminder will appear as shown in Figure 47. If there is no action taken within 5 seconds, fall alarm signal will be triggered as show in Figure 48. The fall alarm can be canceled by pressing a button or moving the detector.

c. Unit: The units can be changed, as shown in Figure 49. Tick to select units and press ok to save settings.

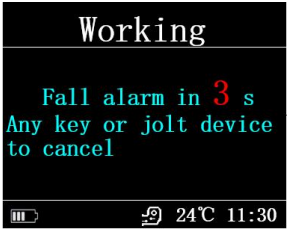


Figure 47

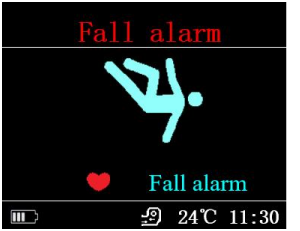


Figure 48

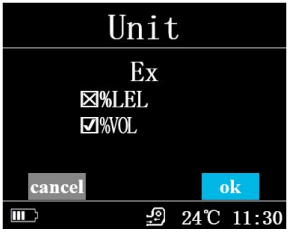


Figure 49

Note: The display unit setting is not applicable to all sensors, such as O2 has only unit "%vol".

d. Calibration overdue warn(Cal due warn)

The sensors will count down for 365 days from the last calibration day. When there is no span calibration beyond 365 days, and if it's ON, detector will display "overdue" on normal interface. If it's OFF, there is no reminder.As Figure 50.

e. Screen

"saving" means power saving mode. If it's ON, the backlight will be off to

save power when the detector has been inactive or has not triggered an alarm for 1 minute. As Figure 51.

Users can adjust the brightness of the screen by pressing ↑ and ↓ buttons. As Figure 51.

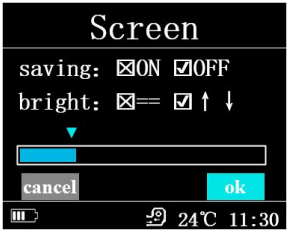


Figure 50

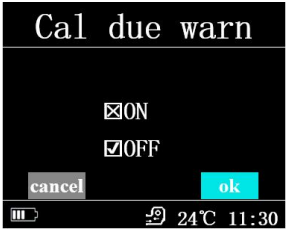


Figure 51

f. Wireless

Users can turn on or off the 4G wireless function here.

9) Detector information(Info)

Detector information includes the device SN, soft verson, sensor No., and the latest

span calibration date.

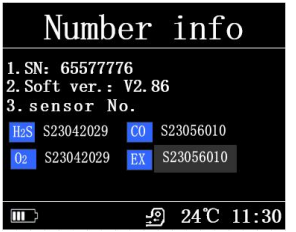


Figure 52

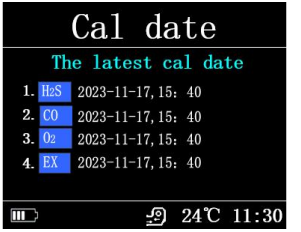


Figure 53

6. Battery power indication and charging

1) Battery power

The battery icon at the bottom left of the screen indicates the charge level. 4 bars indicate full charge and no bar means the battery is running out. When low power, the detector will issue an audible and visual alarm to prompt the user to charge in time.

2) Charging

Please charge in a safe environment. Connect the charger to the charging port at the rear of the detector, as Figure 54. The other end of the charger is connected to 100-240V 50/60Hz AC.

The detector should be turned off while charging. Press any key the screen will light up for about 8 seconds, and display charging progress, as Figure 55. If it's fully charged, it shows “Charging END”.

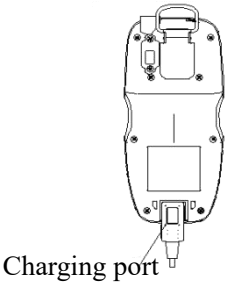


Figure 54

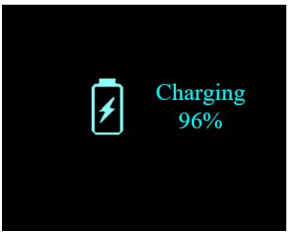


Figure 55

VI. Maintenance precautions

1. It is recommended to do span calibration every 6 months to ensure the detecting accuracy of the detector.
2. Do not frequently use the high concentration gases to impact detector.
3. Non-professionals do not set the menu to avoid the wrong Settings resulting in errors in the detector.
4. The sensitivity of the catalytic combustible sensor will be affected by high concentrations of sulfide, halogen compounds, silicon-containing compounds, and lead-containing gas or steam, also known as "poisoning". Please avoid the use of the detector in the above environment. If the detector has to be exposed to these gases, detector should be checked and calibrated after use, so to ensure accurate measurement later.
5. The detector should not be used at hypoxia conditions.

6. Do not use organic solvents, soap or silicon-containing solutions to clean the detector, so as not to damage the sensors.
7. Use a damp cloth when wiping the shell to prevent static electricity.
8. Precautions for battery use:
   - This battery has been explosion-proof treatment, it is not allowed to replace with ordinary batteries.
   - Please purchase original batteries for replacement. Otherwise, if there is a loss, the manufacturer is not responsible.
   - Do not charge or replace battery in dangerous places.
   - Do not let the plug of the battery touch metal objects; otherwise, the battery may short circuit, discharge, heat, or leak.

VII. Solutions of common faults

Table 3 methods of diagnosis analysis and elimination of common faults

NO.	Common fault	Analyze	Solution
1.	System failure	detector failure	Return to depot
2.	Memory error	Memory corruption or contents overwritten	Return to depot
3.	Sensor error	Sensor is damaged or loose	Contact us
4.	Sensor calibration expired	Calibration overdue	Recalibration
5.	The device does not trigger sound, light and vibration alarm	1.Alarm Settings error. 2.Sound, light, vibration circuit fault	1.Check alarm Settings. 2.Return to depot.

6.	Pump error	Gas circuit is blocked or the pump is faulty	Perform pump test in settings. If it passes, OK. If it doesn't pass, return to depot.

VIII. Accessories list

1. Users manual *1
2. Power adapter * 1
3. CYG-01 sampling probe * 1
4. Dust filter(for pump air intake) * 5 pcs
5. PVC hose for sampling * 3m
6. Calibrating certification * 1
7. Rigid plastic box * 1

IX.Warranty

- Within 1 year from the date of sale, we provide free repair service for the faults and defects of portable multi-gas detection&alarm devices and accessories in terms of materials and processes.
- The warranty does not apply to items for man-made damage, accidents, changes, modifications, unauthorized repairs, misuse, abuse, malfunctions caused by improper operation or maintenance, and claims beyond the warranty period.
- The Company is not responsible for any direct, indirect or accidental damage resulting from the sale, purchase or use of this instrument.
- In no event shall our liability under this guarantee exceed the actual price paid by the Customer at the time of purchase of the product.

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