

Thank you for choosing our product! Before using the product, please read this user manual carefully and keep it in a safe place for future reference.

Multi-Parameter Gas Detection Alarm Instrument User Manual



Product Compliance Standards: AQ6207-2007, MT703-2008, MT704-2008, MT563-1996,
GB3836.1-2010, GB3836.2-2010, GB3836.4-2010

Henan *DUOTESI* Electronic Technology Co., Ltd.

Warning:

- 1、 Do not arbitrarily alter the intrinsically safe circuit and the electrical parameters, specifications, and models of components related to the intrinsically safe circuit during maintenance!
- 2、 The product can only be used in conjunction with products specified in the manual!
- 3、 Charging underground and disassembling the battery are strictly prohibited.
- 4、 Batteries other than those specified in the manual are strictly prohibited!

1、 Overview

1.1、 Purpose and Scope of Application

The DTS-B004(B) multi-parameter gas detection alarm instrument (hereinafter referred to as the alarm instrument) is an electronic instrument that uses electrochemical principles, catalytic carrier principles, embedded micro-controller intelligent control, and liquid crystal display. It is mainly used for the detection and alarm of methane, oxygen, carbon monoxide, and hydrogen sulfide.

1.2、 Operating Environmental Conditions

- a. Temperature: 0°C to 40°C
- b. Relative Humidity: $\leq 98\%$ (at +25°C)
- c. Atmospheric Pressure: 80kPa to 116kPa
- d. Wind Speed: $\leq 8\text{m/s}$
- e. In locations without significant vibration and impact
- f. In hazardous areas with explosive gas mixtures.

2、 Working Principle and Structural Features

2.1、 Overall Working Principle

The alarm instrument uses the catalytic combustion principle for methane detection and the electrochemical principle for carbon monoxide (CO), oxygen (O₂), and hydrogen sulfide (H₂S) detection.

2.1.1、 Gas Measurement Principle

The alarm instrument converts methane, oxygen, carbon monoxide, and hydrogen sulfide gases in the air into corresponding electrical signals through their respective sensors. These electrical signals are then amplified, filtered, and processed by a micro-controller, which then displays the concentrations of methane, oxygen, carbon monoxide, and hydrogen sulfide in the air in digital form. When the concentrations of methane, carbon monoxide, and hydrogen sulfide exceed the set alarm points, or when the oxygen concentration falls below the set alarm value, the alarm circuit issues an audible alarm signal to indicate that the concentration is beyond the limit.

2.2、 Structural Features



Multi-Parameter Gas Detection Alarm Instrument Physical Device

3、 Technical Features

3.1、 Power Supply and Charging

a) Battery Parameters:

- ① The battery pack consists of a 3.7V/1.5Ah mining manganese acid battery and a battery protection board, which are encapsulated in series (providing overcharge, over-discharge, overcurrent protection, and short circuit protection);
- ② Battery open-circuit voltage: $\leq 4.2\text{V}$;
Maximum output current: $\leq 1.6\text{A}$;

b) The alarm instrument uses batteries without "memory effect."

c) The alarm instrument should have power voltage display, under-voltage indication, and automatic power-off function when under-voltage occurs.

d) When the alarm instrument is charging, it should have charging indication,

charging completion shut-off, and indication functions.

3.2、Main Technical Parameters

3.2.1、Measurement Range

- (1) Methane: (0.00~4.00)% CH₄.
- (2) Oxygen: (0.0~25.0)% O₂.
- (3) Carbon Monoxide: (0~1000) ppm CO.
- (4) Hydrogen Sulfide: (0~100) ppm H₂S.

3.2.2 Basic Error

Gas	Measurement Range	Basic Error
Methane (CH ₄)	0.00~1.00	±0.10%CH ₄
	1.00~3.00	±10%
	3.00~4.00	±0.30%CH ₄
Oxygen (O ₂)	0.0~5.0	±0.5%O ₂
	> 5.0~25.0	±3%FS
Carbon Monoxide (CO)	0~100	±2×10 ⁻⁶ CO
	> 100~500	±5%
	> 500~1000	±6%
Hydrogen Sulfide (H ₂ S)	0~49	±3×10 ⁻⁶ H ₂ S
	50~100	±10%

3.2.3 Alarm Points:

- (1) Methane: Can be set arbitrarily within the measurement range (default set to 1.00% CH₄ at factory);
- (2) Oxygen: Can be set arbitrarily within the measurement range (default set to 18.0% O₂ at factory);
- (3) Carbon Monoxide: Can be set arbitrarily within the measurement range (default set to 24 ppm CO at factory);
- (4) Hydrogen Sulfide: Can be set arbitrarily within the measurement range (default set to 10 ppm H₂S at factory);

3.2.4 Alarm Error:

- (1) Methane: ±0.05% CH₄.
- (2) Oxygen: ±0.3% O₂.
- (3) Carbon Monoxide: ±1 ppm CO.
- (4) Hydrogen Sulfide: ±1 ppm H₂S.

3.2.5 Alarm Method and Effect:

Audible alarm, with a sound intensity of not less than 75 dB at a distance of one meter from the sound source along the axis.

3.2.6 Alarm Instrument Resolution:

- (1) Methane: 0.01% CH₄.
- (2) Oxygen: 0.1% O₂.
- (3) Carbon Monoxide: 1×10^{-6} CO.
- (4) Hydrogen Sulfide: 1×10^{-6} H₂S.

3.2.7 Response Time:

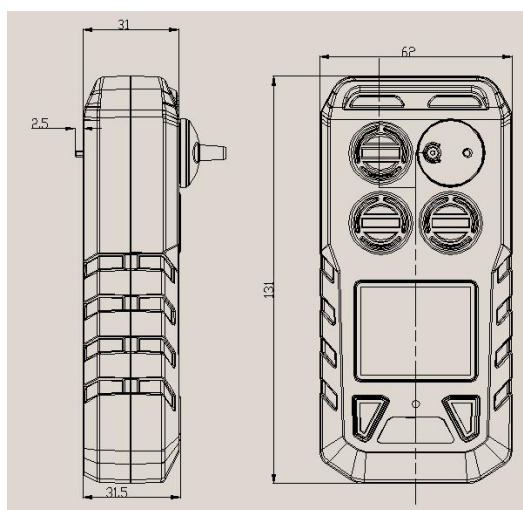
- (1) Methane: Not more than 20 seconds.
- (2) Oxygen: Not more than 35 seconds.
- (3) Carbon Monoxide: Not more than 45 seconds.
- (4) Hydrogen Sulfide: Not more than 45 seconds.

3.2.8 Continuous Working Time: More than 16 hours on a single charge.

4 Dimensions, Weight

4.1 Outer Dimensions

131mm×62mm×31mm



Multi-Parameter Gas Detection Alarm Instrument Outer Dimensions

4.2 Weight: Approximately 0.5 kg.

5 Usage and Calibration

5.1 Charging the Alarm Instrument

Warning: The charging of the alarm instrument must be carried out in a safe place above ground, and the instrument must be switched off during charging!

The battery symbol on the upper right side of the alarm instrument indicates the level of battery charge. Three to four squares “■” indicate a full charge. When the alarm

instrument gives a low-voltage alarm and the battery square symbol flashes with only one square “■” displayed, it means the battery charge is low and needs to be recharged.

To charge the alarm instrument, please place it in a safe location and switch it off. Insert the small end USB plug of the data charging cable into the charging port of the alarm instrument, and the large end USB plug into the USB port of the charger power plug.

Insert the charger power plug into the AC power source, which should be AC220V 50Hz. At this time, the alarm instrument's indicator light turns red, indicating that it is charging. When the indicator light goes out, it means the battery is fully charged. The entire charging process takes approximately 5 to 6 hours.

5.2 Operating Instructions

5.2.1 Powering On

Alarm Point	
CH4	1.00 %VOL
O2	18.0 %VOL
CO	24.0 PPM
CO2	1.00 %VOL

The alarm instrument adopts a menu-based operation mode. To facilitate operation, the following will be introduced with a combination of graphics and text. When the alarm instrument is powered off, press the red "Right" button to turn it on. It will perform alarm sound, alarm light, and self-check, while displaying the boot logo. After 2 seconds, it will automatically enter the boot alarm point interface, which displays the alarm points for the measured gases. As shown in the figure, this interface is maintained for about 3 seconds.

5.2.2 The main interface

2009.11.25 11:30 		
CH ₄	0.00	%vol
O ₂	20.9	%vol
CO	0	ppm
CO ₂	0.00	%vol

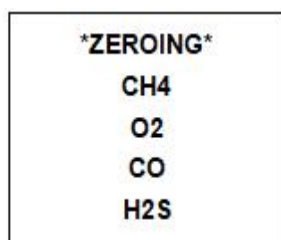
Once the interface display is complete, the alarm instrument automatically transitions to the main interface display. The following image represents the main interface: This interface is the normal detection main interface, capable of monitoring the concentrations of three types of gases, and it also displays battery voltage, time, and date. When an alarm is triggered for a specific gas, in addition to audible, visual, and vibration alerts, the numerical value for the alarmed gas turns red. To enter the power-off interface, press and hold the "right button"; to enter the function interface, press and hold the "left button".

5.2.3 The operation of the function interface

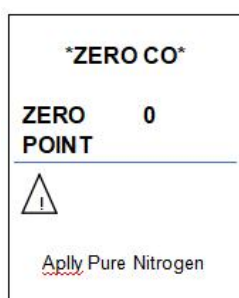
MENU
ZERO SETTING
CALIBRATION
ALARM POINT
TIME SETTING
STORED DATA
RESTORE
SETLAN

This interface is the function selection interface, where you can choose the relevant functions and enter the corresponding function interfaces. The item pointed to by the arrow is the selected item, and it changes color. Press the green "left button" briefly to adjust the function options, and the arrow points to the next option; press and hold the red "right button" to enter the function item; press the "right button" briefly to return to the main interface.

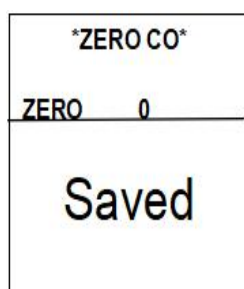
5.2.4 Zero Calibration Operation and Related Interfaces



1). Zeroing Interface: This interface is the gas zeroing selection screen, where you can choose the appropriate gas zeroing function and enter the corresponding gas zeroing screen. The item pointed to by the arrow is the selected item, which changes color. To adjust the gas options, press the "left button" briefly; to enter the selected gas zeroing interface, press and hold the "right button"; to return to the function selection interface, press the "right button" briefly.



2). Original Zero Point Display: This interface is the gas zeroing interface, where the gas zeroing operation is performed. This interface indicates that it is the CO zeroing interface with "CO Zeroing" and displays the zero point value next to it. The bottom of the interface also includes environmental requirements for zeroing. Press and hold the "left button" to save the zero point and a prompt interface will appear. Press the "right button" briefly to return to the gas zeroing selection interface.



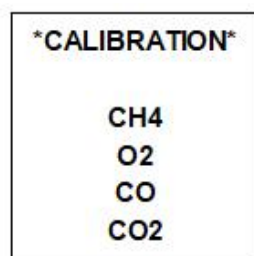
3). Save Interface: This interface is the zeroing save screen. Press and hold the "left button" to save the zero point, and a prompt will indicate that the zero point has been adjusted. The interface will then return to the gas zeroing selection interface.

4). Zeroing Interface for Other Gases: The zeroing interfaces and operating methods for other gases are similar to this one. The appropriate zeroing environment is indicated on the zeroing

interface for the respective gas.

Note: For oxygen zeroing, pure nitrogen gas should be used.

5.2.5 Calibration Operation and Related Interfaces



A. Calibration Interface: This interface is the gas calibration selection screen, where you can choose the corresponding gas calibration function and enter the corresponding gas calibration interface. The item pointed to by the arrow is the selected item, which changes color. Press the "left button" briefly to adjust the calibration function options for different gases; press and hold the "right button" to enter the calibration of the selected gas; press the "right button" briefly to return to the function selection interface. Before calibrating a gas, it is necessary to first complete the zeroing operation for the gas.

CALIBRATION	
CO	0498
The Calibrating Gas Concentration	

B. Standard Gas Setting Interface: This interface is for setting the calibration value of the gas, where "0498" represents the concentration of the standard gas used. You can change the calibration value using the left button; press and hold the left button to select the digit, and press the left button briefly to cycle through the numbers from 0 to 9. Press and hold the right button to enter the gas ventilation interface, and press the right button briefly to return to the gas calibration selection interface.

CALIBRATION	
CO	0498
Aply 498PPM CO	

C. Ventilation interface: This interface is the gas ventilation interface. After entering this interface, you can introduce the standard gas of the concentration you have just set. The interface displays the concentration of the gas being introduced at the bottom, such as "498ppm". The "0" following the real-time value will change as the gas is introduced. Once this displayed value stabilizes, press and hold the "left button" to save the calibration value, and press the "right button" briefly to return to the gas calibration selection interface.

CALIBRATION	
CO	0
Saved	

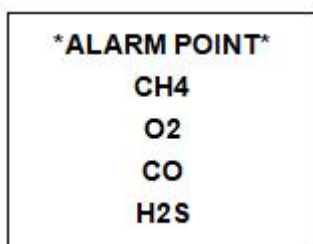
D. Calibration Storage Interface: Once the displayed value stabilizes, press and hold the "left button" to save the calibration value, and a calibration completion prompt interface will appear. Press the "right button" briefly to return to the gas calibration selection interface.

Calibration Notes:

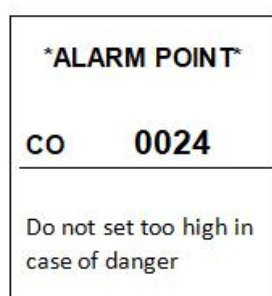
1. Calibration must be conducted using standard gases produced by manufacturers recognized by the national metrology department, with a concentration that is half of the maximum measuring range of the gas being measured. When the requirements are not very strict, clean air (20.9% VOL) can be used as a standard gas for oxygen calibration; please do not use gases with concentrations too low relative to the measuring range for calibration.
2. Use the specialized alarm instrument calibration hood provided by the manufacturer for calibration, with a flow rate typically set at 200ml/min. Allow the gas to flow for half a minute to stabilize the flow rate, then place the alarm instrument calibration hood over the front end of the alarm instrument sensor and tighten the calibration hood fixing screw.
3. It is recommended that the calibration (standardization) cycle for the alarm instrument be once a month.
4. Each channel of the alarm instrument must be calibrated separately; mixed gases

should not be used for simultaneous calibration.

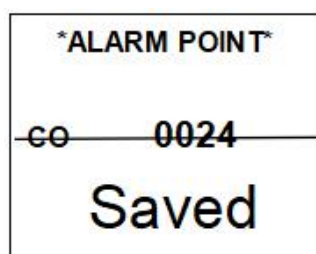
5.2.6 Alarm Point Setting and Operation



A. Alarm Point Selection Interface: This interface is the gas alarm point setting selection screen, where you can choose the corresponding gas alarm point setting function and enter the corresponding gas alarm point setting interface. The item pointed to by the arrow is the selected item, which changes color. The "left button" is used to adjust the function options; press and hold the "right button" to enter the function item; press the "right button" briefly to return to the function selection interface.



B. Alarm Point Setting Interface: This interface is for setting the alarm points for gases, please set the alarm values suitable for the location where the alarm instrument will be used. Press and hold the "left button" to select the digit, and press the "left button" briefly to cycle through the numbers from 0 to 9. Press and hold the "right button" to save the set alarm points, and a completion interface for alarm point setting will appear. Press the "right button" briefly to return to the alarm point setting selection interface.



C. Alarm Point Storage Interface: This interface serves as a prompt indicating that the alarm point settings have been completed. After the prompt, it returns to the alarm point setting selection interface.

D. The method for setting alarm points for other gases is similar; please refer to this for guidance.

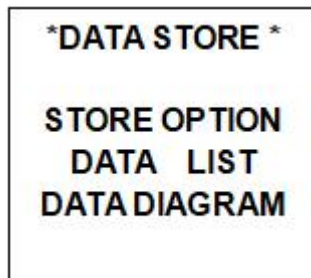
5.2.7 Time Setting Operations and Interfaces



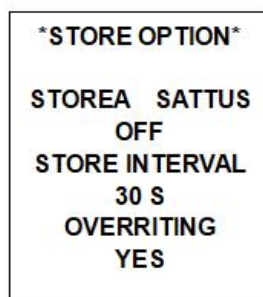
In the function interface, select "Time and Date Settings," and the alarm instrument will enter the time setting interface, with the upper row displaying the date and the lower row displaying the time. You can adjust the time using the left and right buttons. Press and hold the "left button" to adjust the selected position, selecting two digits at a time. Press the "left button" briefly to change the numbers. The first two digits of the year change between 20 and 99, and the last two digits change between 00 and 99. The month changes between 01 and 12, the day changes between 01 and 31, the hour changes between 00 and 23, and the minute changes between 00 and 59. After setting, press and hold the "right button" to save the

time and date, and return to the function interface. Press the "right button" briefly to return to the function interface without saving.

5.2.8 Data Storage Operations and Interfaces



A. This interface is the Data Storage Selection Interface, where you can choose the corresponding data storage functions. The item pointed to by the arrow is the selected item, which changes color. Press the "left button" briefly to adjust the options. Press and hold the "right button" to enter the function item, and press the "right button" briefly to return to the function selection interface.

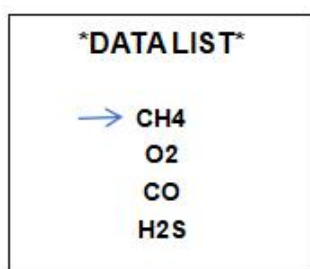


B. This interface is the Storage Settings Interface, where you can configure the activation and deactivation of automatic storage, as well as the time interval for each storage operation. The selected item changes color. Press and hold the "left button" to select the adjustment item, and press the "left button" briefly to change the option content. For example, when the storage status "Off" is selected, it changes color, and pressing the "left button" briefly toggles between "On" and "Off". Press and hold the "left button" to jump to the storage time interval "30" and change the color, then press the "left button" briefly to adjust the storage interval time. The default interval time is 30 seconds, with available intervals of 15 seconds, 30 seconds, 45 seconds, 1 minute, 2 minutes, 3 minutes, 4 minutes, 5 minutes, 6 minutes, 7 minutes, 8 minutes, 9 minutes, 10 minutes, 20 minutes, 30 minutes, 40 minutes, 50 minutes, and 60 minutes. Each adjustment increases the interval by one step from smallest to largest, and when it exceeds 60 minutes, it resets to 15 seconds. Press and hold the "left button" to jump to "Yes" for storage overwrite; if you do not want to overwrite previous stored data, press the "left button" briefly to switch to "No". When the storage status is set to "On", press and hold the "right button" to save the current settings and jump to the storage prompt interface. Press the "right button" briefly to return to the data storage selection interface.



C. This interface is the storage prompt interface. It contains prompt messages indicating that there are already 35 data points stored, which means 35 pieces of data have been saved. This number will change depending on the amount of

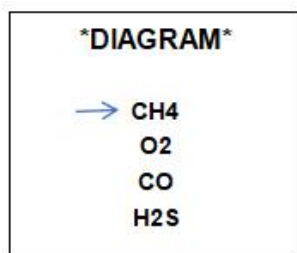
stored data. It also states that there is enough storage capacity for an additional 8 hours, which means, based on the previously set storage interval, there is space to store data for another 8 hours. This number of hours will change based on the set storage interval and the number of data points already stored. Below, there is a prompt asking "Do you want to delete existing data?" This prompt asks whether you want to delete the original 35 data points. If you press "Yes," the data will be deleted; if you press "No," the data will not be deleted. "Yes" represents the left button, and "No" represents the right button.



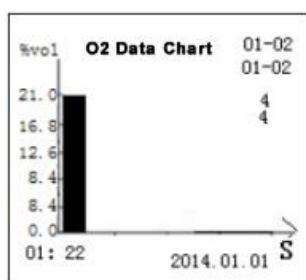
D. This interface is the Data Viewing Interface, which includes options for data related to the measured gases. The item pointed to by the arrow is the selected item, which changes color. The "left button" is used to adjust the function options; press and hold the "right button" to enter the function item and view the data list; press the "right button" briefly to return to the function selection interface.

CO Data		001-002 ppm
2014.01.01	00:31	0
2014.01.01	00:31	0
2014.01.01	00:32	0
2014.01.01	00:32	0
2014.01.01	00:33	0
2014.01.01	00:33	0

E. This interface is the Data Display Interface, which is used for viewing stored data. In the upper right corner of this interface, "001 - 002" indicates that 001 is the current page number, and 002 is the total number of pages stored. When displaying data, each line consists of the date, time, and concentration value, forming a set of data, with each page storing six sets of data. Press the "left button" briefly to turn pages, and press the "right button" briefly to return to the data viewing interface.



F. This interface is the Graph Display Selection Interface. Press the "left button" briefly to adjust the options, and the arrow will point to the selected item, which changes color. Press and hold the "right button" to enter the option and view the data graph, and press the "right button" briefly to return to the data.



G. This interface is the Data Graph Display Interface, where you can view the changes of various gases over a continuous period of time. The unit "%vol" is indicated. The "01-02" on the first line indicates that there are two pages of data for that day, and you are currently on the first page; the "01-02" on the second line indicates that there are data for two days in total, and you are currently viewing the

data for the first day. Below the coordinates, there is a display of time and date. Press the "left button" briefly to flip pages (change time) within the same day, and press and hold the "left button" to change the displayed date. Press and hold the "right button" to change the graph concentration display scale, and press the "right button" briefly to return to the graph display selection interface.

H. The data display and operation for other gases are similar; please refer to the instructions for operation.

Note: After the data storage of the alarm instrument is turned on, data can only be stored when you return to the concentration display interface.

5.2.9 Power Off Operations and Interfaces



This interface is the power-off interface. By long pressing the "right button" on the normal detection interface, the alarm instrument displays this interface. Press the "left button" briefly to select "Yes" to power off, and press the "right button" briefly to select "No" to return to the normal detection interface.

6. Precautions for Use

6.1 Please read the manual carefully before use;

6.2 The alarm instrument should be maintained and used by designated personnel, and operated and adjusted strictly according to the manual. Unauthorized disassembly of the alarm instrument is prohibited;

6.3 When carrying or using the alarm instrument, it should be placed in a leather case to prevent severe impacts and attention should be paid to keeping the alarm instrument clean;

6.4 The environment where the alarm instrument is used or stored should be free of organic silicon, adhesives, and other chemical substances to avoid poisoning of the carrier elements;

6.5 The battery assembly is an explosion-proof component. Its specifications and parameters must not be altered during maintenance or replacement. Accessories from the alarm instrument manufacturer should be used, and replacement should be done by professional personnel;

6.6 The alarm instrument should be calibrated regularly, generally once a month;

6.7 Disassembly and repair underground are strictly prohibited. During maintenance, do not change the model, specifications, or parameters of the original circuit components;

6.8 Low voltage indication: When the battery voltage drops below 3.4V, the buzzer will sound an alarm;

6.9 Shutdown protection: When the voltage drops below 3.2V, the alarm instrument will shut down automatically.

6.10 The alarm instrument should be charged every three months while in storage to activate the battery pack and maintain the characteristics of the sensor and battery pack. Please use the manufacturer's dedicated charger for charging, and charging must be conducted in a safe location above ground;

6.11 USB data communication must be carried out in a safe location above ground

7. Common Faults and Repairs of the Alarm Instrument

Malfunctions	Causes	Actions
- Inaccurate measurement	1.The alarm instrument has not been calibrated for a long time. 2.The sensor has aged and failed.	1.Calibrate the alarm instrument. 2.Replace the sensor.
- Failure to alarm	1.Incorrect alarm point settings. Circuit failure.	1.Reset the alarm points. 2.Send back to the manufacturer for repair.
- No response to measured gas	1.Sensor failure. 2.Circuit malfunction	1.Replace the sensor. 2.Send back to the manufacturer for repair.
- Unable to power on	1.Insufficient battery voltage.	1.Charge the device
- Not charging	1.Charger malfunction. 2.Alarm instrument malfunction.	1.Replace the charger and charge the device. 2.Send back to the manufacturer for repair.
Malfunctions	Causes	Actions
- Insufficient working time of the alarm instrument	1.Alarm instrument malfunction	1.Send back to the manufacturer for repair.
- Zero point is not zero in clean air	1.Drift in the zero point.	1.Perform zeroing operation (in clean air or pure nitrogen).
- Short, abrupt audio and visual alarm	1.Low battery voltage.	1.Check the battery voltage and charge.

8. Transportation and Storage

8.1 The alarm instrument can be transported by various means, including land and water transport. During transportation, it is necessary to prevent severe impacts, heavy pressure, and rain exposure, and to avoid mixing with corrosive materials.

8.2 The alarm instrument should be stored in a warehouse that is dry, clean, well-ventilated, free of corrosive gases, free from water drips and liquid intrusion, with a relative humidity not exceeding 90%, and at a temperature range of (-40~60)°C.

9. Packing List

Name	Unit	Quantity
Gas Detection Alarm Instrument	Unit	1
Manual	Copy	1
Calibration Cap	Piece	1
Charger	Stick	1
Charging Cable	Sheet	1
Certificate of Conformity	Unit	1

10. Warranty Commitment

This product has a warranty period of 12 months, calculated from the date of shipment. During this period, if the product is damaged due to reasons other than human error, our company will be responsible for free repairs.

Henan *DUOTESI* Electronic Technology Co., Ltd.

Henan Duotesi Electronic Technology Co., LTD

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