Gas Chromatograph

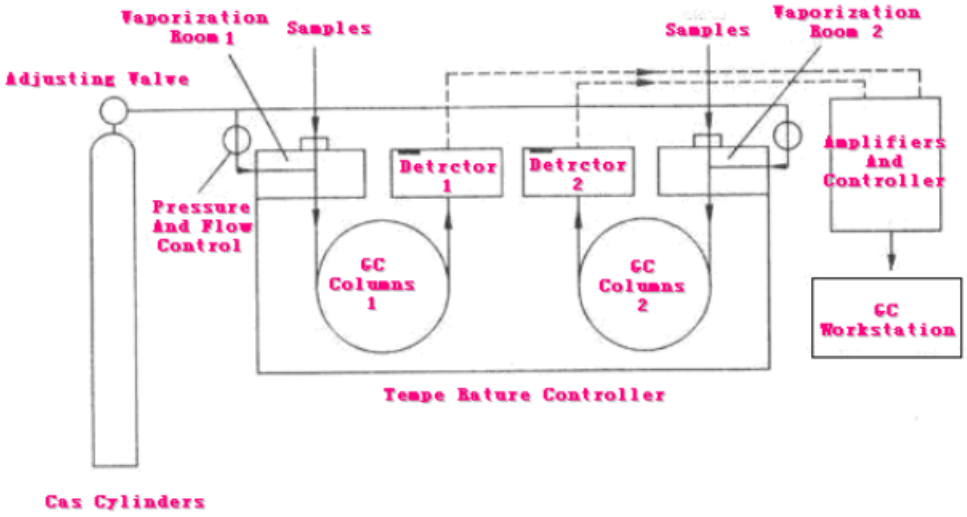
Operation Manual

1. Introduction

1.1. Working principle of gas chromatograph

Gas chromatography analysis technology is a technique for separating and analyzing multi-component mixtures. It mainly utilizes the differences in boiling points, polarity and adsorption coefficients of various components in the sample along the chromatographic column, enabling the separation of each component in the chromatographic column and conducting qualitative and quantitative analysis of the separated components.

The gas chromatograph uses gas as the mobile phase (carrier gas). When the sample is sent into the sampler and vaporized, it is carried by the carrier gas into the packed column or capillary column. Due to the differences in boiling points, polarity and adsorption coefficients of each component in the sample, they are separated in the column. Then, the detector connected to the column detects each component according to the physical and chemical properties of the components in sequence. Finally, it is sent to the chromatography workstation through the local area network (or the Internet), and the chromatography workstation records and analyzes the gas chromatogram of each component to obtain the analysis report of each component. The schematic diagram of its working principle is shown as follows:

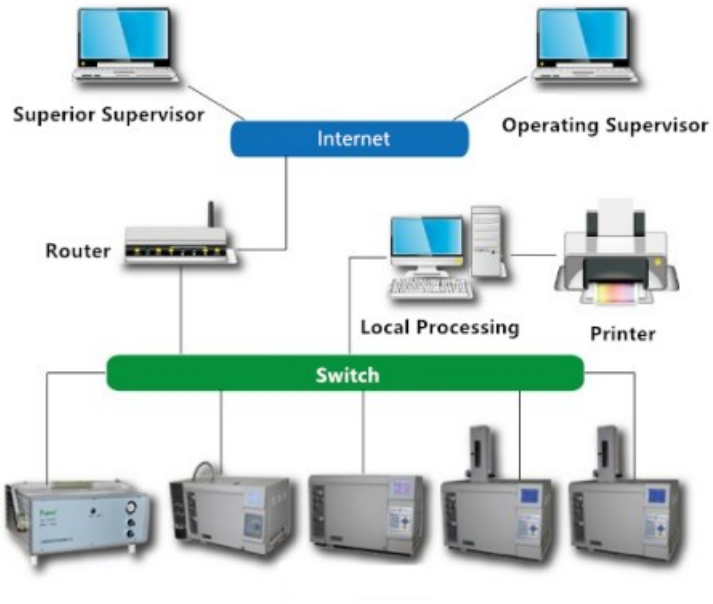


Pic 1.1 Gas chromatograph working principle diagram

Due to the characteristics of this analytical method, such as high separation efficiency, fast analysis speed, and low sample requirement, it has been widely applied in various fields including petrochemicals, biochemistry, medicine and health, health quarantine, food inspection, environmental protection, food industry, and medical clinical. Gas chromatography has solved problems such as the quality inspection of intermediate products and industrial products in industrial production, scientific research, pollution detection, and production control in these fields.

1.2. Feature of gas chromatograph

The networked gas chromatograph has adopted network technology and incorporated spectral data processing technology, completely breaking the cumbersome and heavy working mode of existing domestic chromatographs. This enables multiple chromatographs to share one computer to complete data analysis, printing, and storage, making it a reality. It also realizes remote monitoring of the instrument and remote transmission of chromatographic data, minimizing the laboratory investment and operating costs for users to the greatest extent. It also facilitates enterprise managers to conduct real-time tracking and management of product quality. The following is a simple diagram of the operation of the networked chromatograph.



Pic1.2 GC network chromatograph working diagram

Functions and features:

- It adopts an advanced 10/100M adaptive Ethernet communication interface and integrates an IP protocol stack, enabling the instrument to easily achieve long-distance data transmission through the enterprise internal local area network and the Internet. This facilitates the setup of the laboratory, simplifies the configuration of the laboratory, and facilitates the management of the analysis data.
- The internal design of the instrument features three independent connection processes, which can be connected to local processing (at the laboratory site), unit supervisors (such as quality inspection section chiefs, production plant managers, etc.), and higher-level supervisors (such as environmental protection bureaus, technical supervision bureaus, etc.). This enables unit supervisors and higher-level supervisors to monitor the operation of the instrument and the analysis results in real time.
- The NetChrom workstation equipped with the instrument can simultaneously support the operation of multiple chromatographs, enabling data processing and remote control. It simplifies document management and minimizes the laboratory investment and operating costs for users to the greatest extent.
- The instrument can be connected to the manufacturer via the internet, enabling remote diagnosis and remote program updates (subject to user permission).
- The instrument can be equipped with a 320*240 blue-backlit large-screen liquid crystal display (with an optional 5.7-inch color liquid crystal display).
- The temperature control area and the electronic gas path control (EPC) can be freely named by the user, facilitating the user's operation.
- The instrument adopts a multi-processor parallel working mode, making it more stable and reliable. It can handle complex sample analysis and can be equipped with various high-performance detectors, such as TCD, HTCD, uTCD, FID, FPD, ECD, NPD, ZD, PDHID, PID, AID, HID, etc. Up to three detectors can be installed simultaneously. It can also adopt the detector addition method, where other detectors can be purchased and installed after the instrument is purchased.
- The instrument adopts a modular structure design, which is clear in design, easy to replace and upgrade, and ensures the effectiveness of the investment.
- The brand-new microcomputer temperature control system features high control accuracy, superior reliability and anti-interference performance. It has six completely independent temperature control systems, enabling it to achieve eight (or sixteen-stage) programmed temperature rises, thus making this equipment capable of handling a wider range of sample analyses. It also has an automatic rear door opening system for the column chamber, which improves the precision of low-temperature control and increases the heating/cooling speed.
- The instrument can be equipped with an advanced electronic gas path control system, enabling digital control, which

significantly improves the reproducibility, consistency and reliability of qualitative and quantitative results.

- The instrument is equipped with a timed self-starting program, which enables the online analysis of gas samples (requiring an online automatic sample introduction component).
- The operating system of the fully microcomputer-controlled keyboard is simple and convenient to operate. It also incorporates an automatic detector recognition technology. It has the functions of fault diagnosis and power-off data protection, and can automatically remember the set parameters.
- The chromatograph is equipped with a low-noise, high-resolution 24-bit AD circuit, and it also has the functions of baseline storage and baseline elimination.
- Collect chromatographic signals and perform data processing. It is compatible with operating systems such as WinXP, Win2000, and Windows7. Sampling data can be read in from CDF files that comply with A/A (American Society for Testing and Materials) standards, enabling connection with chromatographic workstations from brands like Agilent and Waters.
- The chromatography system with complete independent intellectual property rights has a standard MODBUS/TCP interface, which can be easily connected with the DCS.
- The instrument can be compatible with automatic sample injectors produced by multiple domestic and foreign manufacturers, such as Shimadzu's AOC-20i, and the HT series high-efficiency gas-liquid automatic injectors from Italian company HTA, etc.
- The perfect center-cutting design and the automatic valve-switching control system enable users to complete complex multi-dimensional chromatography analysis tasks.

1.3. Introduction and technical specifications

The ZHIYI-1123 gas chromatograph is composed of an injector, detector, chromatographic column box, gas flow control system, circuit control detection system and chromatography workstation, etc.

1.3.1. Introduction

The ZHIYI-1123 networked series gas chromatograph can be classified into various products such as Plus, A, B, E, T, N (non-network transmission), M (portable and vehicle-mounted types) based on different configurations and functions. This manual only introduces the P type.

The instrument has fully absorbed the advanced technologies of similar foreign products and adopted the leading manufacturing technologies and processes in the domestic industry to ensure its reliability and trouble-free operation time. It not only can maximize the normal operation time, reduce the number of maintenance, but also has a more concise and reasonable structure and a more grand and elegant appearance. The intuitive keyboard operation and the convenient remote control software make it easy to learn and operate. The ZHIYI-1123 series network gas chromatography system can load the advanced electronic gas path control (EPC) system, providing industry users with industry-leading excellent quality and reliable results. This instrument has a unique network remote transmission and control function, making it possible to achieve unattended, decentralized monitoring and centralized control. The data analysis results can be connected to DCS to complete the statistics, analysis and monitoring of chromatographic component contents, improving the automation of the production process.

The ZHIYI-1123 gas chromatograph is widely used in various analysis fields such as petrochemicals, fine chemicals, biomedicine, environmental protection, food hygiene, high-purity gases, power, brewing, research and education.

The ZHIYI-1123 Plus and B series gas chromatographs all injection ports and detector gas paths can be controlled by electronic path control (EPC), thereby providing better retention time and peak area accuracy. Users can set various parameters such as gas flow rate, external events, temperature and detector through the reverse control software, and save all parameters of the analysis method. The digital circuit ensures that the setting values are consistent for each run and different operators. Therefore, users can achieve better retention time reproducibility and more consistent and reliable results, achieving twice the result with half the effort.

The ZHIYI-1123 networked gas chromatograph is equipped with an automatic liquid injector. The parameters can be controlled by the remote control software, which will result in better repeatability and higher efficiency, while eliminating the errors caused by manual injection.

1.3.2. Outstanding solutions

1) Gas analysis in power transformer oil (GB/T 17623-1998, DL/T 722-2000, DL/T 703-1999).

2) Underground coal mine safety gas analysis - Gas chromatography method (capable of conducting 24-hour continuous cyclic sampling and analysis at 32 points).
3) Air quality analysis (TVOC, benzene, total hydrocarbons, and non-methane total hydrocarbons) (in accordance with GB/T 50325-2001, GB/T 18883-2002, and GB16927-1996). Analysis of workshop exhaust gas and flue gas, as well as 24-hour continuous online analysis of VOCs, benzene, and non-methane total hydrocarbons in the flue gas.
4) Water Quality Analysis (Compliant with GB/T 5750-2006).
5) Analysis of various industrial gas types such as natural gas, refinery gas, cracking gas, and artificial gas (simple single-valve type, broad-spectrum process double-valve four-column economy type, broad-spectrum process three-valve four-column practical type, broad-spectrum process five-valve six-column high-end type, three-valve four-column TCD type, four-valve five-column dual TCD type, etc. In accordance with GB/T 13610-2003, UOP539, ASTM1945, ASTM D 1946 and GPA2261. Can be customized according to specific samples).
6) Gas and biogas analysis (six components: H2, O2, N2, CH4, CO, CO2, with unique single-valve sequential switching).
7) Sulfides in natural gas (Unique single-valve sequential shift-blowing method for detecting H2S and total sulfur).
8) High-purity gas analysis, industrial gas analysis for electronics (minimum detection concentration can reach over 20 ppb)
9) Analysis of benzene and toluene in gasoline (in accordance with ASTM D3606. SH/T 0713—2002).
10) Analysis of oxygen-containing compounds in gasoline (in accordance with AZTM D4815 and SH/T 0633-1998).
11) Analysis of benzene, toluene and aromatics in gasoline (in accordance with ASTM D5580-1995, SH/T0693-2000).
12) Analysis of hydrocarbon composition in gasoline (SOA), analysis of monomeric hydrocarbons in gasoline (detection of saturated hydrocarbons, alkenes, aromatics and benzene content, using a specially designed alkene adsorption trap. in accordance with SH/T 0741-2004).
13) Simulated distillation gas chromatography method (in accordance with SH/T 0558, ASTM D5307, D3710, D6352, D2887).
14) Blood ethanol analysis (in accordance with the standards of the Ministry of Public Security GA/T 105-1995).
15) Cigarette carton VOC (in accordance with YC/T 207-2006), drug residue analysis, ethylene oxide in medical devices (in accordance with GB/T 16886.7-2001), solvent residue detection in packaging materials.
16) Special gas chromatography method for greenhouse gases (CO2, CH4 and N2O, 0.1 ppm - 100%).
17) Catalytic evaluation, online analysis system under high pressure and high temperature (the system chromatography is customized according to requirements).
18) Process gas chromatograph (industrial chromatograph), construction of analysis room, multi-stream sample selection (up to 32 sample selections supported), sample pretreatment, etc.

1.3.3. Technical specifications





Main specifications:
1) The Plus series features a 5.7-inch dot-matrix Chinese-featured large-screen LCD display (with the option of a color touchscreen) and supports the switching between Chinese and English. The B series chromatograph main unit adopts a high-brightness vacuum fluorescent screen for display and has a fast and simple keyboard operation.
2) Manual control of the gas path and fully electronic gas path (EPC) control are optional. Network communication (using Ethernet interface IEEE802.3) is available. Computer-based full control operation is also possible.
3) Electronic gas path EPC control method
➢ The EPC electronic gas path control has an accuracy of 0.01 mL/min or 0.01 Kpa, ensuring better retention time reproducibility and more consistent and reliable results.

- EPC working mode: Constant current, constant voltage, and diversion mode.
- Program Pressure Control: 4-Stage
- EPC working gas: N2, H2, Air, He, Ar
- EPC control range: Pressure 0 - 0.6 Kpa. Flow 0 - 100 sccm or 0 - 500 sccm
- EPC control accuracy: Pressure 0.01 Kpa. Flow 0.01 sccm

1) Supports rapid heating with a maximum rate of 80°C /min, suitable for rapid analysis.
2) The temperature can be raised to 450°C, which is suitable for the analysis of samples with high boiling points.
3) Supports dual-column box and dual rear door opening mode.
4) The temperature increment of the column chamber is 1°C, with an accuracy of ±0.01°C. This level of precision is already comparable to that of high-end imported products of the same type.
5) 6 channels of external events, 2 channels of auxiliary control outputs.
6) Diversified injection system. options include packed column injection, capillary split/splitless injection, valve injection, liquid automatic injection, fully automatic headspace injection, pyrolysis injection, thermal desorption injection, and sweep-capture injection.
7) The configurable perfect center-cutting and valve-switching system helps users complete complex multi-dimensional chromatographic analysis tasks. The Plus model is a multi-purpose gas chromatograph specially designed for multi-dimensional application analysis and online analysis.
8) A wide variety of detector types are available. The Plus model can accommodate up to three detectors (the B type can install two detectors simultaneously): TCD, HTCD, uTCD, FID, FPD, ECD, NPD, ZD, PDHID, PID, AID.
9)The program supports the MPV system for multi-stream sample selection. It has functions such as automatic identification of valve numbers, automatic level determination, automatic reset, valve position selection, and valve position analysis memory. It can support up to 32 sample stream routes.
10) The unique network remote transmission and control function enables unmanned analysis, decentralized monitoring and centralized control.
11) The data can be connected to the DCS system via the MODBUS protocol, enabling the statistics, analysis and monitoring of chromatographic component contents, thereby enhancing the automation level of production process control.
12) Temperature control indicators:

- Temperature Control Channels: 8 Channels
- Column oven temperature indicator:

Column oven temperature range: 4°C to 450°C above room temperature (increment of 1°C).
Column oven temperature control accuracy: better than ±0.01°C.
Column oven temperature ramping: 16-step temperature increase.
Temperature rise rate setting: 0.1 - 39°C/min (standard type). 0.1 - 80°C/min (high-speed type).
Constant temperature time for each stage: 0 - 999 minutes (increment of 0.1 minute).
Program cooling: It takes only about 6 minutes to reduce the temperature from 260°C to 50°C.

- Injection system, detector, and thermal conductivity cell temperature indicators

Temperature range: 4°C to 450°C at room temperature (increment 1).
Temperature control accuracy: better than ±0.01°C.

1.3.4. Detector technical indicators

Hydrogen flame ionization detector (FID)

- Detection limit: ≦6×10-12g/s (n-hexadecane)
- Baseline noise: ≦1.8 × 10^-13 A
- Baseline drift: ≦6 x 10^-12 A per 30 min
- Linear range: ≧10^7

Thermal Conductivity Detector (TCD)

- Sensitivity: S≧ 3000 mV•ml/mg (benzene) (Choose from amplification factors of 1, 2, 4, or 8)
- Baseline noise: ≦20 μV
- Baseline drift: ≦50 μ V/30min

- Linear range: ≧104

1.4. ZHIYI-1123 Main configuration description

1.4.1. Gas flow control system

1.4.1.1. Overview of gas flow control system

The gas path control system configuration of ZHIYI-1123 gas chromatograph is as follows:

- Manual control, pointer pressure gauge pneumatic system
- Manual control, electronic pressure and flow digital display system
- Partial mechanical valves, partial electronic pneumatic control EPC system
- Fully electronic pneumatic control EPC system

① Carrier gas flow path

The carrier gas flow path is supplied with stable input pressure by the upstream pressure regulator valve (adjusted to approximately 3kg/cm² at the factory). It is divided into two gas paths via a three-way joint. The two paths of carrier gas are respectively regulated for flow rate through flow stabilizer valves (or EPC modules), and then further dried and purified through pipeline filters before entering injector A (and injector B).

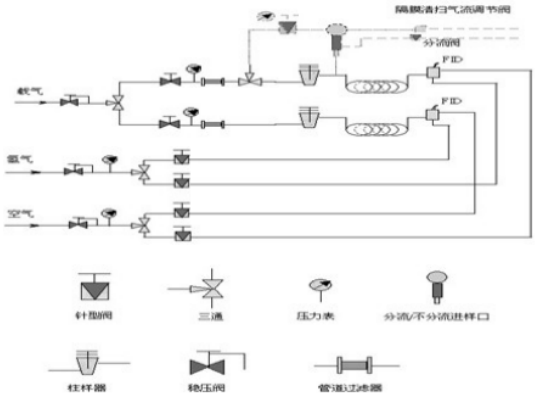
② Hydrogen flow path

The hydrogen gas flow path is supplied with stable input pressure by the upstream pressure regulator valve (adjusted to approximately 1 kg/cm² at the factory). It is divided into two gas paths via a three-way joint. The two paths of hydrogen are respectively regulated for flow rate through needle valves (or EPC modules) or gas resistors, and then enter the detector separately. The hydrogen adjustment knobs are located above the gas path box and can be seen by opening the cover.

③ Air flow path

The air flow path is supplied with stable input pressure by the upstream pressure regulator valve (adjusted to approximately 1.5 kg/cm² at the factory). It is divided into two gas paths via a three-way joint. The two paths of air are respectively regulated for flow rate through needle valves (or EPC modules) or gas resistors before entering the detector. The hydrogen adjustment knobs are located above the gas path box and can be seen by opening the cover.

The gas path rates are shown in the following diagram:



Pic1.6 Gas flow chart

Warning 1: The pressure regulator valves for each gas path (located at the rear of the gas path system) have undergone strict debugging at the factory. Do not adjust the output pressure of the gas path pressure regulator valves by yourself, as this may affect the validity of the scale-flow curve or the output accuracy!

Warning 2: The rotary knobs of the pneumatic needle valve and the steady flow valve should not be rotated to the bottom to avoid damage to the valve components! When it is necessary to turn off the gas, you can directly close the switch valve on the purifier or close the main valve of the steel cylinder!

1.4.1.2. Electronic gas pressure and flow measurement system

When using manual mechanical valves (steady flow valves, steady pressure valves) for gas flow and pressure control, traditional pressure gauge measurement methods can be used, or electronic gas pressure and flow measurement systems can be used. This can greatly improve the accuracy of pressure display and display the gas flow rate in real time, making it convenient to use.

When using a fully electronic gas pressure and flow measurement system, it is necessary to configure an electronic gas pressure and flow measurement module. This module is manufactured using high-quality pressure sensors, flow sensors and temperature compensation, as well as high-resolution digital circuit design. It features accurate measurement and stable performance. Additionally, it internally integrates pressure-flow calculation algorithms (capillary) for various gases, making the instrument's pressure and flow clearly visible at a glance. The main specifications of this module are:

- Pressure sensors: 13 (Maximum)
- Pressure measurement range: 0-0.3kPa
- Pressure measurement resolution: 0.01kPa
- Pressure-flow calculation algorithms: 13 channels. (with automatic temperature and atmospheric pressure compensation algorithms)
- Flow measurement sensors: 3 channels (maximum). Gas types: nitrogen, hydrogen, air, helium.
- Flow measurement range: 0～500 sccm

Warning 1: When the instrument is equipped with this module, the actual insertion position of the sensor must be strictly consistent with the configuration parameters of the instrument. Therefore, the insertion position of the sensor and the gas path configuration parameters of the instrument cannot be arbitrarily modified after leaving the factory. If you need to make changes, please consult the manufacturer!

Warning 2: When the instrument is equipped with this module, the instrument's gas path configuration parameters (capillary column and gas resistor configuration) must not be modified arbitrarily. After replacing the capillary column or gas resistor, the parameters should be modified according to the actual values. Otherwise, the gas flow calculation results will be incorrect. If modification is required, please consult the manufacturer!

Note: When an electronic gas control EPC module is used for a certain gas path, the pressure and flow rate of the gas path will be generated by the EPC module.

1.4.1.3. EPC, EFC control system

The electronic pneumatic EPC control system is a gas micro flow control system designed and manufactured using high-precision proportional valves, pressure sensors, and flow sensors. Compared to traditional mechanical valve control methods, it greatly improves gas pressure and the accuracy of flow control, enhances the automation level of instruments, eliminates the shortcomings of traditional mechanical valves that cannot compensate for temperature, and thus improves the overall performance of instruments!

The ZHIYI-1123 can be equipped with a single-channel or three-channel EPC control module. The instrument can be configured with a maximum of 24 channels for gas pressure and flow control.

All operations of the EPC control module are implemented on the workstation and instrument keyboard.

Note: When the EPC control module operates on carrier gas, hydrogen gas, or air, the minimum working pressure is 0.1kPa, If the pressure is lower than this, the instrument will automatically shut down.

Note: When the EPC control module is working on diversion, blowing, and tail blowing, it will not make a judgment on the input pressure. However, when the module cannot complete the set value you entered, an error message will be displayed.

Note: When the EPC control module is operating in pressure mode, if the output pressure you set is greater than the input pressure, the module will not work and will give an error message.

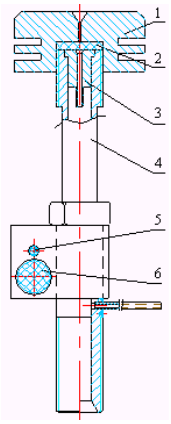
1.4.2. Column oven

The column oven volume of ZHIYI-1123 gas chromatograph is large, making it easy to install packed columns or capillary columns. Built in high-power heating wire and equipped with a rear door structure, greatly improving the speed of temperature rise and fall. The temperature control protection of the column oven adopts dual software (see keyboard settings section) and hardware protection (fuse, see host accessories) to ensure the safety of the chromatography column. The heating wire of the column oven is hidden behind the mesh plate to avoid peak splitting of the elastic quartz capillary column caused by thermal radiation.

The column oven adopts a low-noise motor and high-quality stainless steel fan blades to accelerate temperature equilibrium inside the column oven, ensuring stable instrument operation and minimal machine vibration.

1.4.3. Injector

The injector of ZHIYI-1123 gas chromatograph is installed on the top left front side of the column oven, and its structure is shown in Pic 1.7. Set and control its temperature by a microcomputer controller. The top of the injector is a heat dissipation cap, and the lower part of the heat dissipation cap is embedded with a silicone rubber injection pad. The carrier gas inlet of the sampler is connected to the output port of the steady flow valve in the pneumatic control system.



1 Cooling Cap 2 Injection pad 3 Guiding element 4 Vaporizing tube 5Platinum resistance 6 Heating pipe

Pic 1.7 Schematic diagram of injector structure

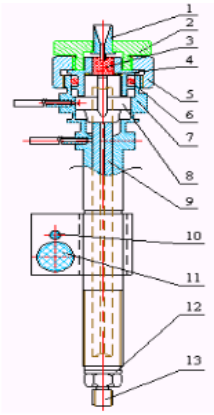
Note:

① The ZHIYI-1123 gas chromatograph is equipped with multiple injectors for simultaneous installation of multiple packed chromatography columns.

② The injector of ZHIYI-1123 gas chromatograph can be directly installed with a packed column with an outer diameter of Φ 6mm. By installing different liners, packed columns with outer diameters of Φ 3 and Φ 4mm can also be installed.

③ The injector of ZHIYI-1123 gas chromatograph can also be composed of a split injector or a non split injector by installing a capillary split liner attachment or a capillary non split liner attachment. In this way, the sampler of the chromatograph can be installed with various stainless steel, glass, or flexible quartz glass capillary columns of different diameters.

④ The ZHIYI-1123 gas chromatograph can be equipped with a dedicated capillary diaphragm cleaning splitter to achieve capillary split/non split injection. As shown in Figure 1.8.

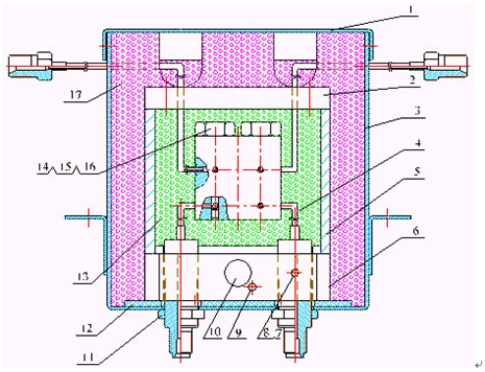


1 Guide (capillary) 2 Nut (capillary) 3 Injector 4 Gasket 5 Hex nut 6 O-ring 7 Vaporization tube (capillary) 8 Sliding sleeve 9 Conduit 10 Platinum resistance 11 Heating wire 12 Gasket 13 Connector

Pic 1.8 Schematic diagram of diaphragm cleaning and diversion injector structure

1.4.4. Thermal conductivity detector (TCD)

The ZHIYI-1123 gas chromatograph can be equipped with a thermal conductivity detector (TCD). The structure of TCD detector is shown in Figure 1.9.



1 shell cover 2 cover 3 TCD box 4 TCD detector 5 conductor 6 base 7 screws 8 tablet 9 platinum resistance 10 heating wires 11 nuts 12 asbestos washer 13 washer 14 tungsten 15 glass beads of 16 nut 17 cotton insulation

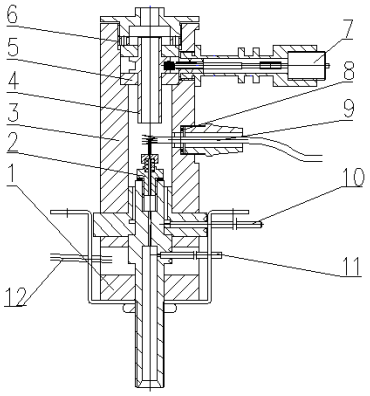
Pic. 1.9 Schematic diagram of the TCD detector structure

The structure and working principle of TCD is to process four symmetrical chambers in a thermal conductor, with one thermistor placed in each chamber. Among them, two chambers are measuring cells, and the other two are reference cells. The four arms of the Wheatstone bridge are composed of the thermistor elements in the measuring cell and the reference cell. The bridge is connected to the signal processing board of the thermal conductivity detector to control the operation of the bridge and the processing of chromatographic data. The thermal conductivity detector is also equipped with electric heating elements and temperature measurement sensors, which are connected to the temperature control system to control its heating temperature.

The TCD reference cell only passes through the carrier gas flow, and the components flowing out of the chromatographic column enter the measuring cell together with the carrier gas. When only the carrier gas flows through the reference cell and the measuring cell, and the same gas has the same thermal conductivity, the bridge is balanced and the chromatograph outputs a baseline signal. When injecting, the sample is separated and carried into the measuring cell by the carrier gas. Due to the difference in thermal conductivity between the carrier gas and the components, the balance of the bridge is disrupted, and the chromatographic instrument outputs peak signals.

1.4.5. Hydrogen flame ionization detector (FID)

FID detector belongs to the quality type detector, which not only has the characteristics of high sensitivity and wide linear range, but also is relatively insensitive to changes in operating conditions and has good stability. It is particularly suitable for routine analysis of constants or trace amounts, as it has a fast response and can be used in conjunction with capillary analysis technology to achieve rapid analysis of trace amounts. It is one of the most widely used detectors in gas chromatography instruments. The ZHIYI-1123 gas chromatograph can be equipped with two independent hydrogen flame ionization detectors. Figure 1.10 is a schematic diagram of the FID detector structure.



1.Hydrogen flame heating block 2. Nozzle 3. Hydrogen flame jacket 4. Collector 5. Insulation ring 6. Cover 7. Q9 connector 8. Gasket 9. Ignition electrode 10. Air 11. Hydrogen 12. Platinum resistance, heating wire

Pic.1. 10 Schematic diagram of the FID detector structure

The FID detector is placed at the top front end of the host. Its base is installed inside a thermal conductor, which is also equipped with electric heating elements and temperature measurement sensors, connected to a temperature control system to control its heating temperature. Polarized pole connected to FID high voltage output. The collection electrode output signal is connected to the FID microcurrent amplifier through a low-noise cable. Hydrogen and air enter from the joint of the gas path control system above the host through stainless steel pipes.

The principle of FID is that the tested sample burns in a hydrogen flame, generating an ion flow. Under the action of a polarized electric field, positive and negative ions are directed to move and reach the collection electrode, generating a weak current signal. After amplification and processing by a microcurrent amplifier, it is then transported to the chromatographic data processing system.

The ZHIYI-1123 gas chromatograph hydrogen flame ionization detector can be used as a single detector or as a dual detector that compensates for each other (such as when performing programmed temperature analysis).

Note:

① Do not open the hydrogen valve when the chromatographic column is not connected to prevent hydrogen from entering the column box. When the instrument is turned off, the hydrogen gas should be turned off first, cooled down, and then the carrier gas should be turned off.

② FID is a high-sensitivity detector that requires purified high-purity carrier gas, hydrogen gas, and air.

③ To prevent contamination of the detector, do not connect the column to the detector when it is aging, and seal the detector with a nut.

④ Before powering on, check whether the circuit connections are correct, whether the gas pipeline connections are complete, and whether the type of gas matches the requirements.

Warning: When the instrument is working, the polarization voltage is 220-250V high voltage. Please prevent electric shock!

Warning: Even if the instrument is turned off, there may still be high voltage remaining on the polarizing electrode! Please avoid electric shock! Only operate after connecting to ground!

1.4.6. Display screen and keyboard

The ZHIYI-1123 series gas chromatograph adopts a large touch screen display, allowing users to easily view the working status of the instrument at a glance. The keyboard design is simple and clear, with complete functions, easy operation, and easy to learn and use.

1.4.7. External event control and communication output (network type and serial type may not be consistent)

The external events of ZHIYI-1123 gas chromatograph are controlled within the instrument. The left column of the control motherboard is for air path control output, and the right column is for external event control output. Two terminals are grouped from top to bottom. The gas path control outputs are: carrier gas (nitrogen), hydrogen, air, ignition control. The external events are: Event 1, Event 2, Event 3 (or alarm output), Event 4 (or rapid cooling control) output.

The communication of the instrument adopts RS232 or 10M/100M adaptive Ethernet interface. Networked control is achieved through communication between a local area network and a workstation computer.

Note:

① In order to maintain the high resolution and stability of the instrument, a 24 bit AD circuit is integrated inside the instrument. Conventional analog signals are no longer output and can only be connected to our company's workstation.

② When event 3 (or alarm output) is used for alarm output, the third external event time program is not used (all reset).

③ When performing rapid cooling control for event 4 (or rapid cooling control), the time program for the fourth external event is not used (all reset).

1.4.8. Power switch

The power switch is the power switch of the instrument.

Warning: When turning on the machine and potentially touching electrical parts, unplug the power plug from the power source! Turn off the power switch, there is still high voltage present in some electrical components inside the chromatography instrument!

1.4.9. ZHIYI-1123 Chromatograph Network Workstation

Features and functions:

1. Communication method: networked communication, IEEE802.3 Ethernet interface.
2. The organic combination of chromatographic data processing and instrument anti control operation makes the operation convenient and the interface friendly.
3. The workstation software can set and control parameters such as heating zone temperature, heating zone name, user-defined switches, gas flow and pressure, program pressure control, program temperature rise and external events, automatic sampler, multi channel sample selection control, detector, etc.
4. The workstation supports multi-channel data processing for multiple chromatographs, with a maximum design support for connecting up to 5000 chromatographs. Single chromatograph data processing supports four channel signal processing, with the fourth channel being a virtual channel, which facilitates the data processing of multiple detector signals to be displayed on one graph, and has baseline flattening function.
5. The workstation software has integration time program settings, practical functions such as baseline locking, negative peak recognition, and negative peak flipping.
6. The data analysis results can be converted into PDF format for easy printing and copying.
7. Automatically generate folders named after the name of the chromatograph, automatically generate time, making it convenient for users to manage multiple chromatographs simultaneously.
8. NetChorm network version anti control workstation can remotely transmit the analysis results to the user's needs through various transmission modes (Internet, CAN bus, MODBUS bus, GPRS communication, 3G communication, wireless private network, etc.).
9. The analysis data can be easily uploaded to the DCS system, with 4mA to 20mA output, making it convenient for industrial online closed-loop control.
10. Adopting multi-threaded technology to achieve simultaneous collaborative work of signal acquisition, data processing, and user management.
11. Unique software architecture enables rich configuration of multiple monitoring seats in a system, and a single chromatograph supports simultaneous access to three IP addresses.
12.Equipped with analysis result extension communication interface, supporting user secondary development and function extension.
13. Unique spectral peak intelligent identification technology minimizes the need for user set spectral processing parameters, and basically achieves automatic processing of peak detection, baseline correction, and overlapping peak segmentation.
14. Sampling data can be read in from CDF files that comply with A/A (American Society for Analysis) standards, which can be integrated with chromatographic workstations such as Agilent and Waters.
15. Adopting a unique high fidelity digital filtering algorithm, it has strong anti noise interference ability and can detect weak peaks of the same level as baseline noise.
16. Data processing includes normalization, calibration normalization, single point correction (single point internal standard method, single point external standard method), and multi-point correction (multi-point internal standard method, multi-point external standard method).
17. The NetChorm network version workstation can also be equipped with a "component content monitoring system" to complete the statistics, analysis, and monitoring of chromatographic component content. It can be used in chemical product production (such as reaction, diversion, distillation, etc.) to perform data statistics, content change trends, threshold detection, and threshold alarms for each component of the sample, making the component content change trends clear at a glance. The data of the day or shift is automatically archived, eliminating the need for manual analysis of spectra, manual sorting of spectra, and manual judgment of results, and improving the automation level of the factory.

Specifications:

- Input voltage range: -2.5V to 2.5V
- sensitivity: 0.05 μV• s
- Minimum resolution: 1 μV
- Dynamic range: 10-7

- Linearity: ± 0.005%
- Repeatability: ± 0.005%
- Sampling period: 10, 20, 30, 40, 50 times/second adjustable.

1.5. Application environment of instrument

1.5.1. Installation environment

The ZHIYI-1123 gas chromatograph should be used within the temperature and relative humidity ranges of 5-35 °C and 0-85%, respectively. But it is best to use it in an environment that people feel comfortable with (appropriate constant temperature and humidity conditions). This way, the instrument can perform at its best and have the longest service life.

Do not expose the instrument to corrosive substances (whether gas, liquid, or solid), as it may harm the materials and components of the ZHIYI-1123 gas chromatograph.

The test bench for installing ZHIYI-1123 gas chromatograph must be stable. The vibration of the test bench can affect the stability of the instrument. In order to facilitate the discharge of hot air from the column oven, at least 30cm of space should be left behind the instrument (and flammable materials should not be placed behind!), as well as a 30-40cm passage for the installation and maintenance of the chromatograph.

The ZHIYI-1123 gas chromatograph requires 10/100M Ethernet. Ethernet can be built using HUB or switches.

1.5.2. Power environment

The power supply for the ZHIYI-1123 gas chromatograph is 220V ± 10% (50Hz ± 0.5 Hz), which can provide a power of not less than 2000W. In order to protect personal safety, the panel and casing of the ZHIYI-1123 gas chromatograph are grounded with a three core power cord according to the requirements of the International Electrotechnical Association.

Note: In order to reduce the electrical noise of the instrument, it must be well grounded.

Warning: It is strictly prohibited to replace grounding wires with water pipes, gas pipes, neutral wires, etc!

1.5.3. Gas environment

In order to achieve the optimal performance of ZHIYI-1123 gas chromatograph, the gas used must reach the corresponding purity level. We recommend the following purity values.

Detector	Gas Effect	Gas Name	Purity
FID	Carrier Gas	He or N2	≥ 99.999%
TCD	Carrier Gas	N2 or He	≥ 99.999%
ECD	Carrier Gas	N2	≥ 99.999% (Deoxy)
NPD	Carrier Gas	N2 or He	≥ 99.999%
FPD	Carrier Gas	N2 or He	≥ 99.999%
	Make-up Gas	N2	≥ 99.99%
	Fuel Gas	H2	≥ 99.99%
	Supporting Gas	Air	As clean and dry as possible

Suggest installing a purifier on the gas path! After using the gas purifier for a period of time, the molecular sieve and silica gel inside the gas purifier should be activated.

2. Install instrument

2.1. Unpacking of Instrument

After the instrument arrives, please check the quality of the outer packaging of the instrument in a timely manner. If there is any damage, please contact the manufacturer or seller immediately. After unpacking, please check the supporting components against the shipping order. If you find that the supporting components do not match or the appearance of the instrument is damaged, please contact the manufacturer or seller immediately to avoid unnecessary economic losses or delays in your work.

After checking for accuracy, please open the instrument column oven door and check if the motor fan impeller is running smoothly and if the fixing screws are loose. If there is any looseness, it should be promptly eliminated.

Please also check if there is a short circuit in the power plug. If there is a short circuit, do not connect the instrument to the mains power!

2.2. Installation of Instrument

After checking for accuracy, carefully place the instrument in a suitable position on the workbench. The workbench must be stable. Do not stack flammable materials behind the instrument and leave space for maintenance.

2.2.1.Installation of gas source

Before using the ZHIYI-1123 gas chromatograph, please refer to section 1.5.3 and provide a gas source according to the type of detector you need to use.

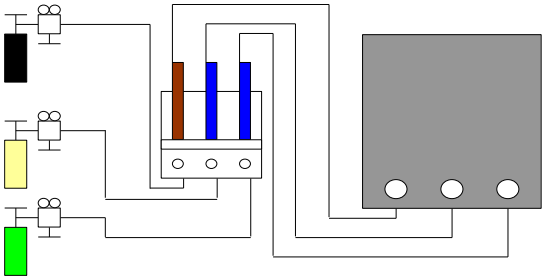
Please install the gas source in a safe location. If a steel cylinder gas source is used, the cylinder should be fixed to prevent tipping over and accidents. Regardless of the form of gas source chosen (such as gas generator, steel cylinder gas source, air compressor, etc.), it is necessary to carefully check whether the quality of the generated gas meets the gas source requirements of ZHIYI-1123 gas chromatograph. To avoid affecting the analysis results or causing contamination or even damage to the chromatograph!

2.2.2.Installation of pressure reducing valve

If using a steel cylinder gas source, the installation steps for the pressure reducing valve are as follows:

1. Unscrew the low-pressure outlet heads of two oxygen pressure reducing valves and one hydrogen pressure reducing valve respectively, connect the pressure reducing valve connector, and screw on the low-pressure output adjustment rod (do not tighten it).
2. Install the pressure reducing valve onto the steel cylinder, tighten the nut, open the high-pressure valve of the steel cylinder, and the high-pressure gauge of the pressure reducing valve should indicate.
3. After closing the high-pressure valve of the steel cylinder, the reading on the pressure gauge of the pressure reducing valve should not decrease, otherwise there may be a leak, which should be eliminated before use.

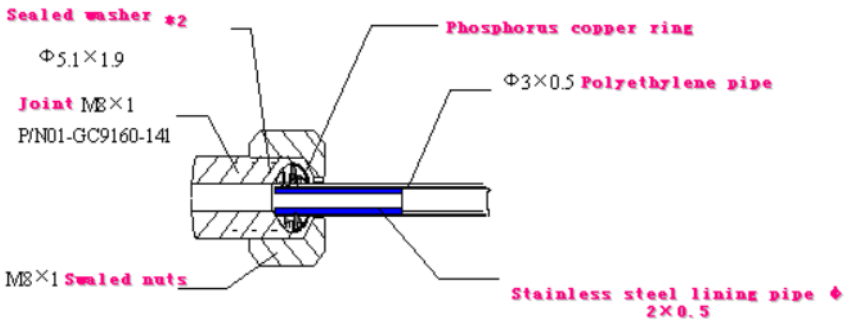
2.2.3.Installation of external air circuit



Pic.2.1 Schematic diagram of external gas circuit connection

The gas pipeline of this gas chromatograph is mainly made of Φ 3 x 0.5 polyethylene pipes (including main engine accessories) or Φ 3 x 0.5 stainless steel pipes (self provided). Cut the gas pipeline into six sections according to the required length, and connect the gas source - purifier - chromatograph as shown in Figure 2.1.

The connection method at the joint of polyethylene pipe or stainless steel conduit shall be operated as shown in Figure 2.2.

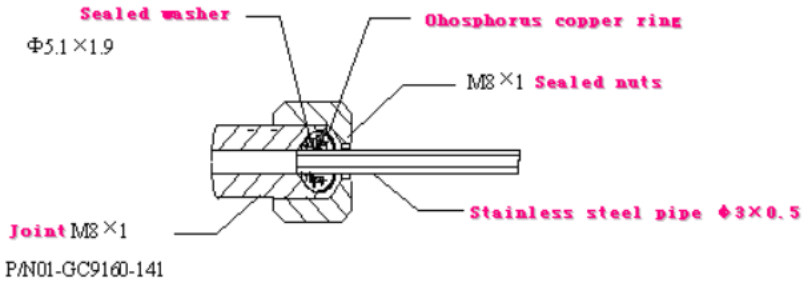


Pic.2.2 Schematic diagram of polyethylene pipe gas path connection

Note:

1. Cut an appropriate length of polyethylene pipe and insert a stainless steel lining pipe with a diameter of Φ 2 x 0.5 at each end.
2. Install the M8 x 1 sealing nut, phosphor copper ring, and 2 O-rings into one end of the polyethylene pipe.

3. Screw the M8 x 1 sealing nut onto the steel cylinder joint (M8 x 1) and tighten it to ensure good sealing.
4. Install the M8 x 1 sealing nut, phosphor copper ring, and 2 O-rings into the other end of the polyethylene pipe.
5. Screw the M8 x 1 sealing nut onto the corresponding connector (M8 x 1) of the purifier and tighten it to ensure good sealing.
The remaining external air connections are the same as above.
The ZHIYI-1123 gas chromatograph can also use stainless steel or copper tubes with an outer diameter of Φ 3 x 0.5 as connecting tubes for the external gas path. The connection method is shown in Figure 2.3:



Pic.2.3 Schematic diagram of the metal tube and gas connection

Note:
1. The gas diversion vent and detector vent should be connected to the outside through pipelines to prevent indoor air pollution caused by the analysis of toxic and harmful substances.
2. In practical operation, pay attention to frequent leak detection! Once a leak occurs somewhere, it can affect the normal operation of the instrument or cause accidents (such as a hydrogen leak that may cause an explosion)!
3. The pressure of the carrier gas input into the chromatograph must be within the range of 343KPa to 392KPa (equivalent to 3.5kg/cm2 to 4kg/cm2).
4. The pressure of air input into the chromatograph must be within the range of 294KPa to 392KPa (equivalent to 3kg/cm2 to 4kg/cm2).
5. The pressure of hydrogen input into the chromatograph must be within the range of 196KPa to 392KPa (equivalent to 2kg/cm2 to 4kg/cm2).
6. If hydrogen is used as the carrier gas, the inlet pressure of the carrier gas input to the chromatograph should be 343000 Pa (equivalent to 3.5 kg/cm2).

2.2.4. System leak detection

After the installation of the external air circuit is completed, leak detection should be carried out to avoid accidents. Perform leak detection according to the following steps:
1. Close all the carrier gas stabilizing valves, hydrogen gas, and air needle valves on the host.
2. Place the low pressure regulating rod of the steel cylinder in a relaxed state, open the high pressure valve of the steel cylinder, and slowly adjust the low pressure regulating rod until the low pressure gauge indicates 3 kg/cm^2.
3. Close the high-pressure valve of the steel cylinder. At this time, the low pressure gauge on the pressure reducing valve should not decrease. Otherwise, if there is a leak in the external air path, it should be carefully checked and eliminated.

2.2.5. Initial testing of system connectivity

After completing the above configurations, you can start the initial testing of the system's connectivity. Run the computer "NetChrom" network chromatograph workstation software separately and turn on the chromatograph power. If the online connection is normal, a colored (gray indicates that the chromatograph is not online) icon will appear in the "Chromatography Management" section of the "NetChrom Network Chromatography Workstation" software (below the icon is the ID code of the spectrometer). Double click the icon, and the right measurement function area will display the operating parameters of the instrument, while the spectrum area will show the baseline of the empty walk. At this point, the system operation can be carried out.

3. Operation of chromatographic instrument

3.1. Operation of display screen

The ZHIYI-1123 gas chromatograph is designed with 8 temperature control algorithms, which can independently set and control the temperature of 8 temperature control zones. And the chromatographic column box has a 16 stage programmed heating function. The rear door of the column oven will automatically open and close according to the temperature control algorithm of the column oven.

The ZHIYI-1123 series displays are all large LCD screens and can be optionally equipped with color LCD or touch screens. You can easily view the working status of the instrument at a glance. The keyboard design is simple and clear, with complete functions and easy operation. Because the keyboard operations of various models of ZHIYI-1123 instruments are similar, this book only provides a detailed introduction to the keyboard operations of the ZHIYI-1123 Plus series. Users of other models can refer to it.

The operation keyboard of ZHIYI-1123 gas chromatograph plus has a total of 20 operation keys and 3 status indicator lights:

Start button is the temperature control start key (pressed for the first time during startup) or the signal processing and program heating start key (after the temperature control state).

Attention: If the preparation light is not turned on, pressing the start analysis key will not work.

End button is a button used to stop program heating in the state of signal analysis or program heating.

Sleep button controls the display screen to turn off or on, without affecting the working condition of the instrument. Can extend the service life of LCD screens.

Injection button allows users to set and view automatic injection information.

Setup button is a button that allows the instrument to enter the setting state. After entering the setting state, the content to be set will be displayed in reverse.

↑ button is the flip up button on the display interface. In the setting state, the set position can be moved.

↓ button is the scroll down button on the display interface. In the setting state, the set position can be moved.

Input button is the confirmation button for setting parameters.

There are a total of 12 intermediate composite bonds. When setting the status, it is the upper part of the key, the "Delete" and "." function keys. When not in the set state, press the function keys shown in the lower part of the keys lightly to enter the corresponding interface display of the instrument.

Preparation The long on light indicates that the measured temperature of each control unit that allows temperature control has reached the set value, with the column furnace temperature being ± 1 °C of the set value and the others being ± 6 °C of the set temperature. At this time, the sample can be injected.

The continuous illumination of the fault light indicates that the instrument has malfunctioned and will display the cause of the malfunction. Users are advised to promptly troubleshoot the issue.

The online light that is on or off indicates that the instrument is working but not connected to the workstation. The light that is on or off indicates that the instrument is working and successfully connected to the workstation. Long bright or long dark indicates that there is an internal malfunction in the instrument that needs to be checked.

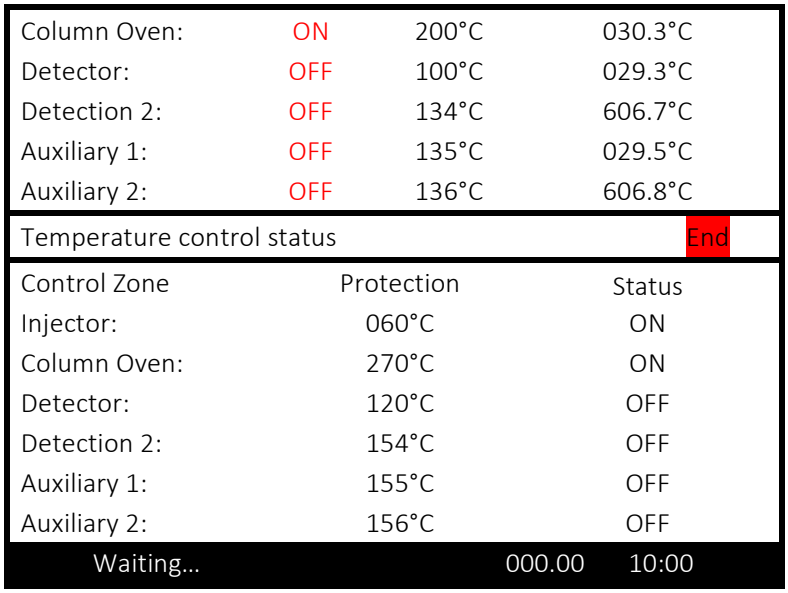
Note: After entering the setting mode, if there is no keyboard operation, it will automatically exit the setting mode after 5 minutes.

When the temperature control system malfunctions, it may cause temperature loss of control. When the measured temperature in any temperature control area reaches the set protection temperature, the microcomputer controller will automatically cut off the heating power and display an over temperature alarm in the status display area of the monitor (see the section on troubleshooting for details). When the temperature inside the chromatographic column oven exceeds 450 °C, the fuse inside the chromatographic column oven melts to cut off the heating power supply and protect the column box. Before restarting, the fuse must be replaced. The accessories of ZHIYI-1123 gas chromatograph are equipped with fuse links.

3.1.1. Viewing and setting of temperature control

When the instrument is turned on, press 'Temperature' button to enter the temperature display state, and you can view the operating status of each temperature control channel, as shown in the following figure:

Temperature	TPD	Event	Quantity of flow	File	Network
Control Zone		enable	Setting	Actual Measurement	
Injector:		ON	040°C	026.0°C	



Control Area is the name for displaying 8-channel temperature control, which has been configured at the factory. If modifications are needed, they can be made through workstation software, as detailed in section 4.2.2. The following only introduces the settings of the basic 6-channel temperature control.

Enable is to set the 6-channel temperature control to working or off state. 'ON' indicates the working state, while 'Off' indicates the closed state. When a certain temperature control is set to the "ON" state, the temperature control of that circuit will be in the heating temperature control state after pressing Start, and its temperature control error will be used as the basis for preparing the light to turn on. When a certain temperature control is set to the "off" state, the temperature control of that path is not in the heating temperature control state after pressing Start, and it is not related to the preparation light being turned on.

Setup is to display the set temperatures for 6 channels of temperature control.

Actual Measurement shows the measured temperatures for the 6 temperature control channels.

Protection is to display the protection temperature of 6 temperature control channels. The temperature is automatically calculated by the instrument based on the temperature set by the user and does not require modification.

Status shows whether the 6-way temperature control is in the heating state. This state is automatically calculated by the instrument based on the temperature control status and does not require modification.

Pressing Setup can cause a parameter to be displayed in reverse (this is the setting state, the same below!). If no setting is required, pressing Setup again can exit the setting. In the setting state, press the ↓ and ↑ keys to select and set other parameters, press the number keys to set parameters, and press Input to store the set parameters in the instrument and automatically enter the next setting. In the non setting state (no reverse display state on the interface), pressing the ↓ key or ↑ key can switch to other operation interfaces, and the parameter setting steps are the same.

Note: When setting the "enable" status for each channel, pressing Delete is the enable key. It can also be set up on the workstation.

Note: When parameters are changed, if Input is not pressed, the set parameters will only be used as display content and will not be saved or executed by the instrument, the same below.

3.1.2. Turn on or off the temperature control system

When the instrument is turned on, press Start temperature control button to enter the temperature control system. At this time, you will hear the sound of relay suction inside the instrument, and each temperature control area will be heated and controlled. At the same time, the "status" bar will display the heating status of each channel.

When the temperature of the column oven reaches the set ± 1 °C and the temperatures of all other enabled channels reach the set ± 6 °C, the "Ready" light will be turned on, and the status display area below the keyboard will also display the word "Ready".

Note: When the "preparation" light is on, pressing Start button again will start the workstation and enter the analysis state. At the same time, if the program heating parameters and external event parameters are valid, the instrument will enter both the program heating state and the external event control state simultaneously.

In the temperature controlled state of the instrument, pressing Close button will display the following interface:

Quantity of flow	File	Help	Stop Watch	Close	Version
Turn off temperature control?					
Note: After turning off the temperature control, follow the operating procedures to turn off the power and carrier gas!					

When the "Turn off temperature control?" in the interface is reversed, pressing the input key will turn off temperature control. At this time, you will hear the sound of a relay inside the instrument, and the rear door will automatically open for cooling. If you press the settings button, "Turn off temperature control?" will stop the reverse display, that is, exit the interface settings. At this time, press other keys to switch the interface.

3.1.3. Viewing and setting of program temperature rise

When the instrument is turned on, press the temperature programming button to enter the program temperature display state (or press the ↓ or ↑ button to enter in the non set state), as shown in the following figure:

Temperature	Temperature Programming	Event	Detect1	Detect2	Detect3
Initialization Time				005.0 min	
1 Order	10.0°C /min		250°C	010.0 min	
2 Order	00.0°C /min		000°C	000.0 min	
3 Order	00.0°C/min		000°C	000.0 min	
4 Order	00.0°C/min		000°C	000.0 min	
5 Order	00.0°C/min		000°C	000.0 min	
6 Order	00.0°C/min		000°C	000.0 min	
7 Order	00.0°C/min		000°C	000.0 min	
8 Order	00.0°C/min		000°C	000.0 min	
9 Order	00.0°C/min		000°C	000.0 min	
10 Order	00.0°C/min		000°C	000.0 min	
11 Order	00.0°C/min		000°C	000.0 min	
12 Order	00.0°C/min		000°C	000.0 min	
13 Order	00.0°C/min		000°C	000.0 min	
14 Order	00.0°C/min		000°C	000.0 min	
15 Order	00.0°C/min		000°C	000.0 min	
16 Order	00.0°C/min		000°C	000.0 min	
Waiting...			000.00	10:02	

Programmed temperature rise refers to the process in which the temperature of the column oven needs to increase according to the set value during sample analysis.

Above the interface is the initialization time, which is the time required to wait for the start of heating up. The first column in the middle represents the order of ascent. The second column is the heating rate. The third column is the termination temperature. The fourth column is for holding time. At the bottom of the interface, the status display area will show the current running status of the instrument, the stopwatch will record the waiting time, and the current time.

Note: The parameter settings are the same as the temperature settings in section 3.1.1.

Note: When the program temperature is terminated, the temperature setting should be higher than the set temperature of the column furnace, and the next stage temperature should be higher than the previous stage temperature.

Note: When the heating rate of a certain stage is 0, it will render the programmed heating of that stage and subsequent stages invalid. A first order heating rate of 0 will render the entire program heating content invalid.

Program heating operation:

When the instrument is turned on, press the start temperature control button to enter the temperature control system. When the instrument is in the "ready" state, press the start analysis button again to start the programmed temperature control of the instrument. The stopwatch (00.00) in the status display area will start timing. At the same time, it will also display which stage the program has reached, such as NO.01 indicating that the first stage of program heating is being executed, and so on.

When the chromatograph executes the heating program and enters the initial temperature holding state, the display area shows "initial temperature".

When the chromatograph executes the heating program and enters the heating state, the display area shows "heating up".

When the chromatograph executes the temperature rise program and enters the temperature holding state, the display area shows "hold".

When the chromatograph executes the heating program and enters the cooling state, the display area shows "cooling".

After the instrument completes a complete program heating cycle, the stopwatch in the status display area will end timing and reset to zero. The instrument will automatically open the back door of the column oven to quickly reduce the temperature inside the column oven to the initial temperature, shortening the cooling time of the instrument. When the temperature inside the column oven drops to the initial temperature (±1 °C), the "Ready" light is lit again, waiting for the next program to start heating up. So repeatedly.

When the instrument is executing the program temperature rise, pressing the "End Analysis" button under the temperature control system will interrupt the program temperature rise state. The stopwatch (00.00) in the status display area will end timing and reset, and the instrument will return to the constant temperature state.

3.1.4. Viewing and setting of external events

When the instrument is turned on, press the event button to enter the external event time program display state. As shown in the figure below:



Note: The parameter settings are the same as the temperature settings in section 3.1.1.

Note: When the third time program is set to all 00, the output of the third external event is an alarm signal. When the third time program has non-zero parameters, the output of the same 1 and 2 time programs will be used.

Note: When the fourth time program is set to all 00, the output of the fourth external event is rapid cooling control. When the fourth time program has non-zero parameters, the output of the same 1 and 2 time programs will be used.

3.1.5. Viewing and setting of detectors

When the instrument is turned on, press detect1, detect2, and detect3 to view and set the installed detectors separately. When a detector is not installed at a certain position, the system will display:

Detector not installed Please check!

When 1-3 detectors have already been installed, pressing the detect1, detect2, and detect3 keys will automatically display the following interface:

When FID1 is installed, it displays:

FID1 Polarity 0	Range 10	20 times/s
Empty baseline	Deducting Invalid	Ignition?
FPD1 signal:	0,000,000uV	

When FID2 is installed, it displays:

FID2 Polarity 0	Range 10	20 times/s
Empty baseline	Deducting Effective	Ignition?
FPD2 signal:	0,000,000uV	

When FPD1 is installed, it displays:

FID1 Polarity 0	Range 10	20 times/s
Empty baseline	Deducting Invalid	
FPD1 signal:	0,000,000uV	

When FPD2 is installed, it displays:

FID2 Polarity 0	Range 10	20 times/s
Empty baseline	Deducting Invalid	
FPD1 signal:	0,000,000uV	

When NPD1 is installed, it displays:

FID1 polarity 0	Range 10	20 times/s
Empty baseline	Deducting Invalid	Current 0.00A
NPD1 signal:	0,000,000uV	

When NPD2 is installed, it displays:

NPD2 Polarity 0	Range 10	20 times/s
Empty baseline	Deducting Invalid	Current 0.00A
NPD1 signal:	0,000,000uV	

The above detection ranges can only be selected by inputting "7", "8", "9" or "10". Entering other numbers is invalid and will sound an alarm. the same below

When ECD1 is installed, it displays:

ECD1 Polarity0	Base current 0.05nA	20 times/s
Empty baseline	Deducting Invalid	
ECD1 signal:	0,000,000uV	

When ECD2 is installed, it displays:

ECD2 Polarity0	Base current 0.05nA	20 times/s
Empty baseline	Deduction Invalid	
ECD2 signal:	0,000,000uV	

The range of the ECD detector can only be selected as input "0" or "1". '0' means to remain unchanged. '1' represents doubling the range. The base flow can choose to input six values: "0.05", "0.1", "0.2", "0.5", "1" or "2". Other values are invalid.

When TCD1 is installed, it displays:

TCD1 Polarity0	Bridge current 000mA	20 times/S
Empty baseline	Deduction invalid	
TCD1 signal:	0,000,000uV	

When TCD2 is installed, it displays:

TCD2Polarity 0	Bridge current 000mA	20 times/S
Empty baseline	Deduction invalid	
TCD1 signal:	0,000,000uV	

The input value range for selecting bridge current is 0-220mA. Other values are invalid.

Empty baseline "refers to the process of recording baseline drift data caused by programmed temperature rise before sample injection, when the instrument is in preparation and the baseline has stabilized (baseline drift does not exceed technical

specifications). After hovering the cursor over the empty baseline and pressing the input key, the instrument will automatically start the program heating (the program heating parameters are valid) and begin recording baseline data. Press the end button to stop empty baseline recording. The maximum recording time for an empty baseline is 2 hours and it is stored by the instrument. The stored empty baseline data is automatically updated at the beginning of the next 'empty baseline' command.
“Deduction is valid” and “Deduction is invalid”indicate whether the baseline stored by the instrument in the analytical state is involved in baseline deduction.
Note: The parameter settings are the same as the temperature settings in section 3.1.1.
Note: Polarity numbers can only be inputted as "0" or "1", other numbers are invalid. "0" means the output data remains unchanged, "1" means the output data changes sign, and the corresponding spectrum will be flipped.
Note: Currently, the sampling rate inside the instrument must be set to 20 times per second to accommodate the data processing software.
Note: If deduction is set to be valid, the baseline data stored inside the instrument must be the correct baseline, otherwise the output of the instrument will be in an unknown state.
Note: The operation of TCD detector must follow the rule of "ventilation first, temperature rise later, and then current". That is to say, when the TCD detector is not connected to the carrier gas, do not set the bridge current, otherwise it will damage the tungsten wire! When shutting down, be sure to first turn off the bridge current, then cool down, and wait until the TCD temperature drops to around room temperature before turning off the carrier gas!
Note: When operating TCD, please try not to use too high a current. High current operation will accelerate the oxidation of tungsten wire, which is detrimental to the lifespan of TCD detector.
Note: In order to prevent damage to the TCD detector, the bridge current setting value is used in the design of this machine to not be shut down and saved. When the machine is turned on, the TCD bridge current setting value is automatically set to 0 milliamps.
Warning: The presence of oxygen in the carrier gas can shorten the lifespan of TCD tungsten wires. The carrier gas must be thoroughly deoxygenated!

3.1.6. Gas protection function, viewing and setting of EPC module

Note: Electronic gas path control EPC includes electronic flow EFC control and electronic pressure control EPC (the same below).
This instrument can use mechanical valves or EPC modules to control the flow or pressure of the gas path. For detailed operation of mechanical valves, please refer to section 3.2 on gas flow control mechanical valves.
This instrument can be equipped with up to one "electronic pressure and flow measurement module" and 18 EPC intelligent modules. Each EPC intelligent module can operate in gas states such as nitrogen, hydrogen, air, helium, etc., and can be set to two working states: constant pressure and constant current.

3.1.6.1. Viewing and setting electronic pressure and flow rate

When the instrument is turned on, press the flow key to enter the gas parameter display state. When the instrument is not equipped with EPC or EFC intelligent modules, but is equipped with traditional mechanical valves to control gas flow, and electronic pressure and flow sensors are used to measure pressure and flow, pressing the flow button will display the following:

N2: 000.00 H2: 000.00 AIR: 000.00
INJ1-EFC:
Column: 000.0sccm 000.00sccm
Split-flow: 000.0sccm 000.00sccm
Purge: 000.0sccm 000.00sccm
Split Ratio: 1/1 1/1
Programmed set: Initial Time000.0min
----Rate----------Hold----------Time-------
000sccm/min 000sccm 000.0min
000sccm/min 000sccm 000.0min

000sccm/min 000sccm 000.0min 000sccm/min 000sccm 000.0min
Mold Set: Steady Flow Gas Set: 0 Column: D=0.32mm L=015.000m Split-flow: D=0.10mm L=000.040m Purge: D=0.10mm L=000.040m
Kinds of gas: N_2: 0 H_2: 1 air: 2 He: 3

The first line displays the pressure after the pressure reducing valves for N2, H2, and AIR.

The middle section displays the set flow rate, measured flow rate, set split ratio, measured split ratio, and chromatographic column lift pressure (or flow rate) parameters of injector 1 (INJ1).

The lower part shows the working mode, gas type, and chromatographic column specifications of injector 1 (INJ1), as well as the gas resistance parameters used for diversion and purging.

At this point, pressing the ↓ and ↑ keys can view or set the EFC module parameters for Injector 2 (INJ2), Injector 3 (INJ3), Detector 1 (DET1), and Detector 1 (DET1).

Detector EFC display and setting interface:

N2: 000.00 H2: 000.00 AIR: 000.00
DET1-EFC: Hydrogen Gas: 000.0sccm 000.00sccm Air: 000.0sccm 000.00sccm Tail Blowing: 000.0sccm 000.00sccm Tail blowing gas: 0 Hydrogen Gas: D=0.10mm L=000.040m Air: D=0.25mm L=000.040m Tail Blowing: D=0.10mm L=000.040m
DET2-EFC: Hydrogen Gas: 000.0sccm 000.00sccm Air: 000.0sccm 000.00sccm Tail Blowing: 000.0sccm 000.00sccm Tail blowing gas: 0 Hydrogen Gas: D=0.10mm L=000.040m Air: D=0.25mm L=000.040m Tail Blowing: D=0.10mm L=000.040m

Press the settings button to set pressure, flow rate, gas type, working mode, chromatographic column parameters, and gas resistance parameters. The parameter setting is the same as the temperature setting in 3.1.1.

Note: This parameter is only meaningful when the instrument is equipped with "electronic pressure and flow measurement module" and "EPC and EFC control module".

Note: Gas type,column, bypass gas resistance, and purge gas resistance are extremely important parameters for the EFC control module. Only when configured correctly can the module function properly. The shunt air resistance and purge air resistance are configured according to actual production conditions when the instrument leaves the factory and cannot be modified by the user. If the data is lost or incorrect, please consult the manufacturer.

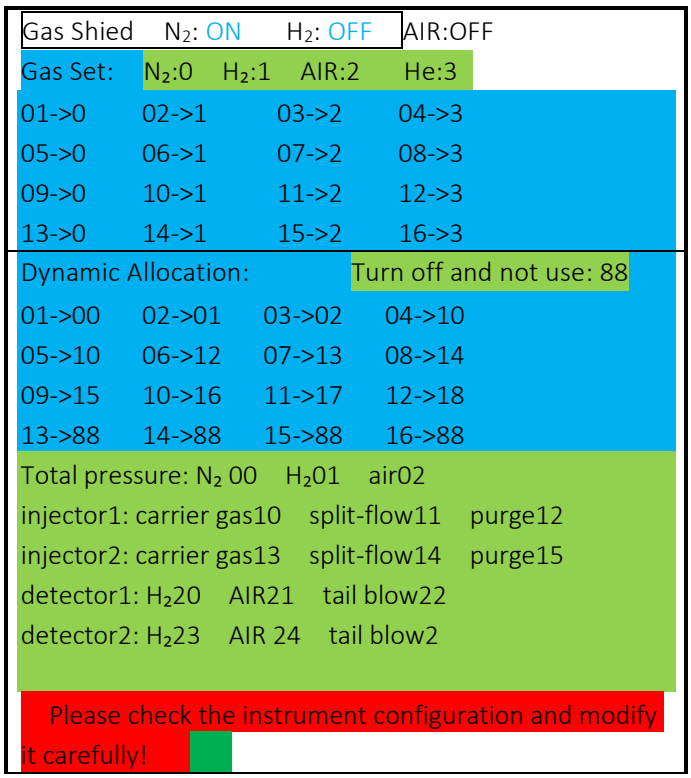
Note: When the EFC module is used for controlling the filling column injector, the chromatographic column parameters are meaningless.

3.1.6.2. Viewing and Setting for electronic pressure, gas configuration of flow measurement module and dynamic configuration parameters

The function of the electronic pressure and flow measurement module is to replace traditional pointer pressure gauges with pressure and flow sensors to measure the pressure and flow of the working gas. Compared to traditional pointer pressure

gauges, it has the advantages of precise measurement, intuitive display, and remote viewing of the instrument's working status.

When the instrument is equipped with electronic pressure and flow measurement modules, pressing the flow button and then pressing the ↓ button while in operation can view or set the gas configuration and dynamic configuration parameters of the gas protection, electronic pressure, and flow measurement modules. The interface is as follows:



Gas protection refers to the use of technical measures such as pressure sensors or EPC modules, and the user's setting of the instrument to automatically shut down temperature control and TCD detector bridge flow when the input pressure of a certain gas does not reach 0.1 MPa. When set to "on", the instrument automatically shuts off when the pressure of this gas path is less than 0.1 MPa. When set to 'off', this gas pressure will not participate in gas protection.

When the instrument is not equipped with hardware for "gas protection" (such as pressure sensors or EPC modules), the setting no longer has any meaning and the instrument can be turned on normally, but without protection function.

The electronic pressure and flow measurement module is installed behind the column box, designed with 13 pressure sensor interfaces and 3 flow sensor interfaces. Among them, channels 1-13 are pressure sensor interfaces, and channels 14-16 are flow sensor interfaces.

The pressure measurement of channels 1-13 of the module is independent of the working gas. But to calculate the flow rate of this gas, the following parameters must be set correctly: gas setting (nitrogen: 0, hydrogen: 1, air: 2, helium: 3), capillary and gas resistance configuration (see next chapter).

To meet the different instrument configuration requirements of users, this module adopts a dynamic configuration approach. Dynamic configuration "refers to the ability to configure the 1-16 sensor interfaces of a module to meet the needs of any detection location.

For example, if the first circuit is configured as nitrogen total pressure, simply set "01->00". Configure as total air pressure, simply set "01->02".

Configure as carrier gas 1 column head pressure, only need to set "01->10". When it is necessary to turn off the calculation of this path, simply set "01->88".

The setting methods for "gas setting" and "dynamic configuration" are the same as the temperature setting in 3.1.1.

Note: Each instrument is installed and configured according to your needs when it leaves the factory. The "configuration record" randomly provided is posted on the back of the circuit box cover, please keep it carefully!

Note: If you need to change the configuration while using it, please carefully check the actual installation positions of sensors 1-16 and configure them correctly in the configuration parameters. Otherwise, it will cause display parameter errors.
Note: This parameter is only meaningful when the instrument is equipped with "electronic pressure and flow measurement module" and "EPC and EFC control module".
Warning: Please do not change the parameters of the instrument configuration unless there is an error!
Warning: After disassembling and assembling gas pressure sensors, flow sensors, or gas circuits, be sure to carefully check for leaks to prevent explosions!

3.1.6.3. Viewing and setting of capillary parameters or gas resistance parameters for electronic pressure and flow measurement modules

When the instrument is equipped with electronic pressure and flow measurement modules, pressing the flow key and then pressing the ↓ key twice while in operation can view or set the capillary parameters or air resistance parameters of the electronic pressure and flow measurement module. The interface is as follows:

Fine column and air resistance configuration:	
Air Resistance01: D=0.10mm	L=000.115m
Air Resistance02: D=0.10mm	L=000.115m
Air Resistance03: D=0.10mm	L=000.115m
Air Resistance04: D=0.10mm	L=000.115m
Air Resistance05: D=0.10mm	L=000.115m
Air Resistance06: D=0.10mm	L=000.115m
Air Resistance07: D=0.10mm	L=000.115m
Air Resistance08: D=0.10mm	L=000.115m
Air Resistance09: D=0.10mm	L=000.115m
Air Resistance10: D=0.10mm	L=000.115m
Air Resistance11: D=0.10mm	L=000.115m
Air Resistance12: D=0.10mm	L=000.115m
Air Resistance13: D=0.10mm	L=000.115m
Air Resistance14: D=0.10mm	L=000.115m
Air Resistance15: D=0.10mm	L=000.115m
Air Resistance16: D=0.10mm	L=000.115m

The "D" of the air resistance parameter is the inner pore diameter of the capillary column or air resistance. L "is the length of the capillary column or gas barrier. Due to the fact that the calculated gas flow rate is proportional to the fourth power of 'D' and inversely proportional to 'L'. So the correctness of setting this parameter directly affects the accuracy of the settlement result.
The randomly equipped air resistance has undergone strict calibration and correction, and this value cannot be arbitrarily modified!
After installing or replacing the capillary column, the nameplate of the column (or consult the capillary column manufacturer) should be checked to correctly input the inner diameter and column length. To avoid discrepancies between the flow rate calculated by the instrument and the actual flow rate, which may delay your testing.
The setting method for "capillary column and air resistance configuration" is the same as the temperature setting in 3.1.1.
Note: This air resistance parameter is for the electronic pressure and flow measurement module and is not related to the EFC control module.
Note: Each instrument is installed and configured according to your needs when it leaves the factory. The "configuration record" provided with the random device is posted on the back of the circuit box cover, please keep it carefully!
Note: Channels 14-16 of the module are interfaces for flow sensors, and the "capillary column and air resistance configuration" parameters for channels 14-16 are not related to flow measurement!
Note: This parameter is only meaningful when the instrument is equipped with an "electronic pressure and flow measurement module".

3.1.6.4. Zero adjustment of electronic pressure and flow rate

To facilitate production and user zeroing after replacing sensors, an interface for "electronic pressure and flow zeroing" is designed in the instrument.

Press the ↓ and ↑ keys to select the "stopwatch" interface, which will display:

Dete1	Dete2	Dete3	Stopwatch	Injection	Regarding
Stopwatch function Set soap bubble flow meter reading: 50ml Actual gas flow rate: 000.0 ml/min					
EPC&EPC zeroing Disconnect all gas sources Turn on the power for 15 minutes and reach thermal equilibrium Zero adjustment?					

Press the "Settings" button to enter the settings mode, press the ↓ and ↑ keys to select "Zero Adjustment", and press the "Enter" button.

Warning: Do not perform this operation with the gas source turned on! Otherwise, it will result in unpredictable measurement results!

3.1.7. Viewing and setting of execution files, automatic injection time, screensaver, clock, and language

When the instrument is turned on, press the time key to enter the display state of the time parameter. As shown in the following interface:

Temperature	Temperature Programmed	Event	Flow	File	Network
The currently executing file: No.1 files					
Gas autosampler program settings Automatic sampling 0006 times at intervals of 008.0 minutes (Start mold 0-1-2s Sampling for 999.9 minutes)					
Screen time: 05 minutes (when 99 is normally on) FID,FPD detector ignition time: 3 s Clock set: 10/06/21 14:09:20 Language choice:0 0:Chinese 1:English					
Machine number: 60F9-990A-4A48-485D Mainboard version: GCM-SUN-V2-1005 Display versions: GCD-SUN-V3-1005 EPC version: GCF-SUN-V1-1006 DEF1 version: GCT-SUN-V1-0911 DET2 version: GCT-SUN-V1-0911 DET3 version: GCF-SUN-V1-0911					
Waiting... 00.00 10:02					

Note: The parameter settings are the same as the temperature settings in section 3.1.1.

Save 8 instrument operating parameter files in this instrument. You can choose files 0-7 as the files currently being executed by the instrument. After replacing the executable file, the instrument will be reinitialized. This will take a few seconds.

Injection: 0006 times "means to have the system automatically complete 6 injections. When it is 0 times, the automatic injection program will not be started. When it is 9999 times, the instrument is not limited by the number of injections and will permanently perform automatic injection until manually stopped by the user.

Interval: 008.0 minutes "represents the time interval during which the system performs automatic sampling. It includes automatic repeated program heating (when the program heating parameters are valid), external event time program (when

the time program parameters are valid), and remote start of workstation software for analysis. When the score is 0, the automatic injection program will not be started.

Screen saver "automatically turns off the backlight after a set time without pressing any keyboard.

FID, FPD detector ignition time setting. It can also be operated directly through the keyboard, as explained in detail later.

The 'clock' is the real-time clock inside the instrument, which includes year/month/day, hour: minute: second. The clock can also be modified remotely through workstation software.

Note: When the screensaver time is set to 99 minutes, the backlight is not turned off.

Note: When turned on, the screensaver time defaults to 5 minutes. When any keyboard is pressed, the actual screensaver time will be the set screensaver time.

Note: Turning off the backlight will cause a sudden change of 10-20uV in the FID baseline. To avoid affecting the analysis, please adjust the backlight time to an appropriate value or set it to 99 minutes.

Note: When in the "ready state" and the number of injections and injection interval time are not zero, pressing the start button or starting the analysis on the workstation software will enter the "automatic injection time" execution state, and "INJ0001" will flash in the status bar. 'INJ0001' indicates that the instrument has entered automatic injection mode and is currently analyzing the 0001st sample.

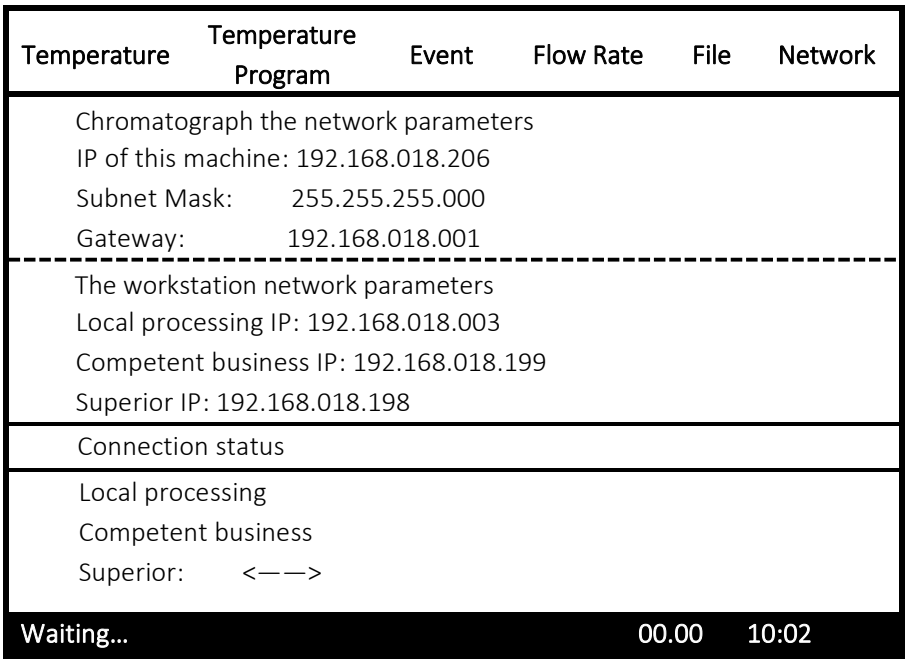
Language selection, 0 represents Chinese operation interface, 1 represents English operation interface. You can also switch the operating interface directly by language, which is more convenient.

Note: The machine number below is an electronic tag automatically generated by the chromatograph and cannot be modified.

Version information refers to the software version information of each component of this instrument and cannot be modified.

3.1.8. Viewing and setting network parameters

When the instrument is turned on, press the network button to enter the display state of network parameters. As shown in the following interface:



Note: The parameter settings are the same as the temperature settings in section 3.1.1.

Note: When modifying the network parameters of the chromatograph, it will interrupt the connection between the chromatograph and the workstation, and attempt to initialize the network parameters of the chromatograph itself and reconnect it to the workstation.

Due to the complexity of Ethernet technology, it is difficult to describe it clearly in limited space. Please refer to relevant books or have the network administrator set the IP address information. Here is only a basic description.

The 'local IP' refers to the IP address of this chromatograph. Generally, set an IP address that is on the same network segment as the enterprise LAN and is not used by other instruments or computers.

Subnet Mask "sets the same subnet mask used for the local area network of this enterprise. Generally 255.255.255.0.

Set up a gateway that is the same as the one used in the local area network of this enterprise. Generally, it is 192.168.1 ×. 1
Local processing "refers to the IP address of the computer where the workstation software is working. That is, set the IP address of the computer where the workstation software works. This parameter must be set correctly, otherwise the chromatograph will not be able to connect to the workstation software.
The IP address of the computer where the workstation software works can be viewed in the "Internet Protocol (TCP/IP)" attribute of the "Local Connection" attribute in the "Network Neighborhood" property. You can also use the "IPCONFIG" command in the command state of the operating system to view it. (See section 4.2.2 for details).
Business supervisor "refers to the business supervisor of the unit (such as chief engineer, quality inspection supervisor, etc.) who installs workstation software on the IP address of their own computer to monitor the operation status and analyze data of the spectrometer. If you want to use this function, this parameter must be set correctly, otherwise the chromatograph will not be able to connect to the business supervisor's workstation. Of course, if the business supervisor does not pay attention to the operation status and analysis data of the chromatograph, they do not need to install workstation software, as long as the IP address is set to an IP address that is not used within the local area network.
"Superior supervisor" refers to the public network IP address of the monitoring system (usually via the Internet) established by the superior administrative units of the unit (such as the Technical Supervision Bureau, the Health Bureau, the Environmental Protection Bureau, etc.) to monitor the operation status of the chromatograph and analyze data. If the superior does not have such a requirement, simply set the IP address to an unused IP address within the local area network. The<-->symbol is displayed after the "superior supervisor" to indicate that the chromatograph and workstation have been successfully connected. If there is no such display, the chromatograph has not been successfully connected to the workstation.
Note: In the case of a local area network, the IP address of the chromatograph and the IP address of the workstation computer must be in the same network segment. Namely: The first three sets of data for the IP address are consistent!
Note: The IP address of the chromatograph and the IP address of the workstation software computer cannot conflict (be consistent) with the IP addresses of other network devices.
Note: The IP address of the chromatograph operates in static IP address mode. The function of 'automatically obtaining IP address' is not supported.
Note: As the working mode of the spectrometer is to automatically connect to the workstation after startup. For the stable operation of the system, the IP address of the workstation computer must be fixed. The IP address of the workstation computer should use static IP address working mode, and should not use the "automatic IP address acquisition" mode.
Warning: The local processing, business supervisor, and superior supervisor set in the chromatograph must not be the same! This will cause the baseline data of the workstation to be abnormal! If the business supervisor or superior supervisor does not use them, these two IP addresses can be set as non-existent IP addresses in the local area network.

3.1.9. Operation of timing stopwatch

The ZHIYI-1123 gas chromatograph is designed with a stopwatch (00.00). This stopwatch is used when the instrument is executing a temperature or time program. When the stopwatch is not in use by the system, users can use it for timing (such as measuring peak time, gas flow rate, etc.). Pressing the stopwatch button will start the stopwatch timer, and pressing the stopwatch button again will end the stopwatch timer.
The following figure shows the stopwatch interface:

Dete1	Dete2	Dete3	Stopwatch	Injection	Regarding
Stopwatch function Set soap bubble flow meter reading: 50ml Actual gas flow rate: 000.0 ml/min					
Disconnect all gas sources Turn on the power for 15 minutes and reach thermal equilibrium Zero adjustment?					

Note: The parameter settings are the same as the temperature settings in section 3.1.1.

Note: The stopwatch function key and delete key are compound keys, and they are stopwatch functions when not set. In the set state, it is the delete function key.

Warning: Do not perform "zeroing" confirmation when EPC&EFC zeroing is not required! Otherwise, it will result in unpredictable measurement results!

3.1.10. Viewing and setting of automatic sample injector

The "sampler" refers to the liquid sampler (such as AOC-20i, etc.) equipped with the instrument.

Press the ↓ and ↑ keys to select the "Injection" interface, which will switch to the "Injector" view settings interface. As shown in the figure below:

Dete1	Dete2	Dete3	Stopwatch	Injection	Regarding
Liquid autosampler program settings					
Order	No.	Injection	T/bottle	Interval	
1:	002-003	01.0uL	003	010min	
2:	000-000	08.0uL	000	000min	
3:	000-000	08.0uL	000	000min	
4:	000-000	08.0uL	000	000min	
Liquid autosampler parameter settings					
Automatic Sampler: model 0 inlet: 0					
Solvent cleaning before sampling: 000time					
Sample cleaning before sampling: 000time					
Solvent cleaning after sampling: 000time					
Pump sample times: 000time					
Viscosity Delay: 00.0s					
Sample Resides: 00.0s					
Sample Mode:0 needle speed: 0					
Stylet Speed:0 start delaying: 00.0h					
State: offline spare Current:003-001					

The upper part of the interface is used to set up the batch processing program for the automatic sampler. For example, from sample bottle 2 to sample bottle 3, each injection volume is 1 microliter, and each sample bottle is analyzed three times with a 10 minute interval between each analysis.

The middle part of the interface is used to set the basic parameters of the automatic sampler.

The lower part of the interface shows the current status of the automatic sampler, such as "online", "offline", "idle", "injection", etc. The current bottle number refers to the number of sample bottles and the number of needles on the sample screen that the automatic sampler has reached during actual injection.

Note: This parameter is meaningless when an automatic sampler is not equipped.

Note: The basic parameters of an automatic sampler are determined by the model of the sampler equipped. The parameters set for different models of automatic samplers may also vary slightly. Please carefully read the instructions for using the equipped automatic samplers!

Note: The basic parameters of an automatic sampler are determined by the model of the sampler equipped. The parameters set for different models of automatic samplers may also vary slightly. Please carefully read the instructions for using the equipped automatic samplers!

3.1.11. Ignition operation of FID

This instrument is designed with an automatic ignition function upon startup.

The condition for automatic ignition upon startup is:

- Install FID detector.
- The actual temperature of FID detector reaches to above 130° C, instrument will open air automatically.
- After the instrument open air, about 1 minutes, will automatically perform ignition.
- When the instrument automatically ignites, the air flow rate will be automatically reduced.

When the ignition conditions are met, it can also be manually ignited at any time.

FID manual ignition can be executed on the detector interface, or directly by pressing the ignition key on the keyboard (ignition function key for non set status, decimal point input key for set status), or directly operated in the workstation software. The ignition interval is automatically controlled by the time set by the "detector ignition duration of 3 seconds", and users do not need to intervene.

Note: The instrument is designed with an automatic air shut-off function: when it is in a non temperature controlled state and ignition conditions are not met (FID temperature does not reach 130 °C or above), the air will automatically shut off. At this point, the air is not open, which is a normal phenomenon.

Note: For the convenience of ignition, the instrument is designed with a function of "automatically reducing the air flow during ignition". It is a normal phenomenon.

Note: Electronic ignition components are optional. If the instrument is not equipped with an electronic ignition device, a lighter or ignition gun can be used for ignition.

Note: According to the actual application situation, the ignition time is generally set to 3 seconds. If it is too long, it will completely shut off the air and turn off when ignited. If it is too short, it is not easy to ignite.

Warning: The instrument is designed with an automatic ignition function after startup (when equipped with a FID detector). To prevent electric shock, do not disassemble the high-voltage discharge wire while the device is turned on!

3.2. Gas flow control operation

This instrument can adopt mechanical valve or EPC and EFC module to control the gas flow or pressure.

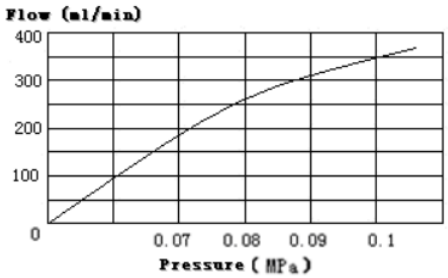
3.2.1. Operation of flow control by mechanical valve

The carrier gas path first go through the regulator valve to steady pressure , steady the pressure at about 0.3MPa (has been adjusted in factory , the user can not adjust by themselves!). Then the carrier gas go through the steady flow valve and output constant flow of carrier gas.

Adjust the "carrier gas flow regulating valve A" (or "carrier gas flow regulating valve B") and you can adjust the flow rate of carrier gas A (or carrier gas B).

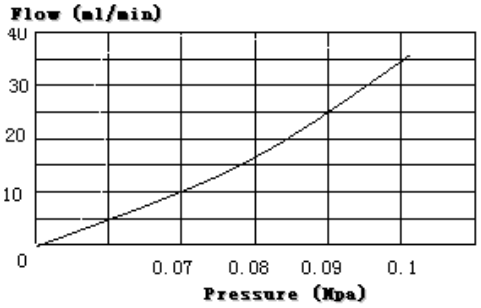
"A pre-column pressure A" (or "pre-column pressure A") the pressure indicator indicates the corresponding column load pressure.

The air through the regulator valve to steady pressure, steady the pressure at about 0.2Mp (has been adjusted in factory , the user can not adjust by themselves!). Then the air through secondary pressure regulator and combine fixed gas resistance to output flow of air. In the gauge 0.1Mp, the flow is 350ml/min, such as the instrument air flow curve shown in the table.



The air pressure-flow diagram of curves

The hydrogen gas first goes through the regulator valve to steady pressure, stable pressure at about 0.2MPa (has been adjusted in factory, the user can not adjust by themselves!). Then hydrogen go through secondary stage stabilized and combine fixed gas resistance to output flow of hydrogen. In the gauge 0.1Mp ,the flow is 35ml/min, such as the instrument of hydrogen flow rate curve shown in the table.



Hydrogen pressure - flow diagram

Note: When equipped with electronic pressure and flow measurement module, can read the pressure and flow numeral from the instrument directly ,you have no need of checking the curve above.

4. Maintenance of equipment

4.1. Clean the injector

The injector is easy to pollution, especially the generatingtube, it is more important to clean the sample injector, injector generatingtube can be directly worn wash by the solvent cotton balls, after worn wash blow with the air flow (mainly blow out of cotton fiber and dry solvents), and install the vaporization pipe gasket and seal nut.

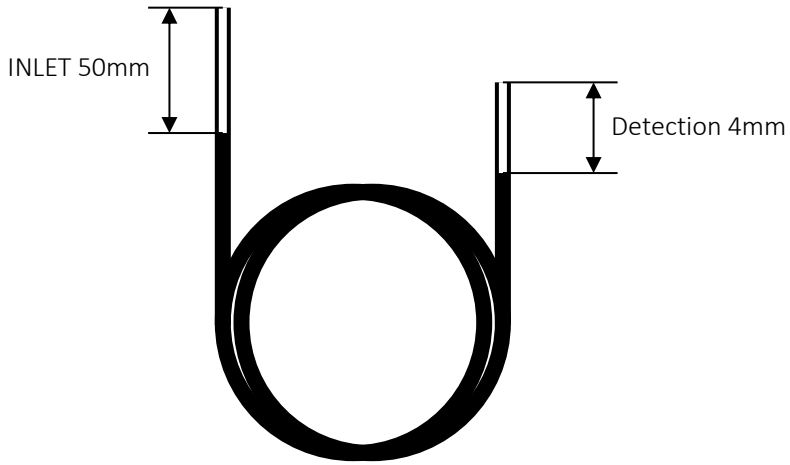
4.2. Cleaning of hydrogen flame ionization detector

Removable FID cover, remove the electrode and the insulating washer, cleaning and drying cover, electrode and insulating washer with acetone or alcohol. If the pollution is serious, can put the parts to be cleaned in ultrasonic cleaning liquid, after ultrasound, rinse with water clean and then cleaned with alcohol and drying. If it is stationary liquid contamination detector, select solvents can dissolve the stationary liquid to dissolve.

4.3. Installation of chromatographic column

4.3.1. Installation of filling column

Packed column's installation on the injector and detector is similar.One end of injector of packed column should be set aside an empty column enough (at least 50mm),in case that the syringe needle inserted reach to glass fiber or column packing filled in end-column. At other end of the detector, should also leave an empty column enough (at least 4mm), to prevent the nozzle end reach to glass fiber and packing filled in the end-column. As shown in figure 6.1:



Pic.6.1 Schematic diagram of leaving empty pipe of both ends packed column

Due to the rigidity of glass, glass filled columns must be installed at both ends of the injector and detector simultaneously. The installation program for each end is the same. For the column installation of the detector end, please refer to the corresponding chapter based on the detector used.

Connection of ZHIYI-1123 gas chromatograph with Φ3 and Φ4mm packed chromatography columns and injector. The installation steps are as follows:

1) Embolia theM10×1 Φ3mm diameter column nuts on both side of the column.

2) Install Φ3mm graphite ring on both ends of the column with diameter, and then install screened pip with corresponding inner diameter . Upward into the detector at the bottom (to push the end), tighten the nut.

3) The height of the chromatographic column should be adjusted according to specific requirements at the injector end, and the nut should be tightened.

4) Use neutral soap solution for leak detection, and there should be no air leakage.

5) Wipe off soap solution.

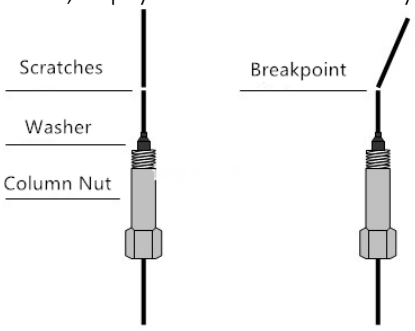
6) The installation steps for the Φ 4mm chromatographic column are the same as above.

Note: the sampling side of the packed columns should keep empty pipe of about 50mm length , con't go so far as to meet difficulty in sampling, the sampling end of chromatographic column can't be mixed up with detector , should make a mark when filling parked column. At one end of detector , should also leave an empty column enough (at least 4mm), to prevent the nozzle end contact to fill in the column end glass fiber or column packing.

4.3.2. Installation of capillary column

Fused silica capillary column is structured, don't need to be neatened. But on the ends of the column should be newly cut , glabrous, edge neat, get rid of particulate matter from column, stationary phase, sealing gasket, these are very important. Therefore, column end need to be new cut, with a suitable glass cutting tools, to scratch on the part will be cut. Generally first install column nuts and washers ,then cutting.

Note: wear protective glasses to prevent the flying particles produced by cutting glass or fused silica capillary column from damage your eyes. should also be careful to prevent skin injuries when disposing capillary column . Because the pillar has quite rigid, therefore in the treatment of capillary column, to pay attention to these very important.



Pic.6.2 Preparation of fused silica capillary column

The capillary column is wrapped around a metal frame, which is suspended on the capillary column frame inside the column box. The suspension position depends on the vertical axis of the frame, and it is best to place the column in the center of the column box. The two ends of the column extend from the bottom of the frame, smoothly bend towards the injector interface and detector interface, and do not let any part of the column touch the inner wall of the column box. When the graphite gasket passes through the column, it may contaminate the column. You can cut the column end according to the instructions in "Preparing a Molten Silicon Capillary Column".

4.4. Maintenance of gas purifier

In flow path control system, connected with a filter, which is arranged with 5A molecular sieve. 5A molecular sieve needs to be replaced or activation timely. Activation temperature is 260 °C, time is 24 hours.

4.5. Maintenance of gas purification pipes

In the flow control system, the carrier gas is connected to a gas purification pipe, which contains 5A molecular sieves. 5A molecular sieves need to be replaced or activated regularly. The activation temperature is 260 °C and the time is 24 hours.

5. Malfunctions and troubleshooting of instrument

5.1. Boot problem

5.1.1. Boot no response

Fault judgment	Methods of examination and repair
Problem of electric supply	Check the power supply
Blown fuse	Check fuse, and replace

Display does not light	Check the display panel

5.1.2.Not online

Fault judgment	Methods of examination and repair
Power supply board problem	Check+12V, +5V, +15V, -15V on power supply board
Electrical component RS485 problem	Demolish the signal board in turn, one by one to eliminate signal board problem
Display panel RS485 problem	Demolish the display board in turn, excluding signal board problem
Fault judgment	Methods of examination and repair

5.2. Chromatographic peak issue

5.2.1. No baseline

Fault judgment	Methods of examination and repair
Install test board without	Check whether inspection board is installed
Detection of fault	Change the inspection board
Baseline and background color set to the same color	Change the color
The sampling rate is not correct	Modification of the sampling rate (20 / sec)
The chromatograph and computer is not online	Check the network and network parameters

5.2.2. No chromatographic peak

Fault judgment	Methods of examination and repair
Sample injector temperature too low	Raise the temperature of sample injector
Injector clogging	Change injector
Amplifier power off	Check the amplifier
No carrier gas through	Check whether carrier gas flow road is blocked, the cylinders run out
Silicon rubber leakage	Change silicon rubber
No fire	Light
FID polarization voltage connecting badly	Eliminate polarization voltage connected bad phenomenon

5.2.3. Normal residence time and sensitivity decreased

Fault judgment	Methods of examination and repair
Sample injector leakage	Change sample injector
The sensitivity of the improper selection	Select proper sensitivity
The carrier gas leakage	Leak hunting and make corresponding processing
Hydrogen and air flow selected improperly (FID)	Adjust their flow
Detector without hypertension (FID)	Fit on high voltage

5.2.4. Peak tailing

Fault judgment	Methods of examination and repair
Sample tube polluted	Clean the sample tube
The chromatographic column temperature is too low	Raise the temperature of chromatographic column
Sample temperature too low	Raise the temperature of sample injector
The column selection	Choose proper column

5.2.5. Fronting peak

Fault judgment	Methods of examination and repair
The volume of goods is too large	Reduce the volume of goods

Sample agglutination in the system	Improve the column temperature first, and then select the proper sample injector, column, detector temperature

5.2.6. Poor chromatographic peak separation

Fault judgment	Methods of examination and repair
Column is too short	Choose longer column
Loss of stationary liquid	Change the column or aging chromatographic column
The column temperature is too high	Reduce the temperature
Incorrect selection of stationary liquid	Choose proper column
The carrier gas flow rate is too high or too low	Adjust the flow of carrier gas

5.2.7. Flat peak

Fault judgment	Methods of examination and repair
The input of the amplifier saturation	Reduced sample volume, reduce the amplifier sensitivity
The recorder zero position changes	Check the recorder zero position and make corresponding processing

5.2.8. Baseline mutation

Fault judgment	Methods of examination and repair
External electric field interference	To eliminate the effect of external electric field interference the normal operation of the instrument
Poor contact of power plug	The power supply socket is installed firmly
Improper selection of hydrogen and air flow rates	Flow adjustment to hydrogen and air

5.2.9. Irregular baseline fluctuations during constant temperature operation

Fault judgment	Methods of examination and repair
Position of instrument installation is not good	Install instruments in where has no strong vibration, the best to put instrument on the cement without vibration.
Instrument grounding is not good	Inspection and do well grounding
Incorrect selection of stationary liquid	Select the appropriate stationary liquid
Improper choice of carrier gas flow rate	Adjust the flow of carrier gas properly
The carrier gas leakage	Leak hunting
Detector polluted	Clean the detector
The improper selection of hydrogen and air (FID)	Appropriately adjust regulation of hydrogen, air flow

5.2.10. Prolonged retention time of low sensitivity

Fault judgment	Methods of examination and repair
The carrier gas flow rate is too slow	Increase the flow of carrier gas
The change of carrier gas flow rate after sample	Change the silicone rubber of sampler
The silicone rubber of sampler leaking	Change the silicone rubber of sampler

5.2.11. When the peak occurs, the signal suddenly returns below the baseline and extinguishes the fire

Fault judgment	Methods of examination and repair

Quantity of sample is too large	Reduce the quantity of sample
The flow rate of carry gas is too fast	Choose proper rate of carry gas
Flow of hydrogen and air is too low	Re-adjust the flow of hydrogen and air
Flame ejector polluted	Clean the flame ejector
Stationary liquid in chromatographic column run off	Re-aging the chromatographic column

5.2.12. Baseline does not return to zero

Fault judgment	Methods of examination and repair
Detector polluting	Clean the detector
Amplifier break up	Check the amplifier

5.2.13. Irregular distances have Spikes

Fault judgment	Methods of examination and repair
Leakage of insulators	Detecting leaks and taking corresponding measures
Amplifier malfunction	Eliminate impurities in the flow path
Flame jumping	Adjust the appropriate hydrogen and air flow rates
High frequency signal line fault	Check the high-frequency signal line

5.2.14. At equal intervals in a certain burrs

Fault judgment	Methods of examination and repair
Water congealed in hydrogen path	Clear up water from the path and changing or active the desiccant
Clogging in flow path	Eliminate impurities in flow path
Gas leakage	Leak hunting and do processing of sonorant
Flame beating	Adjust proper flow rate of hydrogen and air

5.2.15. Round peak

Fault judgment	Methods of examination and repair
Beyond linearity rang of detector	Reduce amount of sample
Select amplifier improperly	Reselect proper amplifier

5.2.16. Baseline noise is large

Fault judgment	Methods of examination and repair
The column polluted	Methods of examination and repair
Carry gas polluted	Change column
The flow rate of carry gas is too high	Change or rebirth carry gas filter
Grounding badly	Re-adjust the flow rate of carry gas
High resistance polluted	Check and do well grounding
Injector polluted	Clean the high resistance
Air or hydrogen flow rate too high or too low (FID)	Clean the injector tube in injector
Hydrogen and air polluted	Re-adjust the rate of hydrogen and air
Water congealed in FID	Change hydrogen or air filter
High frequency signal wire break out	Raise the temperature of FID to remove water

5.2.17. Additional peak

Fault judgment	Methods of examination and repair
High resistance peak of the last sample	To sampling after the last sample has all slipped out

Water condensate in chromatographic column and then output the peak	The operation conditions of install or rebirth purifiers should be selected proper
Sample decomposition	Lower the injector temperature
Samples contaminated	Ensure a clean sample

5.2.18. Zigzag baseline

Fault judgment	Methods of examination and repair
Steady flow valve diaphragm fatigue	Change or repair the valve diaphragm.
Cylinder valve output pressure changes contained	Reduced pressure regulating valve set at another location.
Improper air flow	Reset the flow of air.

5.2.19. Anti-peak

Fault judgment	Methods of examination and repair
Excessive hydrogen stream (FID)	Hydrogen flow adjustment.
Positive and negative switching mistake	Changing the sign switch to the correct position.
Reference cell and measuring cell tungsten wire mistake (TCD)	Check the reference cell and measuring cell tungsten wire situation.

5.2.20. The baseline sample did not change in one direction (FID)

Fault judgment	Methods of examination and repair
Detector temperature is too low	Detector temperature increase
Spectrum column stop runaway warming or out of control	Temperature control system and overhaul platinum resistance heating wire
Leak	Leak detection

5.2.21. Unidirectional baseline drift

Fault judgment	Methods of examination and repair
Substantial change in the detector temperature	Detector temperature stability
Zero Drift Amplifiers	Maintenance amplifier components
Substantial increase or decrease the column	Column temperature stability
Leak	Leak hunting

5.2.22. When the temperature changes from baseline irregular

Fault judgment	Methods of examination and repair
Excessive column bleed	Choose an appropriate chromatographic column, use a column temperature far below the maximum operating temperature of the stationary phase, and age the column
No choosing the appropriate operating conditions	Select the appropriate operating conditions
Column contamination	Replace the column

5.2.23. Cyclical fluctuations in the baseline

Fault judgment	Methods of examination and repair
Detector Thermostat bad	Check the contact is good
Carrier gas flow pressure is too low	Replace the carrier gas cylinder
Column oven temperature improperly adjusted	Check the platinum resistance contact is good
Improper carrier gas flow regulator	Readjust the carrier gas flow rate
Air, hydrogen improperly adjusted (FID)	Readjust hydrogen, air flow rate

5.2.24. After the programmed temperature change from baseline

Fault judgment	Methods of examination and repair
Temperature rises, the column bleed increases	Select the appropriate column or aging column.
Column flow is not good correction	Correction column flow.
Column contamination	Replace the column.

6. Maintenance of thermal conductivity detector

6.1. Precautions for thermal conductivity detector

In TCD detector during use, must pay attention to and comply with the following

- There is no pass into the carrier gas stream prohibition set bridge to avoid tungsten burn accident.
- Initial aging pillars, do not access the post-column carrier gas thermal conductivity, the column should be directly vented box, aging can not use hydrogen! ! Generally with nitrogen. There is absolutely prohibited during aging bridge current settings.
- Thermal conductivity detector is a precision part, do not disassemble pool vivo tungsten wire, so as to avoid unnecessary losses.

6.2. Thermal conductivity detector failure analysis and troubleshooting

6.2.1. Sampling but no peak output

Fault judgment	Methods of examination and repair
No current set	First set the current
The tungsten wire is broken	Replace tungsten wire
TCD thermal conductivity internal connectors and power supply unit cable is not plugged in	Re-plugged the associated plug socket
Syringe leakage or blockage	Replace the syringe
Silicone rubber leak	Replace silicone rubber

6.2.2. Signal amplitude is too large (not injections)

Fault judgment	Methods of examination and repair
Tungsten touch the body wall	Contact factory for repair
Tungsten resistance mismatch	Contact factory for repair
TCD thermal conductivity internal connectors and power supply unit cable is not plugged in	Re-plugged the associated plug socket

6.2.3. Baseline noise is large

Fault judgment	Methods of examination and repair
Impure carrier gas (carrier gas purity is very important)	Before making the carrier gas such as oxygen purification and drying
Thermal conductivity contaminated	Cleaning the cell body and injector
Column unaged	Re-aging column.
Silicone rubber leak	Replace silicone rubber
Air system and column connections with leak	Leak detection detect leakage Department, handled accordingly.
TCD running current setted is too large	Reduce the operating current setting to an appropriate value.
Thermal conductivity unstable power supply	Contact factory for repair

Appendix A Detailed specifications for electrical conditions

A qualified electrical technicians should be able to send the right power to the system . No matter to transform electrical equipment existing or install new equipment all require so.

- Estimate the region's total electricity demand.

- Assemble more convenient output line.
- Draft program for electrical safety.
- To ensure all wiring in accordance with local regulations.

Determine the demand of power

Calculate area of electricity your require.

Note: the total quantity of electricity including the original equipment and equipment when plan will be extended needed to increase later.

1) Voltage limit

In any instrument installation location, when the system has delivery of current supply phase -cental line voltage both shall remain in the rated voltage of the +10% ~ -10% range, to measure voltage from the power input side of system .

2) Frequency limit

The circuit frequency limit allowed depends on device whose rang of limit is the narrowest in the system(measure it from the power input side of instrument).The limit of ZHIYI-1123 network gas chromatograph is very wide,can be operating in the 50Hz to 60Hz range.

3) Harmonic wave quantity

The highest total amount of harmonic wave of Instrument feeder line is not more than 5% (instruments into power after the power input of a measuring instrument).

4) Unexpected condition of power

In some areas, power line used by instrument system may appear excessive voltage drop phenomenon, or impulse voltage, transiently changing voltage, interruption of power supply or other unforeseen circumstances, in this way, instrument system operation is not reliable. Therefore, must check the quality of power supply. If there are some projects that do not meet the system requirements found during inspections, which should be corrected.

5) Current source noise

The structure designed of ZHIYI-1123 network analysis instrument is able to tolerance reasonable noise from input line. But many noise from other electric public program ZHIYI-1123 network analysis instrument is unable to control. The main source of the electrical noise is from other electrical equipment nearby,such as motor, electromagnetic valve, silicon controlled rectifier and X-ray machines.

In addition, it may also due to the poor connection of the midline caused by "midline -- landing noise" and the"landing -- landing" noise cause by the poor connection of landing of floors . The largest wire noise allowed is 3V (rms), from 30Hz to 50Hz.

Can use an oscilloscope to measure small voltage of "ground-- the midline" , because, if the voltage is distorted deviation,the indication on the analog gauge outfit will be distorted. Generally speaking, it is a problem if the voltage is lower than the measurement results.

6) Noise elimination

If you want to eliminate the noise of the existing electrical equipment or the electrical equipment will be installed in future , we insist on such advice that install a qualified feeder between the main deployed switchboard and switchboard distributed by instrument. To check the line contact and the landing is good (see below section"landing"). If after install qualified feeder, there are still poor transiently changing phenomena, it would have to install a device which can reduce the input electrical noise.

7) The interference of power source

Both the power source noise that can disturb the power output and the power source noise that can disturb signal line input in the system will cause the dysfunction of the instrument system. These input disturbance can be classified into shock, pressure drop and transiently changing, now severally account below: "shock" and "fall" is a sudden change of negative and positive value of the input voltage, the last time is in 5 milliseconds. Generally speaking, the "shock" and "fall" should not beyond about ± 15% of normal rated line voltage , and recover to steady state in 17 ms (60Hz) to 20 ms (50Hz) .

"The power source voltage transiently changing" is the positive and negative value of input voltage suddenly change, the duration is between 1 ms and 5 ms. If the transient time is larger than 20% of rated voltage (depends on its energy) will cause the dysfunction of instrument.

In monitoring the quality of input power and evaluating the characteristics of interference, a power source input disturbance monitor is very useful. Because interference of power line may happen every hour, every day and every week, so the monitor should be connected at least one week. Don't consider the measured results as an absolute value, because of seasonal changes, the interference value will be different.

The test method is the using spiked peak signal with 0.5 microseconds of rise time and 10 microsecond of impulse duration , the amplitude is two times of the power source voltage.

8) Power processing equipment

If after install specified feeder and landing,there still have transiently changing phenomenon, then equipments which can reduce the interference of input power line should be installed. Device can fulfill the task basically has four kinds:

① Isolation transformer

② The power source voltage regulator

③ The motor --generator equipment

④ Uninterrupted power supply system

Circuit conditioning equipment must meet the needs of current and future. The lowest rated value my factory recommended is 5KVA, which can meet the requirements of now, also can meet the requirements of future expansion.

Appendix B Grounding

In order to make the instrument can run safely and reliably, the good landing of equipment is very important. Generally speaking, most countries and regions require to install earth wire for electrical equipment, to ensure personal safety.

1) Safety ground

Various standards generally require to install safety conductor for electrical equipment. In these standards generally have such requirement : each live wire (midline) must be accompanied by a security of conductor.Size of safety conductor must be the same size with live wire.

Generally , safety standards all require to connect the safety conductor to electric surface of electrical equipment that operation staff may touch, or to electric surface that may be inspired due to electrical accident . Under normal operating conditions, the wire should not contain reverting AC. If the instrument frame didn’t landing, or live wire infrequently touch the frame, the voltage on the frame is likely to reach a certain level of harm.

Connect the safe earth wire to the batholith of instrument can avoid the danger of electric shock, because in this way, it forms a very low impedance return circuit, it will make the plug-in strip of circuit tripping or fuse burn down. Every instrument should have safety landing device, as long as to connect the instrument to joint with earth wire, or connect the landing ring in the instrument to earth wire according to the specifications customer required, this return circuit is finished.

As described below, safe earth wire in instrument is usually connected to the catheter of the building through the insulating landing device ,in this way,conversely make power distribution of circuit landing. In any case must conform to the local and national safety regulations .

Safe earth wire must be properly connected to the terminal of total distribution earth generatrix. Generally we should know that, the earth wire impedance from any load return to earth generatrix must be less than 11 ohm.

2) Noise free grounding

In order to make the ZHIYI-1123 network equipment running in good condition, we insist on adopt no noise landing device. This landing is also called "insulated landing" ,because it is apart from other electrical landing device in the building . When connecting the ZHIYI-1123 network instrument and other instruments, the use of " insulation ground" will help to keep the reliability of system.

In most cases, common landing can not meet requirements, because this landing device could not bring in non noise that caused by the bad landing . Noise may also come from radio broadcaster, this earth wire may also take common steady current.

Typical landing condition of easily produce noise are shown as following:

- Catheter
- Roof and building beams
- Sprinkler pipes (connecting ground wires to these pipes is not allowed by most fire safety regulations).

- Enhance the support structure of the floor.
- Gas pipe

Connecting earth wire to these tubes is very easy to be impacted by the noise from buildings due to poor landing,at the same time, because effect by the antenna, they wll also received power frequency interference.

Things can landing are as follows (should consulted to the local appliance inspecting department, select a landing method can be received locally):

① Connect a wire of appropriate size to the main pipeline of the building or to the entrance of the main conduit.

② Drive the long nails for grounding into the damp soil layer and connect them to the grounding point.

③ can also connect to other reliable entry points

The insulated ground wire must be firmly connected to the device. Do not use clips to clamp the ground wire onto pipes or grounding posts. Do not use other methods that may loosen the joint to connect. The joint must be brazed or soldered to minimize the decrease in insulation resistance at the grounding joint. If the installation is not suitable, the resistance can be measured at the joint, and the resistance on the ground wire will cause the insulation grounding device to generate the potential we do not want. When installing the grounding wire, it is necessary to prevent accidental contact with other grounding wires, which may have adverse effects on insulation. The insulated wire must be connected to the insulated busbar of the distribution panel, and then connected to each unit of the instrument system through connectors and power grounding wires from the distribution panel. The insulated busbar can be composed of the grounding plate on the distribution panel.

The size of the wires used should be such that the grounding resistance from the farthest point to the grounding point of the main distribution panel is the lowest. Please consult with the local electrical inspection department regarding the specifications of the wires used.

When a power grid processing device is installed in a multi story building, the outer shell of the power grid processing device should be connected to the steel bars in the building structure to reduce grounding noise. One end of the ground wire should be connected to the casing of the line processing device, and the other end should be welded to the nearest building's vertical beam reinforcement. It is better to connect the grounding wire to the steel bars of the building than to a separate grounding column in the basement.

3) Midline - earth wire connection quality

In market you can buy several special device used for measuring the quality of landing system . These devices include grounding detector,used for guiding the current in earth wire, and then test, and can indicate the landing quality (display lamp or scale represented by ohm). An other kind is earth tester, used for measuring the resistance of landing system.

If the grounding impedance is too high, should check several projects. If haven't installed grid processing equipment and no specified landing device,you should check the connection of the building total distribution panel middle wire - earth wire (N - G) is good or not, if you have installed the wire path processing equipment, also should check again the N - G junction of wire path processing device . If the place where install the N- G connector was not appropriate,you should move it to right position, because if the position is not correct, unwanted currents will emerge on earth wire.

Should check the connection of the grounding conductor is good or not. If the sizes of earth wire is smaller than wire on circuit, or, if the earth wire is not insulating, we suggest to change it to insulated wire which size is the same as the wire in circuit.

4) The negative charge balance

It is important to balance the electrical load using three-phase and split phase systems. Because:

- Can reduce the adverse effects of external voltage drops and voltage changes on equipment driven by individual transformers.
- Can improve the performance of insulation transformers.
- Extend the service life of transformers.

Unbalanced negative load can generate voltage difference between the center line and the earth wire. Measuring the voltage can know if the negative load is balance. In balancing negative load, you need to use a clip-on ammeter. You should first measure every current, and then remove the power line from the instrument system , then rearrange the negative load, and then measure again. To repeat the process, until the current dropped to the lowest value.

Measuring voltage difference between midline and earth wire can also be used to verify if the negative load is balance. After sent power to the instrument, to measure the voltage difference between the midline and earth wire on input terminal of

instrument power source with a oscillograph.The connection of earth wire clip probe is shorter is better.Move the power wire off the switchboard in system , rearrange the negative load, and then repeated measurement. Repeated this procedure, until the voltage of middle wire- earth wire reduce to a minimum value.

In balancing other negative load of feeder, middle wire - earth wire voltage may be further reduce, or when increasing the size of the feeder, it will fall down too. If the voltage of middle wire--earth wire in switchboard of system is too high,then hang out a special feeder from the total switchboard .

Appendix C Gas Flow Table

Number of turns on the knob	Carrier gas steady flow valveflow valve		Hydrogen needle valve	Air needle valve	Clean	Auxiliary Gas
	N_2	H_2	H_2	AIR		
				0		
				0		
				0		
				2		
				7		
				20		
3				27.45	1	4.0
				47.0		7.5
				70.0		13
4	18	27	16.88	83.0	2.78	16.8
4.2	24.4	37	21.0	95.0		21
4.4	30.8	46	26.5	110.0		26.5
4.8	43.6	70	37.5	143.0		37.5
5	50.0	84	43.90	159.38	6.03	43.9
5.2	56.4		52.0	178.0		52.0
5.4	62.8		60.0	198.0		60.0
5.6	69.2		68.0	215.0		
5.8	75.6		78.0	233.0		
6	82.0		87.41	252.31		
6.2			98.0	274.0		
6.4			110.0	293.0		
6.6			120.0	315.0		
6.8			135.0	338.0		
7	142		145.19	358.15		
7.2			157.5	380.0		
7.4			172.0	405.0		
7.6			185.0	427.0		
7.8			200.0	450.0		
8	201		216.86	474.36		
8.2			230.0	500.0		
8.4			250.0	522.0		
8.6			265.0	550.0		

8.8				575.0		
9	260			600.0		

Note: The carrier gas stabilizing valve nitrogen is at 0.3MP, hydrogen is at 0.2MP. Hydrogen needle valve is at 0.1MP. Air needle valve is at 0.15MP. Cleaning and tail blowing are at 0.3MP.

Appendix D ZHIYI-1123 Host Accessories

ZHIYI-1123 Host: List of Accessories and Spare Parts						
No.	Accessory Name	Order Number	Model	Quantity	Unit	Remark
1	Operation Manual			1	pcs	
2	Packing List			1	pcs	
3	Power Cord		220V/10A 2m	1	pcs	
4	Data connection cable		RS232 x2 1.5m or network cable	1	pcs	
5	Software CD			1	pcs	Workstation components
6	Dongle			1	pcs	Workstation components
7	Pressure reducing valve connector (special)			3	pcs	
8	Micro injection needle 0.5		0.5u1	1	pcs	
9	Micro injection needle 1		lu1	1	pcs	
10	Micro injection needle 10		l0u1	1	pcs	
11	External pneumatic nut		M8 * 1 ¢ 3.2 hole	15	pcs	
12	Outer air path sealing gasket		¢ 6x1.9	50	pcs	
13	Gas lined pipe ¢ 2 * 0.5 * 20		¢ 2*0.5*20	12	pcs	
14	PVC gas pipeline		¢ 3*0.5	20	pcs	
15	Wrench		8-10, 10-12, 14-17	3	pcs	one each
16	Cross Screwdriver		2 inches	1	pcs	
17	Flat-head Screwdriver		2 inches	1	pcs	
18	Three way ¢ 3mm			1	pcs	
19	Fuse links, fuses (large and small)		2A/5A/10A	12	pcs	3 each
20	Column joint nut		M12x1 Φ6	3	pcs	

21	Graphite gasket with a diameter of 6		Φ9.8x6x8	20	pcs	

ZHIYI-1123 Gas Chromatography Components - Accessories Packing List

SPL (Split/Non Split Injection Port): Attachment Packing List					Please select here ☐	
No.	Accessory Name	Order Number	Model	Quantity	Unit	Remark
1	Joint nut (capillary column)		M5x0.8	3	pcs	
2	Glass lining tube (straight through)		Φ5x97	1	pcs	One of them is loaded into the host
	Glass lined tube (diffusion)		Φ5x97	1	pcs	
3	Capillary tube holder			1	pcs	Install the host
4	Soap-film Flowmeter		50ml	1	pcs	
5	Sample injection pad		Φ7x5	20	pcs	
6	Fluorine sealing ring		Φ16x2.5	3	pcs	
7	Graphite Sasher Φ5		Φ7.7x4.8x5	3	pcs	
8	Stainless steel sleeve		Φ8.8x0.5x4.8	1	pcs	Install the host
9	Small caliber capillary graphite gasket		4x0.5x5	10	pcs	
10	Large caliber capillary graphite gasket		4x0.8x5	10	pcs	
11	Capillary column FID connector		Φ6x1x78.5	1	pcs	

PIP (Fill Column Injection Port): Attachment Packing List					Please select here ☐	
No.	Accessory Name	Order Number	Model	Quantity	Unit	Remark
1	Sample injection pad		Φ10x5	25	pcs	
2	Column connection nutΦ4		M8X1 Φ4.1	10		Optional
3	Graphite sealing ring Φ3.2		Φ6x3.2x6.5	20	pcs	
4	Graphite sealing ring Φ4		Φ6x4x6	20		Optional
5	PIP column joint Φ3.2		Φ3.2x105	2	pcs	
6	PIP column joint Φ4		Φ4.2x105	2	pcs	Optional

FID (Hydrogen Flame Ionization Detector): Attachment Packing List					Please select here ☐	
No.	Accessory Name	Order Number	Model	Quantity	Unit	Remark
1	PIP column joint Φ3.2		Φ3.2x74	2	pcs	
2	PIP column joint Φ4		Φ4.2x74	2	pcs	Optional

TCD (Thermal Conductivity Detector): Attachment Packing List					Please select here ☐	
No.	Accessory Name	Order Number	Model	Quantity	Unit	Remark
1	TCD column connector Φ3.2		Φ3.2x77	2	pcs	
2	TCD column connector Φ4		Φ4.2x77	2	pcs	Optional

Gas valve (injection and switching): Attachment Packing List					Please select here ☐	
No.	Accessory Name	Order Number	Model	Quantity	Unit	Remark
1	Wrench		6-7	1	pcs	