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Portable Composite Gas Analyzer
MST700 **Product Manual**



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I. Product overview of portable composite gas analyzer

portable composite gas analyzer can be used in: accurate detection and analysis of a variety of gas concentration and measurement of environmental temperature and humidity. adopted 3.5-inch high-definition color screen for real-time display, adopted the gas sensors of internationally well-known brands, and the main detection principles include: electrochemical, infrared, catalytic combustion, thermal conductivity, PID photoionization, and so on. Adopted Swiss high-precision capacitive digital temperature and humidity sensors. Advanced electric circuit design, mature kernel algorithm processing, unique external appearance design, had achieved a number of patents about the software works, external appearance, and so on. is suitable for detecting the concentrations of gases in the atmosphere environment in the pipeline or confined space; and the purity of the gas leakage and various high concentration single gases with the background gas as nitrogen gas or oxygen gas. The types for detection are more than 500 types.

II. Product characteristics of portable composite gas analyzer

★ **It is possible to simultaneously detect 1 ~ 6 types of gases, which can be expanded to 18 or more types of gases, and the units can be switched freely**
Units that can be selected: PPM, mg/m3, Vol%, LEL%, PPHM, ppb, mg/l.

★ **Built-in pump-suction type measurement, built-in water vapor and dust filter, fast response, and the long-distance sampling is supported**
The built-in water vapor and dust filter is possible to prevent the damage of sensors and instruments due to the water vapor and dust, it can be used in the high humidity, and high dust environment, and the sampling distance is more than 10 meters.

★ **Rich human-machine interface**
3.5-inch high-definition color screen, display the information such as real-time concentration, alarm, time, temperature, humidity, storage, and so on; the menu interface adopted high definition simulation graphics to display the function name of each menu.

★ **Function of large-capacity data storage (capacity can be customized), multiple storage modes are supported, and remote wireless transmission function is optional configuration**
Standard configuration is the data storage capacity for 100, 000 entries; USB disk storage and SD card storage functions are optional configuration, real-time storage and fixed time storage are supported, or only the data of the alarm concentration

will be stored; it is supported to use the local host to view, and delete data, and upload the data via USB, RS232 interface or infrared communication to the computer for data analysis or printing.

★ **Various kinds of communication interfaces and printing functions**
Infrared communication interface, RS232 interface, USB interface automatic recognition, and the built-in or external wireless infrared printer is an optional configuration.

★ **High temperature gas detection (optional)**
The optional high-temperature sampling and cooling filter handle or high-temperature high-humidity pretreatment system will be possible to detect the smoke gas at the temperature of 1300 ℃. The detection for the gases at other temperatures can be customized.

★ **It is possible to switch among three display modes**
Simultaneously display the concentrations of six types of gases, repeatedly display the concentration of single-channel gases in large font, and display the real-time curve.

★ **Graphical display, and use the form of curve to reflect the trend of gas concentration changes in a certain period of time.**

★ **Infrared remote control**
Infrared remote control is an optional configuration; one-key operation can be realized via the function key on the infrared remote control, such as: modification of the alarm point, density calibration, zero-point calibration, noise reduction, restore the factory settings, and other functions.

● **Data recovery function; in case of mis-operation, it is possible to select partial or full recovery.**

● **It is possible to set whether to display the maximum value, minimum value, average value or not.**

● **Standard USB charging port, with charging protection function, USB hot-plug supported, and the charging status instrument can work properly.**

● **10000mA high capacity rechargeable polymer battery is adopted, so it is possible to work for a long period of time.**

● **High-precision temperature and humidity measurements (optional configuration).**

● **Real-time detection or timing detection is supported; when no detection will be done, it is possible to shut down the pump so as to extend the startup time.**

● **Multiple alarm modes, and multi-directional and three-dimensional indication alarm states.**
It includes sound & light alarm, display screen visual alarm.
Alarm types include: concentration alarm, under-voltage alarm, and failure alarm.

● **Multiple alarm mode settings: low alarm, high alarm, interval alarm, and weighted average alarm.**

- **Mis-operation recognition function: automatic recognition and prevention of the concentration calibration mis-operation, which is possible to avoid the poor performance that may be caused by human factors.**
- **Zero-point automatic tracking; long-term use will not be affected by the zero drift.**
- **Multi-level calibration for target points, can ensure the linearity and accuracy of the measurements.**
- **Chinese and English interfaces can be selected.**
- **Broad operating temperatures: -40～+70℃, and temperature compensation is supported.**
- **Log recording**
  Record the calibration logs, repair logs, failure history, failure countermeasure solutions, sensor service life due reminder, and function of reminder for the time of next concentration calibration.
- **Meet the requirements on the design of the intrinsically safe circuits, such as anti-static, anti-electromagnetic interference.**
- **Protection level is up to IP66, and it is possible to prevent the splash water, dust, and shock.**

III. Technical parameters of portable composite gas analyzer

Gases to be detected	Arbitrary combination of 1 ~ 6 types of gases which can be expanded to 18 or more types of gases, such as toxic gases, oxygen gas, carbon dioxide, inflammable and explosive gases, TVOC, and so on. Optional configuration: temperature and humidity measurements.
Application scenarios	All the cases which requires the portable rapid detection of gas concentrations such as petroleum, chemical, pharmaceutical, environmental protection, combustion gas distribution, warehousing, smoke gas analysis, air governance, and so on.
Detection range	0 ~ 1, 10, 100, 1000, 5000, 50000, 100000ppm, 200 mg/L, 100%LEL, 20%, 50%, 100%Vol, can be selected; and other ranges can be customized.
Resolution	0.01ppm or 0.001ppm (0 ~ 10 ppm);0.01ppm (0 ~ 100 ppm), 0.1ppm (0 ~ 1000 ppm), 1ppm (0 ~ 10000 ppm or more), 0.01 mg/l (0 ~ 200 mg/l), 0.1% LEL, 0.01%, 0.001% Vol
Detection principle	Electrochemical, catalytic combustion, infrared, thermal conductivity, PID photoionization, and so on, depending on the type of gas, range, field environment and user demand.
Sensor service life	Electrochemical principle: 2 ~ 3 years; Oxygen gas: 2 years or 6 years can be selected; infrared principle: 5 ~ 10 years; catalytic combustion: 3 years; thermal conductivity: 5 years; PID photoionization: 2 ~ 3 years.

Allowable error	≤±2% F.S (other or higher precision levels can be customized)				
Linearity	≤±2%	**Linearity**	≤±2%	**Linearity**	≤±2%
Response time	T90≤20 seconds			**Recovery time**	≤30 seconds
Working environment	Temperature: -40 ℃ ~ + 70 ℃, humidity: ≤10 ~ 95% RH, and built-in filters can be used in high humidity or high dust environment.				
Sample gas temperature	-40 ℃ ~ + 70 ℃, and the optional configuration of high-temperature sampling and cooling filter handle will be possible to detect the smoke gas at the maximum temperature of 1300 ℃.				
Temperature and humidity measurement	Optional configuration: temperature at -40 ℃ ~ + 70 ℃, accuracy level at 0.5 ℃; humidity at 0 ~ 100% RH, precision level at 3 % RH				
Power supply	3.7VDC, 5400mAh ×2 high capacity rechargeable polymer battery				
Display mode	3.5-inch high-definition color screen				
Detection mode	Built-in pump-suction type measurement, and flow rate at 800 ml / min. Calibration flow rate should be greater than 800 ml / min, three-way pipe should be connected, so as to ensure that the excessive gas will be discharged from the bypass				
Alarm mode	It is possible to set as sound & light alarm, turning off the alarm.				
Communication interface	USB (charging and communication), optional: RS232, infrared communication, automatic recognition				
Data storage	Standard configuration is the data storage capacity for 100, 000 entries; SD card storage and USB disk storage functions are optional configuration				
Protection level	IP66				
Explosion-proof type	Intrinsically safe type				
Explosion-proof mark	Ex ia IIC T4 Ga				
Exterior dimensions	255×210×125mm(L×H×W) 420×210×125mm(L×H×W)custom-made				
Weight	2.5Kg				
Standard accessories	Manual, qualification certificate, warranty card, USB charger (including the data cable), high-grade aluminum instrument case, built-in humidity dust filter, 0.4 meter stainless steel sampling handle (1 meter of hose, with dust filter, not retractable),				
Optional items	Temperature and humidity measurement function, 1.2 m retractable sampling handle (1-10 meter hose, and the standard length is 1 meter), external remote sampling pump, high temperature sampling and cooling filter handle, high temperature humidity pretreatment system, CD-ROM (upper level computer communication software), external mini wireless infrared printer, built-in mini printer, SD card storage, USB disk storage, wireless data communications				

IV. Outline drawing and explanation about the details



V. Key definitions and operation instructions

Power key: power key, return key. Long press for 5 seconds to start the equipment, and after startup, long press for 5 seconds to shut down the equipment

PUMP key: switch key of pump. Press for one time to turn off the pump, and press again for one time to turn on the pump

MENU key: menu key. Enter and exit the menu; press it for one time at the time of alarm, it will function as muting, after muted, press the Return key (POWER) for one time to cancel the mute state

Enter key: confirmation key

◀key: direction key, movement of the cursor to the left will play the role of position shift at the time of modifying the numerical value

▶key: direction key, movement of the cursor to the right will adjust the numerical value at the time of changing the value

▲ key: direction key, movement of the cursor to the upper will play the role of increasing at the time of modifying the numerical value

▼ key: direction key, movement of the cursor to the lower will play the role of decreasing at the time of modifying the numerical value

VI. Explanation of startup

Address numbers and software versions of this equipment will be displayed during the startup, as shown in Fig. 1, 2:

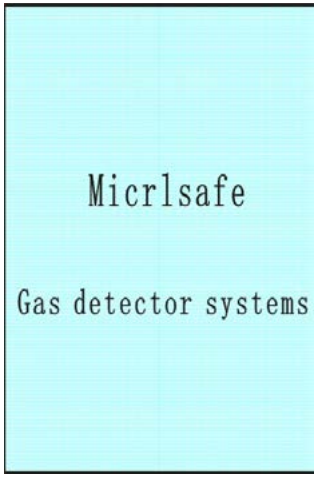


Fig. 1

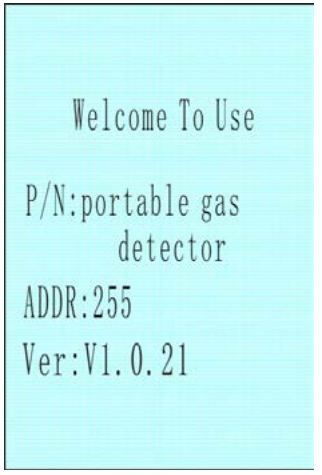


Fig. 2

Display the countdown time which is needed forstartup self-check and sensor preheating, as shown in Fig. 3:

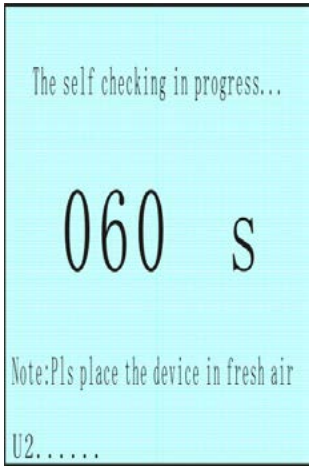


Fig. 3

After the countdown was finished and entered the test screen, press the "Enter key", it will be possible to switch between different display modes, press "▲" key and "▲" key to switchthe channels. As shown in Fig. 4, 5, 6, 7:

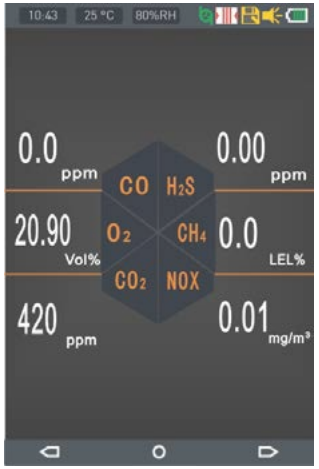


Fig. 4

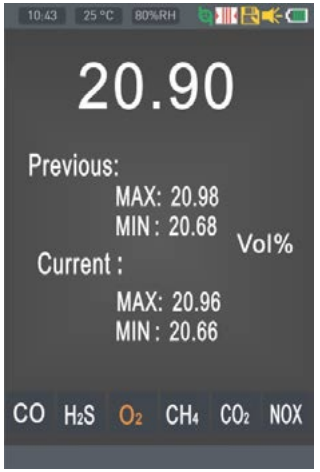


Fig. 5

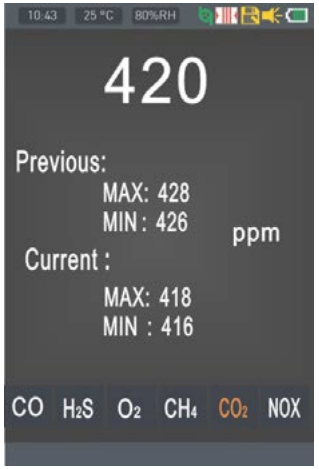


Fig. 6

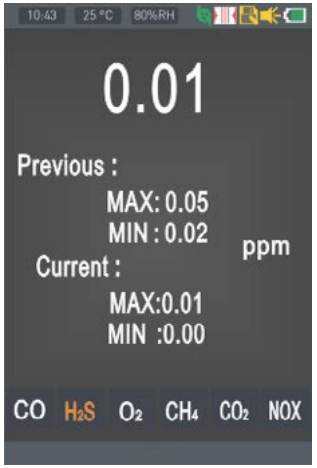


Fig. 7

VII. Menu operation instructions

7.1 Zero-point calibration operation instructions

Only when the zero drift of the sensor is too large, or it is required to accurately detect very low concentrations,the zero-point calibration will be carried out. In the testinterface, press the menu key or "MENU" key for 3 secondsto enter the menu, use "◀" key and "▶" key to select the "zero-point calibration" menu, as shown in Fig. 8:



Fig. 8

Press "ENTER" key to enter zero-point calibration interface, as shown in Fig. 9:

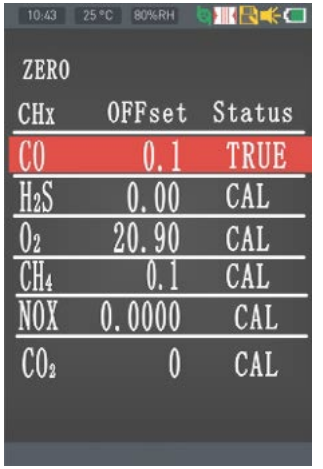


Fig. 9

Select the channel to be calibrated by "◀" key and "▶" key, and press "ENTER" key to carry out the zero-point calibration, as shown in Fig. 10:

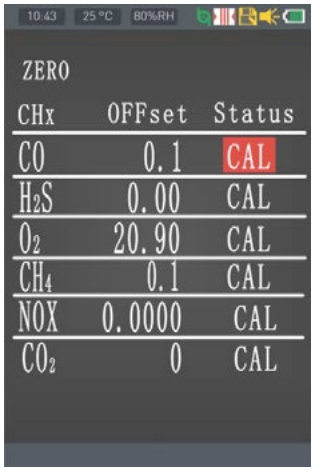


Fig. 10

After the calibration is successful, it will display: the statement of "Calibration is successful", as shownin Fig. 11:

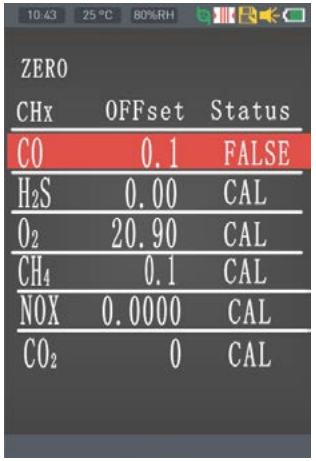


Fig. 11

For example, if calibration of CO2 in the air is successful, it will display as about 400ppm, as shownin Fig. 12:

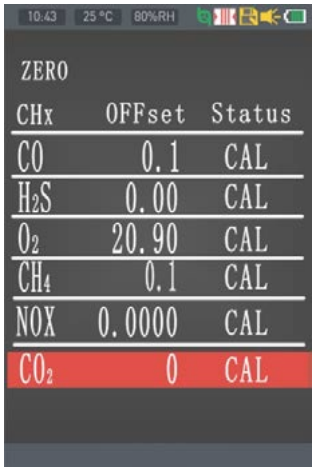


Fig.12

If the calibration is not successful, it will display: thestatement of "Calibration failed". When the zero-pointcalibration is performed for O2 or N2 in the air, it will fail, as shown in Fig 13:

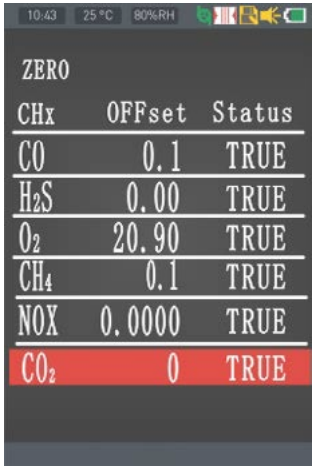


Fig. 13

7.2 Concentration calibration operation instructions

The deviation of the concentration which was detected out by the instrument from the standard gas concentration can be corrected by calibrating the concentration or changing the display coefficients.In the test interface, press the "MENU" key for 3 seconds to enterthe menu, use"◀" key and "▶" key to select the "Concentration calibration"menu, as shown in Fig. 14:



Fig. 14

Then, press "ENTER" key to enter the concentration calibration interface, as shown in By default, the cursor will appear at the position of Level I concentration, press "ENTER" key and then use "▲" key and "▲" key to modify the concentration values of respective levels, after finished the modification, press "ENTER" key to save, as shown in Fig. 15, 16:

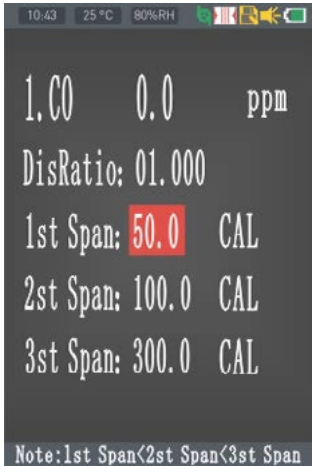


Fig. 15

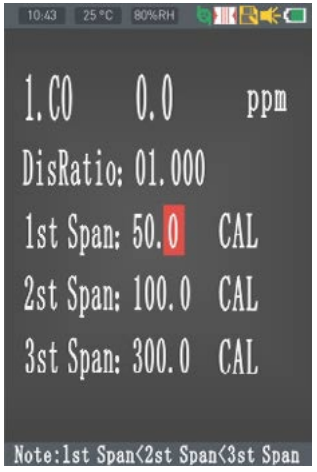


Fig. 16

Then, introduce the standard gas or the gas to be measured, move the cursor to the "calibration" position, and then press "ENTER" key for calibration, if successful, it will display the statement of "Success", if unsuccessful, it will display the statement of "Failure", as shown in Fig. 17,18, 19:



Fig. 17

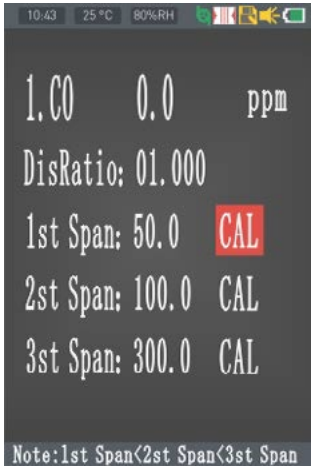


Fig. 18



Fig. 19

Precautions:

Normally, calibration of Level I concentration will be enough to meet the accuracy requirements. After the concentration value to be calibrated or the concentration value of the standard gas was preset, and then the gas to be detected was introduced at 500 ml / min for 30 seconds, the calibration will be performed.

At the time of calibration, the three-way flow diverter should be connected, so that the excessive gas can be discharged from the bypass, and avoid the excessive pressure which may cause the deviation of value.

Rules for setting calibration concentration values of three levels:

Level I concentration value < Level II concentration value < Level III concentration value

Concentration calibration sequence for three levels:

Level I concentration calibration →Level II concentration calibration →Level III concentration calibration

If the concentration of the introduced standard gas is too low, the calibration may not succeed.

7.3 Operation instructions to restore factory settings

In the test interface, press the "MENU" key for 3 seconds to enter the menu, use "◀" key and "▶" key to select the menu of "Restore the factory setting", as shown in Fig. 20:



Fig. 20

Press "ENTER" key to enter to the interface of "Restore the factory setting", use "◀" key and "▶" key to select the channel to be restored, then press "ENTER" key to enter. It is possible to select "Restore the concentration", "Restore the alarm", "Fully restore" and then press "ENTER" key to restore; if restoring is successful, it will display the statement of "Success"; if unsuccessful, it will display the statement of "Failure", as shown in Fig. 21, 22, 23:

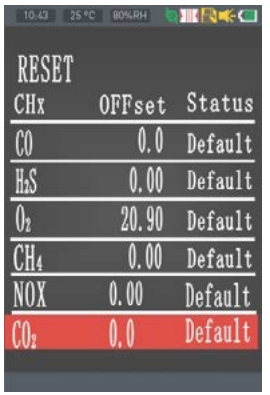


Fig. 21



Fig. 22



Fig. 23

At the time of setting error or inaccurate detection of the concentration, it is required to carry out the operation of restoring the factory setting; if it is poor performance which was caused by human factors, it will be possible to restore, and the parameters which can be restored to the factory settings are: zero-point calibration, concentration calibration values, alarm values, alarm method, alarm mode, and maximum range

7.4 Data recording operation instructions

In the test interface, press the "MENU" key for 3 seconds to enter the menu, use "◀" key and "▶" key to select the menu of "data recording", as shown in Fig. 24:



Fig. 24

Press "ENTER" key to enter the interface of data recording: as shown in the figure: press "ENTER" key to select the channel for the query of the records, as shown in Fig. 25:



Fig. 25

Use "◀" key and "▶" key to select "Start Time", press "ENTER" key to enter the setting of the query start time, as shown in Fig. 26:



Fig. 26

Use "◀" key and "▶" key to select "End Time", press "ENTER" key to enter the setting of the query end time, as shown in Fig. 27:



Fig. 27

Select the type of query, press "ENTER" key to select "All data" or "Alarm data", as shown in Fig. 28:
Select "Start query", press "ENTER" key to query, as shown in Fig. 29:



Fig. 28

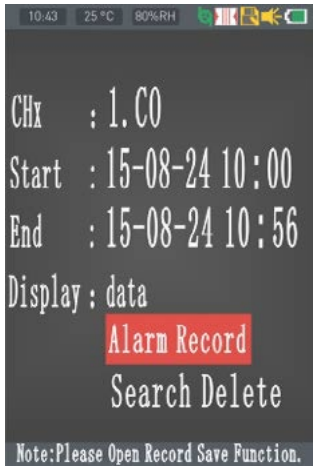


Fig. 29

If there is no result found for the query, it means that the data storage function is not enabled, it is necessary to enable the storage function in "System setting" → "Storage setting". Select the "timing storage" that is the real time storage function, and set the storage cycle (time interval), as shown in Fig. 30, 31:

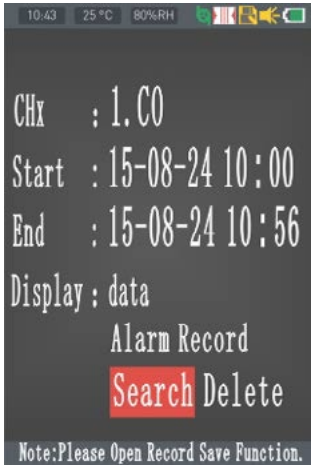


Fig. 30



Fig. 31

Follow the following steps for startup, as shown in Fig. 32, 33, 34, 35, 36



Fig. 32



Fig. 33



Fig. 34

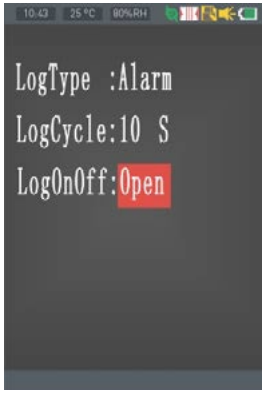


Fig. 35

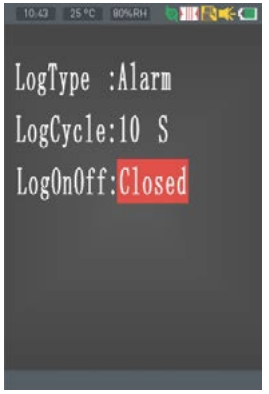


Fig. 36

7.5 Alarm setting operation instructions

In the test interface, press the "MENU" key for 3 seconds to enter the menu, use "◀" key and "▶" key to select the menu of "Alarm setting", as shown in Fig. 37:



Fig. 37

Press "ENTER" key to enter the interface of alarm setting, as shown in Fig. 38:

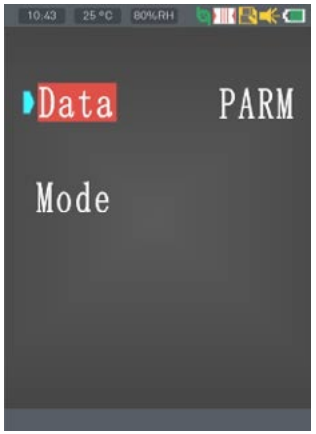


Fig. 38

Alarm value setting

It is possible to use "ENTER" key and "◀" key and "▶" key to modify. Low alarm limit value: that is the Level I alarm value, and it can be modified; high alarm limit value: that is the Level II alarm value, and it can be modified, as shown in Fig. 39, 40, 41:

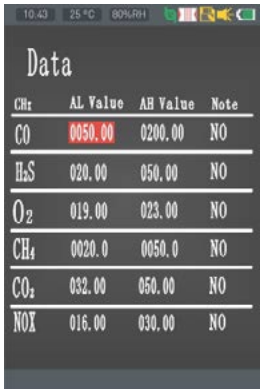


Fig. 39

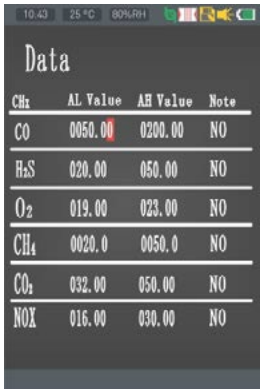


Fig. 40

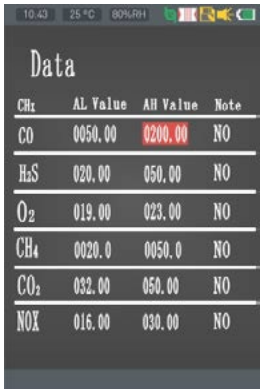


Fig. 41

Alarm parameter setting, as shown inFig. 42:

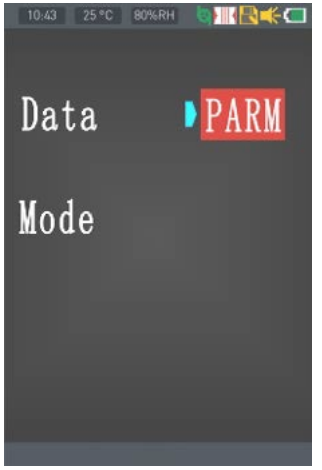


Fig. 42

Alarm method: it is possible to select sound & light, vibration, sound & light + vibration, no alarm; press "ENTER" key to select, as shown in Fig. 43:

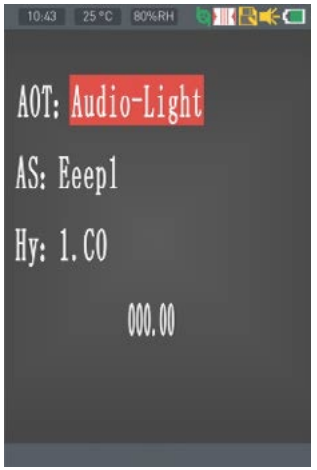


Fig. 43

Alarm sound: 3 kinds of sound can be selected, as shown in Fig. 44, 45:



Fig. 44



Fig. 45

Alarm hysteresis: that is the alarm return difference, it is possible to set the alarm return difference for each channel; if it is set as 0, as long as the value reaches the set value of alarm, the alarm will be activated immediately; if it is not desired to have frequent occurrence of alarming at the critical point of the set value of alarm, then, the alarm hysteresis should be set to a certain value.

Alarm mode: generally no setting is needed, because it had been set by default already.

The default setting of O2 and N2 is <AL&>AH alarm; the default setting of other gases is>AL&>AH alarm, and it is possible to modify or set to "Turn off alarm", as shown in Fig. 46, 47:

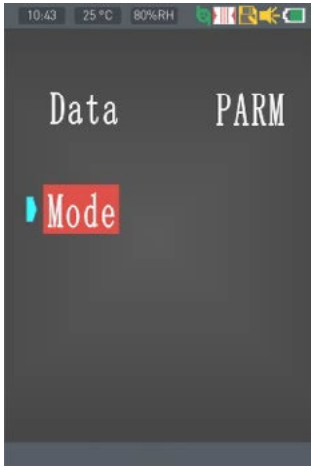


Fig. 46

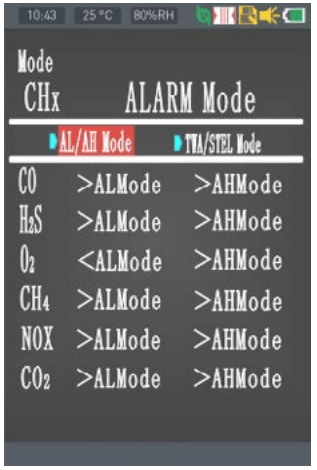


Fig. 47

7.6 System setting operation instructions

In the test interface, press the "MENU" key for 3 seconds to enter the menu, use "◀" key and "▶" key to select the menu of "System setting", press "ENTER" key to enter the interface of system setting, as shown in Fig. 48:



Fig. 48

Setting of range: it will display the maximum detection range of each gas, and has been set up before leaving the manufacturer, if modification is needed, please call the manufacturer to confirm whether it is possible or not to modify; when some sensors are measuring under overload conditions, the sensor may be damaged, as shown in Fig. 49, 50:



Fig. 49

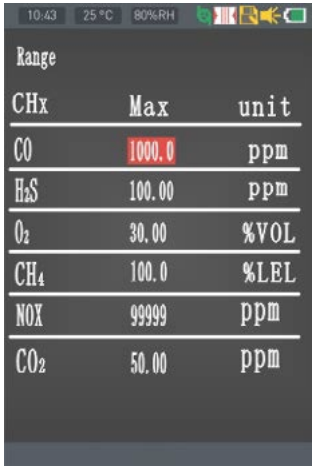


Fig. 50

Setting of time: modify date and time, after pressed "ENTER" key, use "◀" key and "▶" key to select and modify, and then, press "ENTER" key to save, as shown in Fig. 51, 52:



Fig. 51



Fig. 52

Setting of background: based on personal preference, it is possible to modify the font color, background color, backlight sleep time, and it is also possible to select "Restore Default" to restore the default settings, use "◀" key and "▶" key to select and modify, then, press "ENTER" key to save, as shown in Fig. 53, 54, 55:



Fig. 53



Fig. 54



Fig. 55

Setting of storage: move the cursor to "Setting of storage", press "ENTER" key to enter the interface of storage setting, as shown in Fig. 56:



Fig. 56

Storage method: it is possible to set two modes which are the timing storage, and alarm trigger; "timing storage" is to store the data for one time during each period of storage cycle, as shown in Fig. 57:



Fig. 57

Alarm Trigger storage mode is to store only the data about the alarm; only when the concentration value reaches the alarm setting value the storage will begin; and if there is no alarm, the storage will not begin,as shown in Fig. 58:



Fig. 58

Storage cycle: the time interval for storing the data, it is possible to set as 1-9999 seconds, and it is valid only for the timing storage

Storage function: select Turn on or Turn off the data storage function, as shown in Fig. 59, 60:



Fig. 59



Fig. 60

Setting of communication: when there is no connection with the computer or data transmission, there will be no need for setting, as shown in Fig. 61:



Fig. 61

Equipment address: address number of the local host, and can be set as 1-255Comm unication interface: the mode of automatic recognition communicationBaud rate: communication speed, generally select 9600, as shown in Fig. 62:



Fig. 62

Timing measurement: if the value was set, after startup, once reached the set time, the measurement will stop automatically; when needed to measure again, just press the "PUMP" key as the switch of the pump to start the measurement again, as shown in Fig. 63:



Fig. 63

The default measuring time is 0 seconds; if this value is not modified, this function will not work; when it is modified to a certain value, this function will start working; if it is required to use the timing measurement function, in general cases, it is necessary to modify the valueto be 30-60 seconds, press the pump switch of"PUMP" key for one time to start the measurement; once reached the set time, stop The measurement. As shown in Fig. 64.



Fig. 64

Interface of Timing Measurement: the set time and the remaining time will be displayed at the bottom part of the display screen, as shown in Fig. 65:

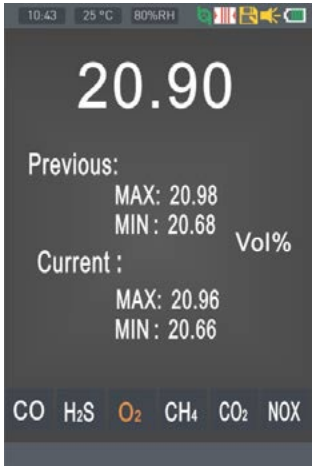


Fig. 65

7.7 Unit setting operation instructions

In the test interface, press the "MENU" key for 3 seconds to enter the menu, use "◀" key and "▶" key to select the menu of second page of "Unit setting", press "ENTER" key to enter the interface of setting, as shown in Fig. 66:



Fig. 66

Automatic conversion between various units is possible to switch between the following units: ppm, Vol%, LEL%, ppb, pphm, mg/m3, mg/l, g/m3, as shown in Fig. 67:

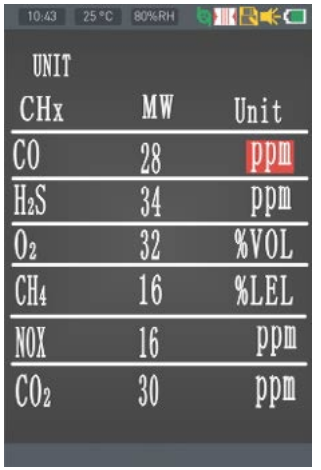


Fig. 67

7.8 Other setting operation instructions

In the test interface, press the "MENU" key for 3 seconds to enter the menu, use "◀" key and "▶" key to select the menu of second page of "Other setting", press "ENTER" key to enter the interface of setting, as shown in Fig. 68:



Fig. 68

Preheating time: it is the time for preheating and stabilizing which is needed by the sensor, and it is not recommended for modification, as shown in Fig. 69:



Fig. 69

Language options: default is Chinese, English can be selected, as shown in Fig. 70

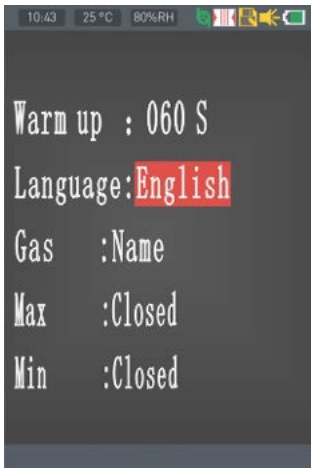


Fig. 70

Name of the gas: the molecular formula will be displayed by default, as shown in Fig. 71:

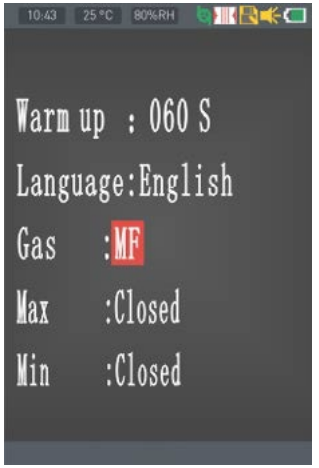


Fig. 71

Display the maximum value: select Open, then the maximum value of the measurement of this time and the maximum value of the last measurement in the single-channel interface will be displayed. Display the minimum value: select Open, then the minimum value of the measurement of this time and the minimum value of the last measurement in the single-channel interface will be displayed, as shown in Fig. 72:

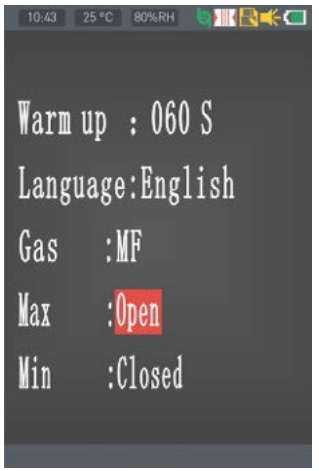


Fig. 72

7.9 Explanation about local host information

In the test interface, press the "MENU" key for 3 seconds to enter the menu, use "◀" key and "▶" key to select the menu of second page of "Local information", press "ENTER" key to enter the interface of view, as shown in Fig. 73:



Fig. 73

Equipment information: it is possible to view the relevant information about this equipment, as shown in Fig. 74, 75:



Fig. 74



Fig. 75

Sensor information: it is possible to view the service life and the used years of the sensor on this equipment, so as to avoid the extended use which will affect the accuracy and reliability, as shown in Fig. 76, 77:



Fig. 76

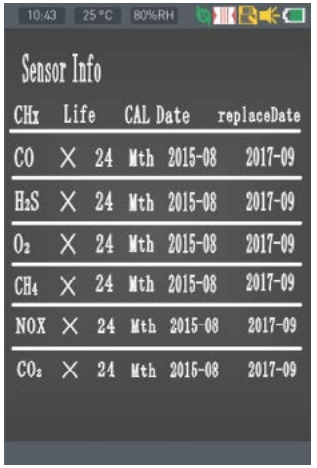


Fig. 77

Repair records: record the repair information of this equipment, as shown in Fig. 78, 79:



Fig. 78

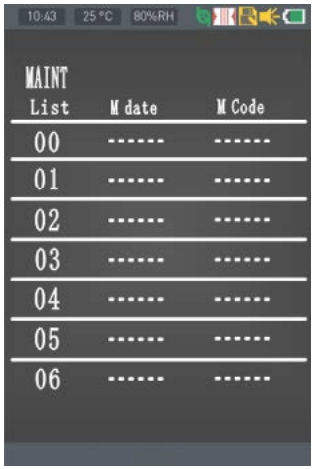


Fig. 79

Guidance about the failures: it will introduce the simple troubleshooting methods for the failures; at present, it could not be viewed temporarily, as shown in Fig. 80:



Fig. 80

VIII. Common failures and countermeasure solutions

Failure 1: it is not possible to detect when the concentration is low

Countermeasure solutions:

1. Check whether the pump is working or not; when the pump is working properly, there is slight vibration, and if the finger is used to block the gas inlet for 2 seconds, it is possible to feel the obvious suction force. And then, check whether the gas inlet of the filter is clogged or not, or whether the gas leakage and no suction force were caused by the poor sealing of the connection joint or not.
2. **Introduce the nitrogen gas for the zero-point calibration or carry out the zero-point calibration in the clean air,** and after the calibration is finished, carry out the detection immediately.
3. If it was still impossible to detect out the gas to be measured after the zero-point calibration, then it is necessary to conduct the operation of **Restoring the factory setting.**
4. If it is still impossible to detect out after restored the factory setting, then it will be necessary to introduce the nitrogen gas again, or carry out the zero-point calibration in clean air again, after the calibration is finished, carry out the detection immediately.
5. Check whether the connection cable of the sensor has been damaged by human factors or there was poor contact.

6. If it is still not possible to detect out after the above mentioned four steps are done, then, it will be necessary to check whether the gas to be measured exist or not on the spot, or whether the concentration of the detected gas is very low indeed; if it is lower than the minimum detection limit value of the instrument, it will not be possible for the detection.

Failure 2: there is no gas to be detected in the air, but the value fluctuates greatly or bounces wildly

Countermeasure solutions:

1. In general, it belongs to the normal range if the short-term fluctuation range of zero point is less than 1% of the maximum range; under the situation without the presence of the gas to be measured, it belongs to the normal range if the long-term drift is less than 2% of the maximum range; if exceeded this range, it is necessary to check whether the gas to be measured exists or not on the spot, or the great fluctuations of air temperature and humidity resulted in the instability of the numerical values, and in general cases, the great fluctuations in temperature and humidity may cause the great fluctuations of the numerical values of the measurement by the instrument in a short period of time; after the air the temperature and humidity became constant, the numerical values will become relatively stable too.
2. Verify whether the zero-point calibration or target point calibration was carried out for the instrument or not; if the zero-point calibration was carried out in the case when the gas to be measured existed, it might be impossible to detect out the gases at low concentrations; if the target point calibration was carried out in the case when the gas to be measured existed, but the concentration value after calibrated did not match the actual concentration value, it might cause that the fluctuation of the numerical values of the instrument is very great, or the numerical values which are measured is relatively small; for these 2 cases, it is possible to be solved through the operation of **Restoring the factory setting.**
3. If the problem still could not be solved, it will be necessary to verify whether the gases of high concentrations had been introduced or the gases of high concentrations had impacted the sensor; if the sensor had been impacted, after 24 hours of aging through connecting the power supply to the instrument, the numerical values are till instable or the numerical values still could not decrease further, the sensor may be damaged due to the impact, and it will be necessary to replace the sensor.

Failure 3: detection result is inaccurate

Countermeasure solutions:

1. Check whether the gas concentration on the spot is accurate or not; sometimes the difference between the theoretical value and the actual value is great, the best method is to verify the accuracy of the instrument by the introduction of the standard gases, or send to a third party metrology authority for checking.

2. If the use time of the sensor was too long, there might be some errors of the measurement values, and it will be necessary to check with the manufacturer whether it is still possible or not to continue using the sensor; if the sensor itself has almost been close to the service life, even at the moment after the calibration, it can be used normally, soon, it will become not possible to work properly again, so, it is recommended to replace the sensor.

Failure 4: the alarm is activated even when the numerical value was 0 or the alarm value in the air had not been reached

Countermeasure solutions:

1. Check whether the alarm has been modified or not.
2. Check whether the alarm method, alarm mode had been modified or not.
3. Check whether the alarm status is the concentration alarm or the failure alarm, the concentration alarm will display the words of AL or AH, and the red indicator light may flash, the failure alarm will light yellow.
4. If the alarm is caused by the man-made modifications, it can be resolved by restoring to the factory settings; and the failure alarm requires further checking about whether it is caused by the short circuit, open circuit, poor contact, sensor failure, and so on or not, or, deliver it back to the manufacturer for checking.

Failure 5: it is not possible to communicate with the computer

Countermeasure solutions:

1. Check the equipment address, the address which was set in the communication software must be same as the equipment address of the instrument.
2. At the computer hardware - Equipment Manager - Port, check whether the serial ports corresponding to RS485 / RS232 converter are connected or not. For the equipment of USB interface, it is also necessary to detect whether the serial ports are connected or not, and whether the serial port numbers are correct or not.

IX. Equipment maintenance

During the normal use of the detector, the valid service life of the most sensors is 24-36 months. Within the valid service life, one time of periodic sensor calibration should be performed every 6 months or 1 year, so as to ensure the accuracy and effectiveness of the gas detection function. The sensors which exceeded the valid service life and had failures must be replaced.

9.1 Sensor replacement

After the sensor failure appears, please deliver the instrument back to the manufacturer for replacement and recalibration.

9.2 Sensor calibration

Please refer to the detailed description in 7.1 and 7.2 of the Section 7 for details. Never operate when the standard gas is not ready. **At the time of mis-operation, it is necessary to restore the factory setting through the operations of the section 7.3.**

X. Precautions

- For the charger, it is a must to use the original charger; in the case of using the charger which are provided by other manufacturers, the specifications should be 4.2V, 2A or 5V, 2A, should be neither greater than 5V, 2A, nor less than 4.2V, 1A.
- It is prohibited for the live replacement of the sensor without disconnecting the power supply.
- At the time when the sensor calibration is carried out, and the nitrogen gas or the standard gas is introduced, the gas discharged from the gas cylinder should not be directly connected to the instrument with a hose, and it must be connected to a three-way flow diverter, at the same time of ensuring the ventilation amount is greater than or equal to 500 ml / min, excessive gas can be discharged away from the three-way bypass, so as to avoid the case that the internal pressure of the sensor gas chamber is greater than the normal value.
- The operations such as installation, debugging, setting up and so on must be conducted by professionals.
- The calibration checking of the detector should be carried out regularly; the sensors which exceeded the valid service life and had failures must be replaced timely.
- Avoid using the gases higher than the measurement range to impact the sensor.
- At the time of occurrence of failure, abnormality, and in accurate detection, please conduct the operation of restoring the factory setting, which can usually solve the problem; if the problem could not be solved, please contact the manufacturer.

XI. Table of technical performance and parameters of other optional sensors

Optional configuration: any combination of 1 ~ 6 types of gases, which can be simultaneously the combination of 18 or more types of gases

Gases to be detected	Range	Allowable error	Minimum reading	Response time T90
Combustible gas (EX)	0-100%LEL	＜±2%(F.S)	0.1%LEL	≤10 seconds
Combustible gas (EX)	0-100%Vol	＜±2%(F.S)	0.1%Vol	≤10 seconds
Methane (CH_4)	0-100%LEL	＜±2%(F.S)	0.1%LEL	≤10 seconds
Methane (CH_4)	0-100%Vol	＜±2%(F.S)	0.1%Vol	≤10 seconds
Oxygen gas (O_2)	0-30%Vol	＜±2%(F.S)	0.01%Vol	≤10 seconds
Oxygen gas (O_2)	0-100%Vol	＜±2%(F.S)	0.01%Vol	≤10 seconds
Oxygen gas (O_2)	0-5000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Nitrogen gas (N_2)	0-100%Vol	＜±2%(F.S)	0.01%Vol	≤10 seconds
Carbon monoxide (CO)	0-100ppm	＜±2%(F.S)	0.1ppm	≤25 seconds
Carbon monoxide (CO)	0-1000ppm	＜±2%(F.S)	0.1ppm	≤25 seconds
Carbon monoxide (CO)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤25 seconds
Carbon monoxide (CO)	0-20000ppm	＜±2%(F.S)	1ppm	≤25 seconds
Carbon monoxide (CO)	0-100000ppm	＜±2%(F.S)	1ppm	≤25 seconds
Carbon dioxide (CO_2)	0-500ppm	＜±2%(F.S)	1ppm	≤20 seconds
Carbon dioxide (CO_2)	0-2000ppm	＜±2%(F.S)	1ppm	≤20 seconds
Carbon dioxide (CO_2)	0-5000ppm	＜±2%(F.S)	1ppm	≤20 seconds
Carbon dioxide (CO_2)	0-50000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Carbon dioxide (CO_2)	0-20%Vol	＜±2%(F.S)	0.01%Vol	≤30 seconds
Carbon dioxide (CO_2)	0-100%Vol	＜±2%(F.S)	0.01%Vol	≤30 seconds
Formaldehyde (CH_2O)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Formaldehyde (CH_2O)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Formaldehyde (CH_2O)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Formaldehyde (CH_2O)	0-5000ppm	＜±2%(F.S)	1ppm	≤50 seconds
Ozone (O_3)	0-1ppm	＜±2%(F.S)	0.001ppm	≤20 seconds
Ozone (O_3)	0-5ppm	＜±2%(F.S)	0.001ppm	≤20 seconds
Ozone (O_3)	0-50ppm	＜±2%(F.S)	0.01ppm	≤20 seconds
Ozone (O_3)	0-100ppm	＜±2%(F.S)	0.01ppm	≤20 seconds
Ozone (O_3)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Ozone (O_3)	0-30000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Ozone (O_3)	0-20mg/L	＜±2%(F.S)	0.01mg/L	≤30 seconds
Ozone water (O_3)	0-20mg/L	＜±2%(F.S)	0.01mg/L	≤30 seconds

Gases to be detected	Range	Allowable error	Minimum reading	Response time T90
Hydrogen sulfide (H_2S)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Hydrogen sulfide (H_2S)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen sulfide (H_2S)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen sulfide (H_2S)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Hydrogen sulfide (H_2S)	0-10000ppm	＜±2%(F.S)	1ppm	≤45 seconds
Sulfur dioxide (SO_2)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Sulfur dioxide (SO_2)	0-20ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Sulfur dioxide (SO_2)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Sulfur dioxide (SO_2)	0-500ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Sulfur dioxide (SO_2)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Sulfur dioxide (SO_2)	0-10000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Nitric oxide (NO)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Nitric oxide (NO)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Nitric oxide (NO)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Nitric oxide (NO)	0-5000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Nitrogen dioxide (NO_2)	0-10ppm	＜±2%(F.S)	0.001ppm	≤25 seconds
Nitrogen dioxide (NO_2)	0-100ppm	＜±2%(F.S)	0.01ppm	≤25 seconds
Nitrogen dioxide (NO_2)	0-1000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Nitrogen dioxide (NO_2)	0-5000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Nitrogen oxide (NO_X)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Nitrogen oxide (NO_X)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Nitrogen oxide (NO_X)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Nitrogen oxide (NO_X)	0-5000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Chlorine gas (CL_2)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Chlorine gas (CL_2)	0-20ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Chlorine gas (CL_2)	0-200ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Chlorine gas (CL_2)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Ammonia gas (NH_3)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Ammonia gas (NH_3)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Ammonia gas (NH_3)	0-1000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Ammonia gas (NH_3)	0-5000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Ammonia gas (NH_3)	0-100%LEL	＜±2%(F.S)	0.1%LEL	≤10 seconds
Hydrogen gas (H_2)	0-100%LEL	＜±2%(F.S)	0.1%LEL	≤10 seconds
Hydrogen gas (H_2)	0-1000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Hydrogen gas (H_2)	0-20000ppm	＜±2%(F.S)	1ppm	≤30 seconds

Gases to be detected	Range	Allowable error	Minimum reading	Response time T90
Hydrogen gas (H_2)	0-40000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Hydrogen gas (H_2)	0-100%Vol	＜±2%(F.S)	0.01%Vol	≤20 seconds
Helium gas (He)	0-100%Vol	＜±2%(F.S)	0.01%Vol	≤20 seconds
Argon gas (Ar)	0-100%Vol	＜±2%(F.S)	0.01%Vol	≤20 seconds
Xenon gas (Xe)	0-100%Vol	＜±2%(F.S)	0.01%Vol	≤20 seconds
Hydrogen cyanide (HCN)	0-30ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen cyanide (HCN)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen chloride (HCL)	0-20ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen chloride (HCL)	0-200ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Phosphorus hydride (PH_3)	0-5 ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Phosphorus hydride (PH_3)	0-25 ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Phosphorus hydride (PH_3)	0-2000 ppm	＜±2%(F.S)	1ppm	≤30 seconds
Chlorine dioxide ($CL O_2$)	0-1ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Chlorine dioxide ($CL O_2$)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Chlorine dioxide ($CL O_2$)	0-200ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Ethylene oxide (ETO)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Ethylene oxide (ETO)	0-1000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Ethylene oxide (ETO)	0-100%LEL	＜±2%(F.S)	1%LEL	≤30 seconds
Phosgene ($COCL_2$)	0-1ppm	＜±2%(F.S)	0.001ppm	≤20 seconds
Phosgene ($COCL_2$)	0-50ppm	＜±2%(F.S)	0.01ppm	≤20 seconds
Silane (SiH_4)	0-1ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Silane (SiH_4)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Fluorine gas (F_2)	0-1ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Fluorine gas (F_2)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Fluorine gas (F_2)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen fluoride (HF)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen fluoride (HF)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen bromide (HBr)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Diborane (B_2H_6)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Arseniuretted hydrogen (AsH_3)	0-1ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Arseniuretted hydrogen (AsH_3)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Arseniuretted hydrogen (AsH_3)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Germane (GeH_4)	0-2ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Germane (GeH_4)	0-20ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrazine (N_2H_4)	0-1ppm	＜±2%(F.S)	0.001ppm	≤30 seconds

Gases to be detected	Range	Allowable error	Minimum reading	Response time T90
Hydrazine (N_2H_4)	0-300ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Tetrahydrothiophene (THT)	0-100mg/m3	＜±2%(F.S)	0.01 mg/ m3	≤60 seconds
Bromine gas (Br_2)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Bromine gas (Br_2)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Bromine gas (Br_2)	0-2000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Ethyne ($C_2 H_2$)	0-100%LEL	＜±2%(F.S)	0.1%LEL	≤30 seconds
Ethyne ($C_2 H_2$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Ethyne ($C_2 H_2$)	0-1000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Ethylene ($C_2 H_4$)	0-100%LEL	＜±2%(F.S)	0.1%LEL	≤30 seconds
Ethylene ($C_2 H_4$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Ethylene ($C_2 H_4$)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Acetaldehyde	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Ethanol ($C_2 H_6O$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Ethanol ($C_2 H_6O$)	0-2000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Methanol (CH_4O)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Methanol (CH_4O)	0-2000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Carbon disulfide (CS_2)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Carbon disulfide (CS_2)	0-5000ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Acrylonitrile (C_3H_3N)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Acrylonitrile (C_3H_3N)	0-2000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Methylamine (CH_5N)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Iodine gas (I_2)	0-50ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Styrene ($C_8 H_8$)	0-200ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Styrene ($C_8 H_8$)	0-5000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Chloroethylene ($C_2 H_3CL$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Trichloroethylene ($C_2 HCL_3$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Tetrachlorethylene ($C_2 CL_4$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Laughing gas ($N_2 O$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Nitrogen trifluoride (NF_3)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Hydrogen peroxide ($H_2 O_2$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Methyl bromide ($CH_3 Br$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Methyl bromide ($CH_3 Br$)	0-30000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Methyl bromide ($CH_3 Br$)	0-200g/m3	＜±2%(F.S)	0.1g/m3	≤30 seconds
Sulfuryl fluoride ($SO_2 F_2$)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Sulfuryl fluoride ($SO_2 F_2$)	0-5000ppm	＜±2%(F.S)	1ppm	≤30 seconds

Gases to be detected	Range	Allowable error	Minimum reading	Response time T90
Sulfuryl fluoride (SO_2F_2)	0-10000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Benzene (C_6H_6)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Benzene (C_6H_6)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Benzene (C_6H_6)	0-2000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Benzene (C_6H_6)	0-20000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Methylbenzene (C_7H_8)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Methylbenzene (C_7H_8)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Methylbenzene (C_7H_8)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Methylbenzene (C_7H_8)	0-20000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Dimethylbenzene (C_8H_{10})	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Dimethylbenzene (C_8H_{10})	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Dimethylbenzene (C_8H_{10})	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Dimethylbenzene (C_8H_{10})	0-20000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Total Volatile Organic Compound gases (TVOC)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Total Volatile Organic Compound gases (TVOC)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Total Volatile Organic Compound gases (TVOC)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Total Volatile Organic Compound gases (TVOC)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Total Volatile Organic Compound gases (TVOC)	0-200000ppm	＜±2%(F.S)	1ppm	≤30 seconds
Volatile gases (PID)	0-10ppm	＜±2%(F.S)	0.001ppm	≤30 seconds
Volatile gases (PID)	0-10ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Volatile gases (PID)	0-100ppm	＜±2%(F.S)	0.01ppm	≤30 seconds
Volatile gases (PID)	0-2000ppm	＜±2%(F.S)	0.1ppm	≤30 seconds
Volatile gases (PID)	0-200000ppm	＜±2%(F.S)	1ppm	≤30 seconds

Note: please call us to consult about other gases and other detection range which are not listed in the above table.