Operation Manual For

EClassical 3100 Series
High-PressureConstant Flow Pump

V1.0.4

Statement

The manual is intended to help users to understand, use and maintain EClassical 3100 Series pump. our company does not assume the responsibility caused by business or special purpose use of the manual.

The information in this document is subject to change without notice and should not be construed as a commitment by our company.

This manual is believed to be complete and accurate at the time of publication. our company assumes no responsibility for any errors that may appear in this document.

In no event shall our company be liable for incidental or consequential damages in connection with, or arising form, the use of this manual.

Please read the document carefully before using EClassical 3100 Series pump.

Foreword

Thank you for purchasing our equipment. To ensure correct and safe use of the instrument, please read it carefully before using.

The details of the equipment's composition, installation, method of using, maintenance, parts selection and other points are described in the manual. After reading, please keep it carefully. Please delivery the manual with the instrument.

For safe operation, please read the following Safety Precautions before using the instrument.

Safety Precautions

According to the level of danger and harm, safety signs here are divided into the following three categories:

［**Warning**］Failure to properly follow the instructions and precautions indicated by this sign may result in serious injury or damage to health and property. The property damage includes the environment around and the instrument.

［**Caution**］Failure to properly follow the instructions and precautions indicated by this sign may result in slight injury or damage to health and property. Slight injury means no hospitalization is needed to the wounded. Slight property damage means the instrument can be recovery through simple maintenance.

［**Note**］The sign is used wherever information is given to ensure optimal performance of the instrument.

1. Precaution for usage

［**Warning**］EClassical 3100 Series pump should only be used as a part of liquid chromatography. Do not use it for any other purpose. Except for special instructions, this instrument does not have explosion-proof function.

2. Ambient Conditions

［**Warning**］When we use organic solvent it is recommended that interior must be well ventilated and the firework should be prohibited. Also, a sink or equipment for washing eyes should be installed nearby in case of the organic solvent coming into contact with the eyes or skin.

［**Note**］In order to ensure good efficiency, keep the instrument away from caustic gas, dusty environment or strong magnetic. The worktable should be wide and strong enough. Ambient should be between 10℃ to 30℃ with a small fluctuation, and humidity should be between 20% to 80%. Avoid it from cold or hot source as well as direct sunshine. The air conditioners and other equipment should not blow directly into the instrument.

3. Precaution for installation

［**Warning**］The instrument should be installed following the instructions strictly by professionals, make sure that the voltage of the power socket is the same as the power supply voltage indicated on the instrument. Using the wrong power voltage could result in danger and fire.

The accessory power cable should be used to connect the pump to the power socket. Other cable should not be used.

Make sure the line cord is connected to a properly grounded power receptacle to prevent static and electric leakage.

［**Caution**］ The instrument is so heavy that you should move it carefully and watch your hands in the same time.

［**Note**］The instrument should be connected following the instructions strictly. Wrong connection could cause communication error.

4. Precaution for use

［**Warning**］ Do not use the instrument in places where heat resource, fire seat, magnetic resource, strong vibration exist or may exist. It is prohibited to put flammable nearby.

The bottle for storing the mobile phase should have a pore in cap to prevent the danger caused by negative pressure in the bottle.

A gap between the waste tubing and the cork of the waste bottle is necessary to prevent the waste bottle bursting when it is overfilled. But the gap should be small to prevent evaporate of hazardous solvents. Even though, the waste needs to be clean up promptly.

［**Caution**］When using organic solvents, please wear safety goggles, special lab coats, gloves mask etc. If your body contact with toxic solvent accidentally, wash it immediately, and then go to hospital for specialized treatment.

［**Note**］ When preparing mobile phase, please use HPLC grade solvents or equivalent ones. You’d better filtrate the eluent with a membrane filter (0.45μm), and an online filter is also necessary to prevent small particles from scratching plunger rod, seal ring or blocking tubing. What’s more, please degas all mobile phase before using, degassing is an effective method to prevent chromatogram noise and wrong indicator.

Before first use, rinse the entire piping system according to the requirements of the manual. Direct use is likely to block tubing.

Before sample test, ensure that the tubing in the system is filled with mobile phase without any bubbles, otherwise it will affect the reliability of test results.

If an eluent is replaced with another eluent which is insoluble, such as positive mobile phase (hexane) and reverse phase (methanol), be sure to operate according to the specified method in the manual, otherwise it will cause serious tubing jam, and even system paralysis.

Halogen irons is harmful for stainless steel, if there is stainless steel tubing and fitting in your system, please avoid the use of a mobile phase containing halogen ions. If you can't avoid it, please minimize the content and clean the system with water as soon as finishing the analysis.

If there is peek tubing in your system, it is important to note that:

Do not use the following solvent: concentrated sulfuric acid, nitric acid, dichloroacetic acid, dichloromethane, trichloromethane, chloroform, dimethyl sulfoxide, acetone, tetrahydrofuran, etc. Such solvents can reduce the strength of the PEEK material, make it’s become fragile and broken. But the impact of short-term use of aqueous solution of acetone (lower than 0.5%) in gradient performance is acceptable.

When using PEEK tubing, the pressure of the system should be lower than the tolerance pressure of peek material, otherwise it may burst.

The bending radius of peek tubing should be more than 10mm, make the peek tubing natural relaxation during installation.

The PEEK tubing should be intercepted with professional tubing cutter in order to make the tubing more smoothly. Pay attention to that there should be no cutting debris left in the tubing.

5. Repair, maintenance and parts replacement

［**Warning**］Before repair, maintenance and parts replacement, please turn off the power in case of leakage and electric shock.

There is no need to open the host cover while daily maintenance and repair. If the repair needs to open the host cover please entrust agents or communicate with us.

You should clean the dust on the power cord plug regularly to reduce the electrostatic. Then, dry it before using, otherwise electric shock may occur.

Use dry cloth to wipe the instrument. Do not use thinner or alcohol to avoid erasing characters or color on the panel.

Do not replace components (e.g., fuses, deuterium lamp, etc.) from other company or other type, all accessories are required to be specified to prevent danger.

6. Precaution for static electricity

[**Warning**]As the instrument may use a lot of flammable, explosive organic reagents which may contaminate laboratory air, when the reagent concentration is too high, any spark or flame could cause fire or explosion accidents. Do not use the pump near any fire resource or hot resource, and keep reducing the electrostatic in mind. To reduce static electricity, please take the following measures:

1) Make the instrument grounded. It is very important, please pay attention to it.
2) Maintain proper indoor humidity (humidity is greater than 65% can prevent static electricity effectively) and keep the environment clean.
3) Metal waste bottles (external conductive) should be grounded (no ground insulation). When using other materials container, you can insert one end of the wire into liquid in the bottle and make the other end earthed.
4) Replace a larger I.D. tubing when the flow of mobile phase is higher than usual.
5) Wipe the instrument regularly.
6) Staffs should wear anti-static clothing. An anti-static pad is needed on the floor.
7) People and objects with static electricity is prohibited to touch the instruments.

7. Warning label instructions

To ensure the safety of staffs, we attach warning labels on the equipment where are dangerous. If the label is missing, please request new ones from our company, and attach to the correct position.

Contents

Chapter One: Introduction

1.1 Overview

EClassical 3100 Series pump is based on years of experience in the research and production of high-pressure pumps. It is a high-performance pump for an HPLC system.

As an infusion unit of an HPLC system, EClassical 3100 Series pump can be easily used with a variety of liquid chromatographic detectors, autosampler, column oven etc., and it also can be used independently as a delivery tool.

EClassical 3100 Series products include constant flow pumps, a UV-visible detector, workstations, etc. For more information, please contact our company.

EClassical 3100 Series pump is driven by a small CAM. There are two tandem plungers whose stroke is short and the infusion pulse of EClassical 3100 Series pump is low. Subdivision stepping motor control technology allows motor running smoothly at a low speed. Floating guide plunger installation, high quality piston rod and other key components ensure the pump running stability and durability in long period. Mobile phase compression coefficient correction and flow rate correction results in high accuracy. You can easily control the instruments by workstation. EClassical 3100 Series pump is very suitable for pharmaceutical, biochemical, environmental protection, quality control and other areas of HPLC applications. Also, in some special areas such as high-precision feed pump, it also has a unique advantage.

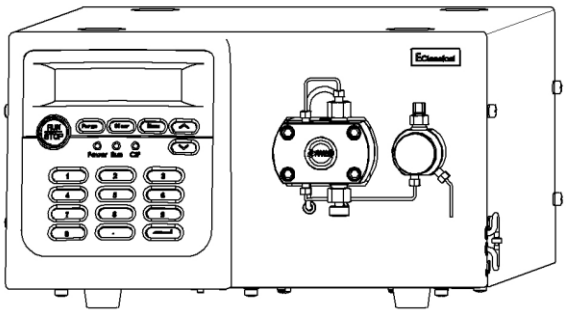

Figure 1-1: P3100/P3110 high-pressure pump

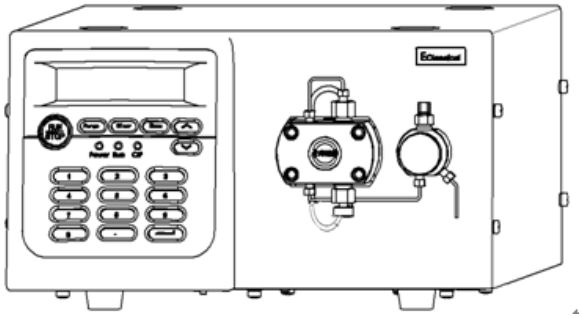

Figure 1-2: P3140 high-pressure pump

1.2 Features & Functions

Draw lessons from the current domestic and foreign advanced technology, our company companies independently developed EClassical 3100 Series pump with independent intellectual property. Its main characteristics are as following:

Driven by a small CAM, the infusion pulse of EClassical 3100 Series pump is low. The traditional liquid chromatographic bumper is canceled, which reduces the system volume.

Subdivision stepping motor control technology ensures that EClassical 3100 Series pump is accurate and precise, even at a low flow rate or binary gradient system. This greatly increases the repeatability of the results.

Floating guide plunger installation, high quality piston rod and other key components ensure running stability and durability of the pump in long period.

The advanced operation menu allows user to emend the flow compressibility and flow correction values. User can adjust the flow rate within ±15% using these two functions. Hence accurate and precise flow rate is obtained for different solvent systems.

EClassical 3100 Series pump has RS-485 connector which can be used to control the instrument from a computer, by using the appropriate software. Furthermore, through RS-485 connector, two pumps can communicate with each other to achieve accurate and consistent binary gradient flow.

Real-time pressure display, maximum and minimum pressure warning ensure the security of instrument operation.

VFD can display pressure in 3 different units: MPa, psi and bar.

The pump has “purge” function to instantly increase the flow rate of mobile phase for flushing purpose (P3100/P3110 8mL/min ;P3140 25mL/min).

Using the integrated circuit controller AT89C55 and SPI bus technology, EClassical 3100 Series pump is compact and reliable.

The VFD display and keypad are user-friendly and easy to operate.

1.3 Performance Specifications

Table 1-1: Performance Specification of P3100/P3110 pump

Items	Specifications
Flow Rate	0.001~10.000mL/min (Step:0.001mL/min)
Accuracy	±0.2% (1.0mL/min, 8±2MPa, water, ambient temperature)
Precision	RSD≤0.075% (1.0mL/min, 8±2MPa, water, ambient temperature)
Max Pressure	45MPa (0.001-5.000mL/min) 20MPa (5.001-10.000mL/min)
Pressure accuracy	±3% or ±0.5MPa
Pressure pulsation	≤1.0%
Sealing	Pressure drop≤1.5MPa(40MPa，10min)
Communication mode	RS-485
Operating temperature	0 to 40°C
Dimension/Weight	420mm×300mm×175mm/12kg
Power Supply	AC 220V,50Hz
Power	80W

Table 1-2: Performance Specification for P3140 pump

Items	Specifications
Flow Rate	0.10~40.00mL/min (Step:0.01mL/min)
Accuracy	±1.0% (10.0mL/min, 8.5MPa, water, ambient temperature)
Precision	RSD≤0.2% (10.0mL/min, 8.5MPa, water, ambient temperature)
Max Pressure	30MPa (0.10-20.00mL/min) 20MPa (20.01-40.00mL/min)
Pressure accuracy	±3% or ±0.5MPa
Pressure pulsation	≤1.0% (10.0mL/min, 8.5±1.5MPa)
Sealing	Pressure drop≤1.0MPa(30MPa，10min)
Communication mode	RS-485
Operating temperature	0 to 40°C
Humidity	≤ 80%
Dimension/Weight	420mm×300mm×175mm/12kg
Power Supply	AC 220V,50Hz
Power	80W

Chapter Two: Installation

2.1 Unpacking inspection and standard accessories

EClassical 3100 Series pump is packaged with corrugated boxes and foam lined structure. As you receive the instrument, check the packaging first. If you found packaging is damaged, please contact with our company or local dealer.

［Warning］If there is any damage to the instruments when you receive it, please don't try to install it. You can ask our company to inspect and assess it.

2.1.1 Demolition of the packing

Put the pump on horizontal ground with the front of the packing box up. Cut the tape on the top, take out the pump and accessories package, and place them on the table. Then remove the foam and open the instrument protective film.

［Warning］The pump is heavy, so it is suggested that installation operation need at least two people to prevent instrument sliding.

2.1.2 Deliver checklist

Before installing, please check the deliver list carefully. If one or several of them omissions, please communicate with our company or local distributors as soon as possible.

Table 2-1: Deliver list of EClassical 3100 Series pump

NO.	Items	Quantity
1	EClassical 3100 Series pump	1 pc.
2	User manual(CD)	1 pc.
3	Certificate	1 pc.
4	Service Card	1 pc.
5	Start Package	1 pc.

［Note］If there is discrepancies between the packing list in the box and in the specification, please refer to the packing list in the box. It is subject to change without prior notice.

2.2 Stack Order

In order to guarantee the best working state of the instrument, it is recommended that the instruments should stacked as shown in figure 2-1 or figure 2-2.

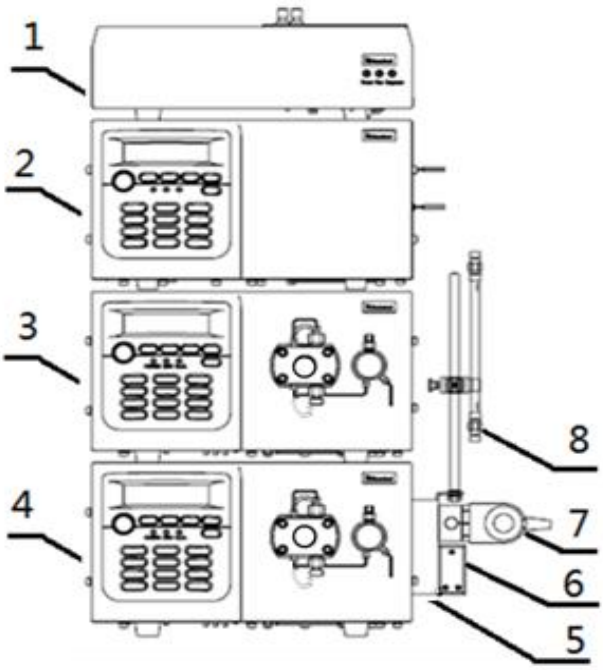

Figure 2-1: EClassical3100 stack order 1

1.Solvent manager, 2. UV-visible detector, 3. Pump A, 4. Pump B,

5.Valve bracket, 6. Mixer, 7. Manual sampling valve, 8. Column

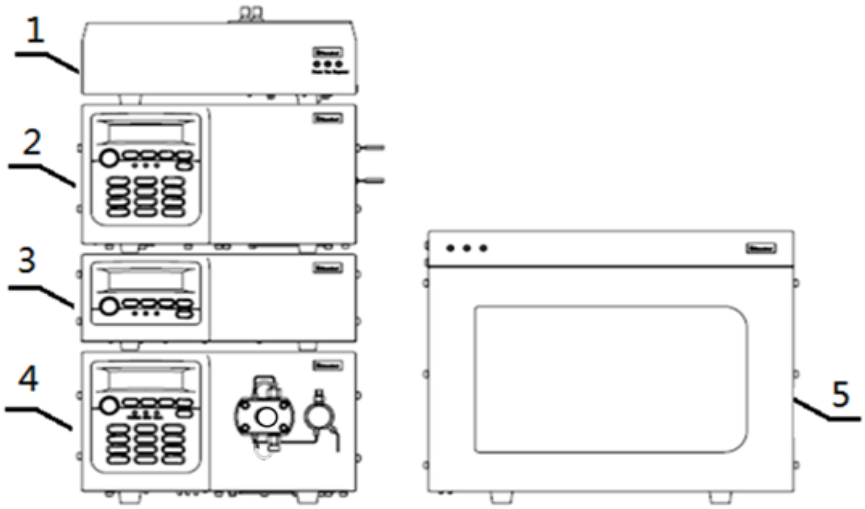

Figure 2-2: EClassical3100 stack order 2

1.Solvent manager, 2. UV-visible detector, 3. Pump A, 4. Pump B, 5. Auto-sampler

2.3 Installation Requirements

2.3.1 Site Requirements

- **Environment**

EClassical 3100 Series pump need to work under ambient conditions in Table 2-2 below:

Table 2-2: Environment requirements

Items	Specifications	Requirements
1	Work environment	Room should be free of dust, inflammable and explosive materials, also, good ventilation is important
2	Electromagnetic field	No electromagnetic noise nearby
3	Operating temperature	4~40℃(39~104◦F)
4	Humidity	20%~80%, non-condensing

［Caution］Do not use the pump under the conditions of temperature fluctuations. If the ambient temperature is too low, make the room temperature increase slowly to avoid condensation inside caused by rapid heating.

- **Bench space**

EClassical 3100 Series pump's dimensions allow placing the pump on almost any laboratory bench. If you want to display the complete 3100 system on the bench, make sure that the table can bear the weight of all components. It needs an additional 50mm on the left, 150mm on the right, 150mm on the back to facilitate the circulation of air and electrical connections.

［Warning］The instruments should be placed on a horizontal position, otherwise there is a risk of falling!

2.3.2 Power and power line

To ensure the instrument can be normal and safe, please use a dedicated power line within the specified voltage range.

Grounding, AC power to 220V ±10%, 50 Hz;

*Please P3100 /P3110 high pressure constant flow pump choose T1.25 A (250V) fuse.

Note: * P3140 high pressure constant flow pump choose T1.5 A (250V) fuse.

［Warning］The accessory power cable should be used to connect the pump with the power socket. Other cable should not be used in case of danger or damage to the instrument.

If the instrument is connected to a grid above the scope of application, it may cause electrical shock or damage to the equipment and staff.

Please unplug the power cord before replacing the fuse to avoid electric shock. The external fuse is installed in the back of instrument.

2.3.3 Computer requirements

Hardware requirements

- The lowest hardware requirement：Intel Core 2 CPU，2G internal storage，more than 1G hard-disk space;(Refer to the manual of workstation)
- The lowest resolution of displayer: 1024×800,64K (16 bit image);
- Others: USB interface for communication, CD-ROM driver for software installation.
- Operation system requirements
- Windows 7 or higher version(Refer to the manual of workstation).
- Workstation requirements
- Use EClassical3100 workstation to control the instruments.

2.4 EClassical 3100 Series pump Front

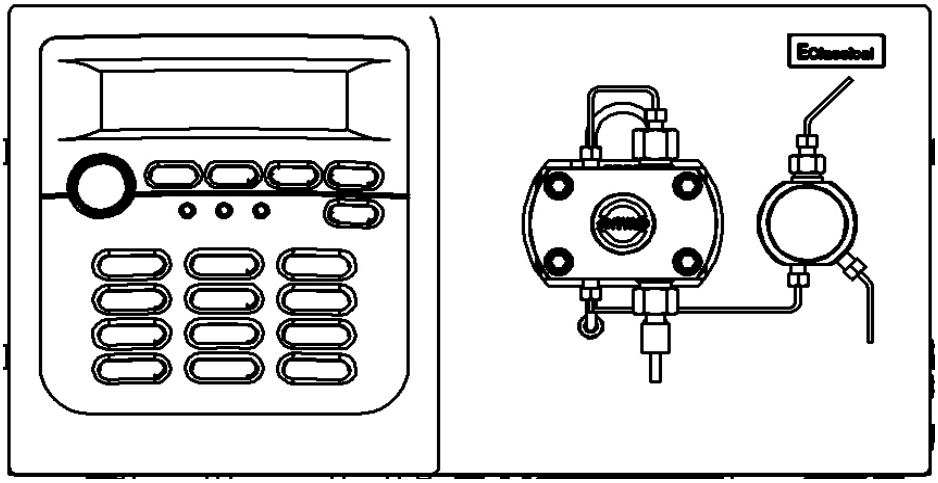

Figure 2-3: Front of P3100 /P3110 high pressure constant flow pump

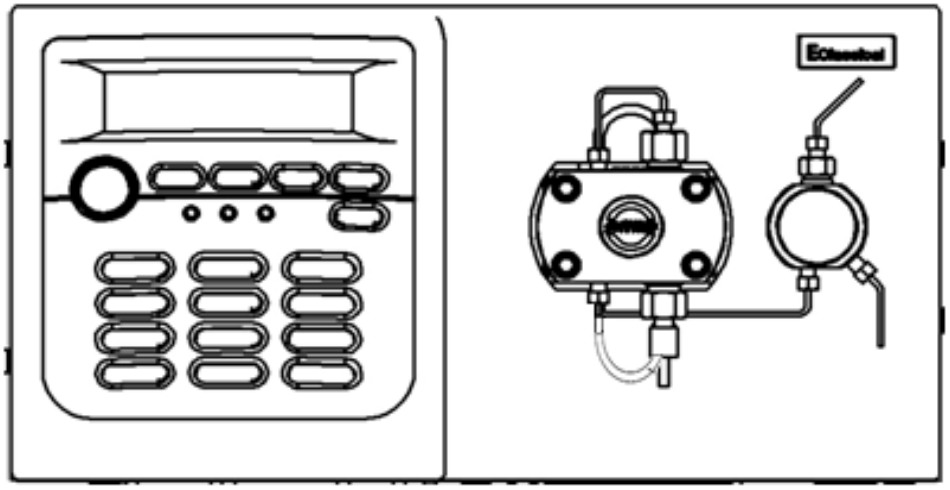

Figure 2-4: Front of P3140 high pressure constant flow pump

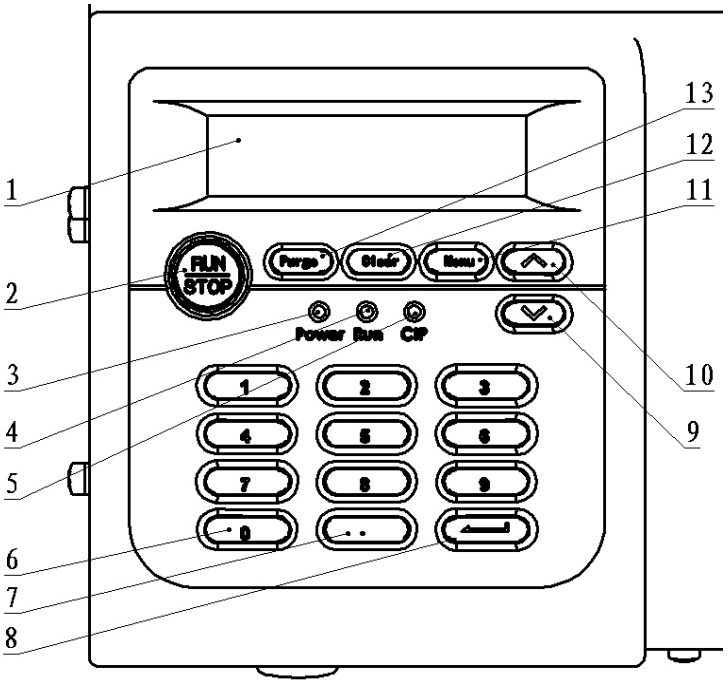

Figure 2-5: EClassical 3100 Series pump keypad and LCD display

Table 2-3: Keypad Function

No.	Key	Function
1	VFD – display	VFD displays operational status, menu and sub-menus, and parameters.
2	RUN/STOP	Local mode: to start and stop the pump. Press once, the pump indicator light will be on and the pump will operate according to a pre-set flow rate. Remote mode: Press RUN/STOP key to pause the pump operation.
3	POWER	Power is on when the indicator is illuminated.
4	RUN	When the run indicator is illuminated, the pump is in run mode.
5	CIP	0(Light is out): The plunger rod will not be cleaned, 1(Light is green): The plunger rod will always be cleaned, 2(Light is yellow): The plunger rod will be cleaned 2 minutes for ten minutes.
6	0 – 9	Numerical keys
7	.	Decimal point
8	ENTER	To confirm values and selections. Upon pressing ENTER key, the cursor will automatically move to the next parameter.
9	↓	Press ↓ key to move between different menu and sub-menu.
10	↑	Press ↑ key to move between different menu and sub-menu.
11	MENU	To access to function menu. Press the MENU key once, to access to the respective MENU1. Press again, to MENU2.
12	CLEAR	To delete wrong data input or to disarm an alarm.
13	PURGE	To flush the pump system at a large flow for EClassical 3100 Series pump. It can be used to purge out trapped air bubbles or change the mobile phase.

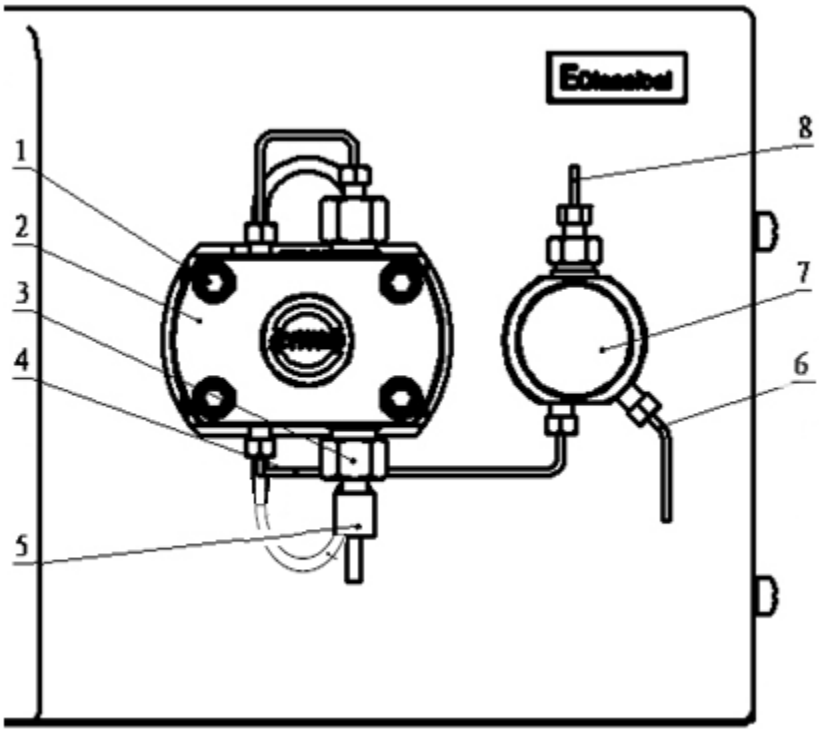

Figure 2-6: Fluid-contact components of pump head assembly

Table 2-4: Fluid-contact components

No.	Component	Function
1	Mounting screws	To fasten and lock the pump head
2	Pump head	To draw and deliver mobile phase
3	Check valve	Prevent backflow and allow mobile phase to flow in one direction
4	Connecting tube	To connect pump head with relief valve
5	Inlet of the pump	Connect with the mobile phase pipe
6	Relief tube	release air and waste liquid from the pump head
7	Relief valve	Loosen the relief valve knob to release pressure from the pump head. It can be used for purging and priming purpose.
8	Outlet of the pump	Mobile phase come out from here

2.5 EClassical 3100 Series pump Rear

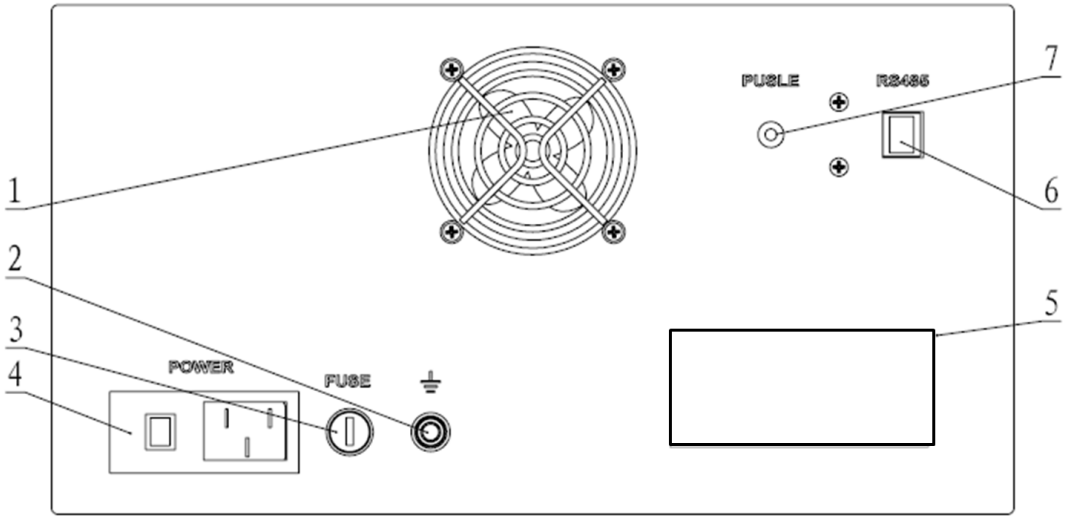

Figure 2-7: EClassical 3100 Series pump real panel

Table 2-5: Rear panel

No.	Components	Function
1	Cooling fan vent	Cool the instrument.
2	Ground terminal	Ground the main body of the pump.
3	Fuse	Fuse is in it
4	Power connector and Power switch	The power cable is connected into grounded power outlet.Turn on / turn off the power.
5	Instrument panels	Identify the information of instrument.
6	RS485 interface	This socket is connected to detector or workstation for remote control.
7	*Pulse line interface	This socket is connected to LU3100 quaternary low pressure gradient mixer.

Note: * Only equipped for P3110 high pressure constant flow pump.

Attention: Using RS485 interface, please tighten the screws on the sides of DB9 to avoid a bad connection issues.

2.6 Fluid Connection System

2.6.1 Solvent pipeline system diagram

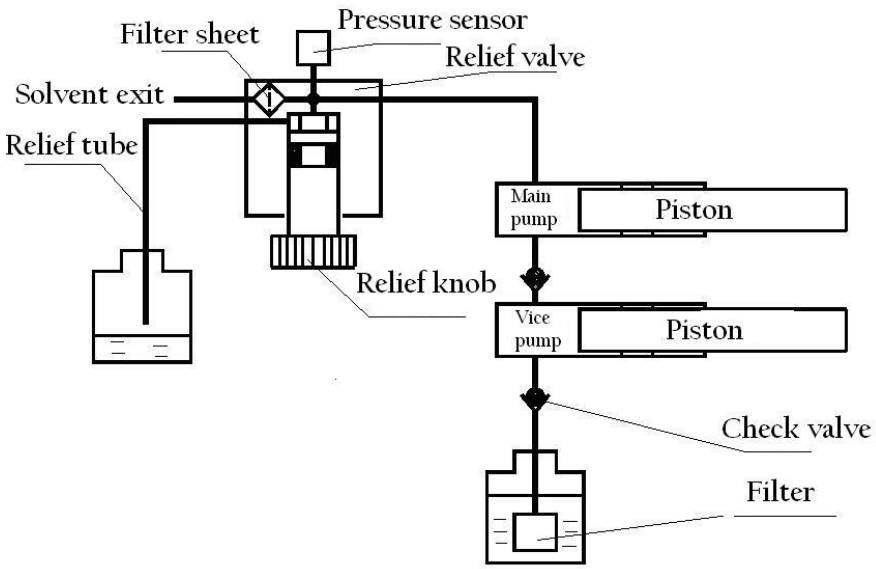

Figure 2-8: Fluid Connection Diagram

2.6.2 Installation Preparations

A 500mL or bigger solvent reservoir is needed. There should be two 3-4mm holes on the cap. Remove the seal plug of the pump outlet that is above the vent valve. Connect the stainless-steel tube (O.D.1/16"× I.D.0.02") with the pump port, the other end of the tube will be connected with injection valve.

2.6.3 Connecting solvent reservoir to the pump

Attach the solvent inlet filter to one end of the solvent tube, then put it inside the solvent reservoir. The other end of tube should be connected with the inlet of the pump.

2.6.4 Connecting injection valve to the pump

Connect the outlet of the pump to the inlet of injection valve (No. 2 hole is usually the inlet for the mobile phase) with stainless steel tube (with screw connection and sealing edge ring).

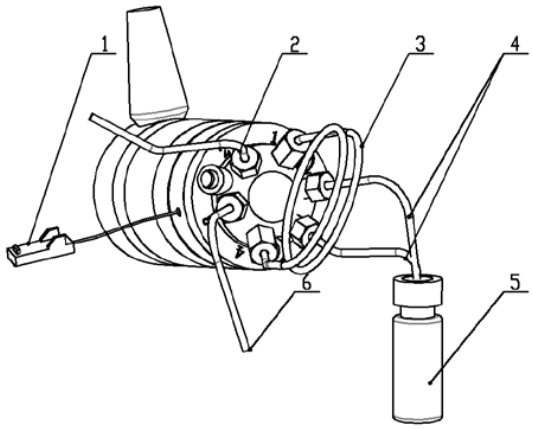

Figure 2-9: Fluid connection of manual filling valve

1.Automatic trigger interface; 2. Mobile phase entrance; 3. Quantitative loop;

4.Waste tube; 5. Waste bottle; 6. Mobile phase export

Port #3 of injection valve should be connected to the entry of column.

Port #2 of injection valve should be connected to the outlet of pump.

Do not over tighten the connecting screw, as it may damage the ferrule.

If there is leakage, please replace the ferrule.

To reduce the column efficiency loss, the pipe length between the injection valve and the column, between the column outlet and the detector inlet should be as short as possible (ID:0.007"is recommended).

Make sure the end of all the stainless-steel tube is smooth to reduce dead volume of the system (It is recommended that you'd better choose the universal column connector to connect column inlet and the outlet, which is available from our company).

2.6.5 Connecting the pump to the mixer

A mixer is required when the pump system consists of more than one pump, e.g. gradient system. The mixer ensures the mobile phases come from different pumps mix well before entering HPLC systems.

The mixer is placed outside EClassical 3100 Series pump. Using a stainless-steel tube, the pump outlet is connected to the mixer's inlet. Connect the mixers outlet to port #2 of the injection valve.

You can choose different mixer (Mix volume: 1.5mL, 2.5mL and 3.0mL) according to the analysis.

2.6.6 Solvent waste bottle

The solvent waste bottle should be place at a lower position with respect to the equipment.

2.7 System Configuration

The following are two examples of P3140 high pressure constant flow pump.

2.7.1 Isocratic System

Isocratic system is a relatively simple system, shown as figure 2-10. It can meet the requirement of analysis when the mobile phase is invariant. The configuration is listed in table 2-6.

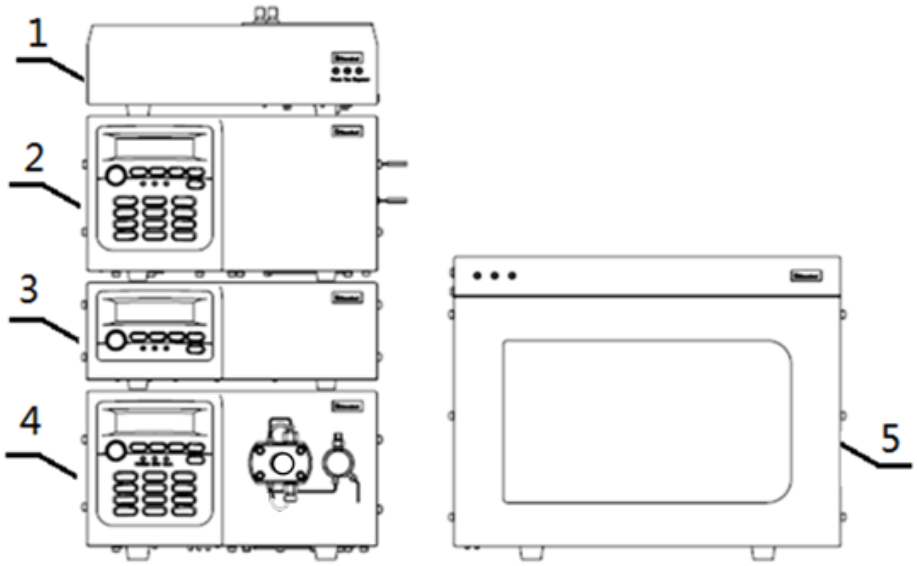

Figure 2-10: Isocratic system configuration

Table 2-6: The configuration of isocratic system

No.	Components	Function
1	M3100 solvent manager	Take gas out from the mobile phase (optional)
2	UV3100 UV-visible detector	Detect the signal and control the other signals
3	Column oven	Make the column temperature constant (optional)
4	P3140 pump	Transport the mobile phase
5	S3100 autosampler	Inject the sample into the chromatographic system automatically(optional)

2.7.2 Gradient system

This binary high-pressure gradient system is a controlled by chromatography workstation, as shown in figure 2-11. It can realize that the composition of the mobile phase changing while analysis. The system can analyze complicated samples such as proteins, peptides, medicines and so on. The configuration is list in table 2-7.

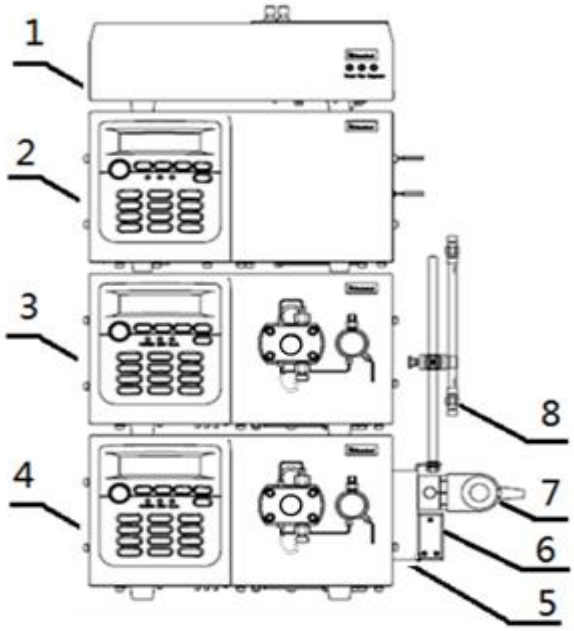

Figure 2-11: Gradient system configuration

Table 2-7: The configuration of gradient system

No.	Components	Function
1	M3100 solvent manager	Take gas out from the mobile phase (optional)
2	UV3100 UV-visible detector	Detect the signal and control the other signals
3	P3140 pump A	Transport the mobile phase A
4	P3140 pump B	Transport the mobile phase B
5	Revolving valve stent	For fixed manual sampling valve and mixer (optional)
6	Mixer	Mix mobile phase A and B
7	Rheodyne7725i manual injector	Inject sample into the chromatographic system manually (optional)
8	Column	Separate the sample

2.8 Verification

In normal instance, the instrument customers received have been tested and came with verification. the performance met our requirements in factory. Users have no need to test and verify. If you have any doubt about the performance of the pump, verify it refer to the following steps:

2.8.1 Check the sealing performance

- **The sealing performance of P3100/P3110**

1) Connect the chromatographic column properly, then, start the pump and observe whether the pressure displayed is stable. If not, please clean check valve or relief bubble in pump head.
2) Set the max alarm pressure to 40MPa. Close the outlet of the injection valve.
3) When start the pump, the pressure will raise slowly. When the pressure rise to 40MPa, the pump will stop automatically. Observe the pressure drop on the screen.
4) Pressure drops less than 1.5MPa in 10min, sealing of the pump is qualified.
5) Pressure drops more than 1.5MPa in 10min, many factors should be considered, such as seals lax of check valve, sampling valve or piping joint, or air bubbles in the pump head.

- **The sealing performance of P3140**

1) Connect the chromatographic column properly, then, start the pump and observe whether the pressure displayed is stable. If not, please clean check valve or relief bubble in pump head.
2) Set the max alarm pressure to 30MPa. Close the outlet of the injection valve.
3) When start the pump, the pressure will raise slowly. When the pressure rise to 30MPa, the pump will stop automatically. Observe the pressure drop on the screen.
4) Pressure drops less than 1.0MPa in 10min, sealing of the pump is qualified.
5) Pressure drops more than 1.0MPa in 10min, many factors should be considered, such as seals lax of check valve, sampling valve or piping joint, or air bubbles in the pump head.

- **Isocratic system**

1) Take a chromatographic column. For the positive phase system SiO2 column can be selected, while C18 column can be used for inverse system.
2) Prepare mobile phase and samples according to evaluation report provided by the column manufacturer.
3) Empty air bubbles in the pump system. When the system is stable, detect the signal according to the testing requirement.
4) If the result and column efficiency is confirmed to the information provide by column manufacturer within the error range, that means the HPLC is qualified.

- **Gradient system**

1) Connect gradient system to the detector through a two-way union. Set the detected wavelength to 254nm.

2) Link the workstation to gradient system and detector, set gradient parameters according to figure 2-12. Mobile phase A is pure water, mobile phase B is 0.2% (V/V) acetone water and the total flow rate is 1.0 mL/min.

3) Start to collect data until the instrument is stable. Gradient error was calculated by the formula (2-1). Take the largest for gradient accuracy.4) If each step is smooth without obvious concave and convex and mixed gradient accuracy is within ±2.0%, the gradient confirms to the requirements and the two pumps match well.

$$T_{Ci} = L_{ti} - \frac{V_i - V_A}{V_A - V_B} \times 100\% \qquad (2\text{-}1)$$

T_{Ci} ——The i segment gradient error

L_{ti} ——Set gradient value of the ith segment

V_i ——The signal value of the ith segment

V_A ——The signal value when the mobile phase A is 100%

V_B ——The signal value when the mobile phase B is 100%

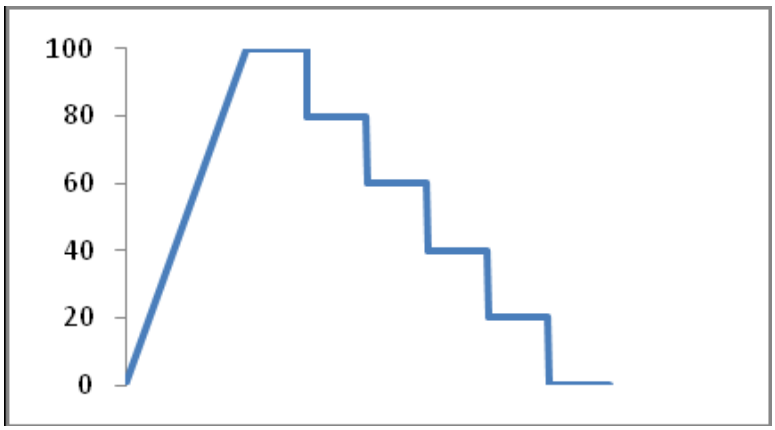

Figure 2-12: Gradient diagram

2.9 Transportation

High pressure constant flow pump is a precision instrument, please be careful while long-distance transportation. Severe vibration and drops are likely to cause damage to the internal parts of the instrument. The original packaging can effectively protect the instrument. When the instrument is required to move or returned for service, please follow these steps for packaging.

Turn off the power.

Unplug the power cord and RS485.

Remove the connecting pipe and other elements between components.

Remove the pump from chromatography system. Put it into special sealed bag on a large platform.

Put the pump into the original packaging foam and fix it.

Place the fixed pump and other accessories into original packaging carefully.

Tape the box sealed to prevent liquid from entering. Covering the packaging box with plastic wrap is recommended.

Transport packaged instrument.

［Warning］Before packing, please check the box. If the original packaging has been damaged, do not use it. You should consult your local dealer or our company customer service staff to solve!

Chapter Three: Basic Operation

3.1 Power On

Only when the system is correctly connected and the power supply of the constant current pump meets the requirements of the instrument, can it be started to run.

［Caution］The power switch should be turned off at this time (“I” means power on, “O” means power off).

Turn on the power switch.

Power light is on, display screen is bright and EClassical 3100 Series pump begins to self-test. The VFD display sequence is as follows:

```
    EClassical P3100
         Ver 1.01
```

```
Flow      1.000   mL/min
P  10.0  MPa  Pmax  40.0
```

［Caution］If this is the first time you use EClassical 3100 Series pump, the parameters displayed on the main interface are default parameters. All parameters of the pump are maintained the previous parameters before last shutdown.

［Caution］The default parameters of P3100/P3110 pump are list as follows:

Flow：1.000mL/min;

***Pmax：40.0MPa;**

Pmin：0MPa;

Pressure unit：MPa.

Note: * P3140 high pressure constant flow pump Pmax=30.0 MPa.

3.2 Menu 1: Basic Operation

In the main interface, you can modify the maximum alarm pressure and the flow rate. If you want to modify a parameter, first press the "↵" enter key, and then press "↑, ↓" key to move the cursor to the parameter that need to be modified. After typing the new parameter value, press "↵" button to confirm. Press the "Run / Stop" button directly, the pump will run according to the set value. If you want to stop the pump press the "Run / Stop" button again.

If the setting value of a flow rate is greater than the limit range, the pump will sound an alarm after confirmation and restore the value before the modification. Press the "Menu" button once to enter "MENU-1 Basic Operation" functional state. You can move into the setting interface of the flow rate, the maximum limit of the pump pressure, the minimum pressure by "↑, ↓" key. You can modify them in corresponding interface. You can type a new value directly when the cursor is flashing on the parameter you want to modify. Press "↵" button to confirm.

Flow : 1.000 mL/min

［Caution］P3100/P3110 flow rate range：0.001～10.000mL/min

P3140 flow rate range：0.10～40.00mL/min

Pmax : 20.0 MPa

［Caution］P3100 / P3110 pressure limit set value：

Pmax: ≤45MPa (flow rate: 0.001~5.000mL/min);

Pmax: ≤20MPa (flow rate: 5.001~10.000mL/min）

P3140 pressure limit set value：

Pmax: ≤30MPa (flow rate: 0.10~20.00mL/min);

Pmax: ≤20MPa (flow rate: 20.01~40.000mL/min）

Pmin : 0.0 MPa

［Caution］The work pressure of the pump is real-time detection. If the pressure reaches Pmax or less than Pmin in one minute from it starts, the pump will send an alarm signal and stop. For all parameters, if the setting parameters beyond the scope, EClassical 3100 Series pump will not accept it and continue to maintain the original ones.

After modifying the parameters in MENU-1, press "Menu" again to enter MENU-2. Press the "Menu" twice to return to the main screen.

Seal Washing: Off
1.Off 2.On1 3.On2 ?

［Caution］The input number of the plunger rod washing menu indicate:

1(Light is out): stop to clean the plunger rod,

2(Light is green): always clean the plunger rod,

3(Light is yellow): intermittently clean the plunger rod.

3.3 Advanced Operation

From the main interface, press MENU button to access “MENU-2 Advanced Operation”. Use ↑ and ↓ to access the setting interface of various parameters in MENU2, including the coefficient of the mobile phase adjustment, the velocity correction factor and pressure unit setting. Key the new value in and press "↵" to alter the parameters.

```
        M E N U   2
A d v a n c e d   O p e r a t i o n
```

3.3.1 Setting EClassical 3100 Series pump A / B in Gradient system

EClassical 3100 Series pump can be controlled from its front panel, you can also control it by a computer through our workstation software. Further gradient analysis, flow time program analysis and other functions can be found in the workstation to meet the requirements of users in the field of production and research.

The setting of A/B pump can be changed in “MENU2 Advanced Operation”. Press "↑/↓" button to enter A/B pump select interface. Set it before analysis. The cursor flash at where can be modified. Enter the according number, then press “↵” button to confirm.

```
      N u m b e r : P - A
  1 . P - A .   2 . P - B .   ?
```

3.3.2 Flow compressibility

Different solvents exhibit different compressibility characteristics. The compressibility of the solvents in use will affect retention time. In order to minimize this effect, EClassical 3100 Series pump provides a compressibility compensation feature which optimizes the flow stability according to the solvent type. The flow compressibility is set to a default value of 100% (using degassed distilled water as mobile phase) and can be changed through the user interface.

- **Measurement of the flow compressibility**

Equipment: 10mL volumetric flask, stopwatch, degassed solvent.

Procedure:

(a) Disconnect the column and eliminate the backpressure of the system.

(b) Select a proper flow rate according to the analysis method. Press the “RUN/STOP” key to start the pump.

(c) Start the stopwatch and begin to collect the mobile phase from the pump outlet in a 10mL volumetric flask.

(d) Record the time it takes to reach 10mL, t.

(e) Repeat step (b) to (d) three times to get the average, t1.

(f) Stop the pump and reconnect the column. Then repeat step (b) to (e). Calculate the mean time with column attached to the system, t2.

Relative error = (t2 – t1) / t2 x 100%

If the relative error is allowable, you have no need to change the compression coefficient. If the error is obvious, adjust the compression coefficient following the steps blow.

- **Adjusting the compressibility parameter**

Enter the “MENU2 Advanced Operation” to adjust the compressibility parameter, input a new compressibility parameter and press "↵" to confirm.

Comp. Flow : 100 %

［Caution］The range of the flow compressibility is 85–115%. If the entered flow compressibility value exceeds the range, the cursor will blink, and the value will return to 100%.

3.3.3 Flow correction

Several factors will affect the accuracy of flow: dirty block filter, clogged capillary tubing connection, dirty valve, leaking seal, etc. Do check these areas before correcting the flow calibration.

The method of the flow accuracy correction is the same as the flow compressibility measuring. If the flow accuracy is beyond the permitted standard, you should adjust the calibration parameter as below:

Enter the “MENU2 Advanced Operation”, press “↑、↓”button to get into the flow correction interface. Then input a calibrated parameter and press "↵" to conform.

［Caution］The range of the flow correction is 85 – 115%. If the entered flow correction value exceeds the range, the cursor will blink, and the value will return to 100%.

3.3.4 Pressure unit

EClassical 3100 Series pump can display pressure in three different units: MPa, bar and psi.

1 MPa = 10^6 Pa = 10 bar = 145.04 psi

Enter the “MENU2 Advanced Operation”, press “↑、↓”button to get into unit interface. Then chose the unit you need and press "↵" to conform.

```
Pressure Unit : MPa
1.MPa 2.bar 3.psi ?
```

［Caution］Select “1” for MPa, “2” for bar and “3” for psi.

3.4 Mobile phase replacement

There are various liquids used in HPLC as mobile phase, including organic solvents, water, buffers, etc. Miscibility and buffer salt precipitation are important issues that should be considered. Please take care when you need to replace mobile phase. If necessary, you can refer to the corresponding physical chemistry handbook.

3.4.1 Replacing with miscible liquid

E.g. replacing methanol with acetonitrile

1) Store acetonitrile in a clean solvent bottle.

2) Take the filter components out from methanol reservoir, wash it with acetonitrile, then, put it into acetonitrile.

3) Open the relieve valve. Flush the pump with approximately 20mL of the new mobile phase.

4) Close the relieve valve, disconnect the column from the system, then, put a bottle at the outlet of the inject valve.

5) Turn on the pump and pump the new mobile phase out about 10 mL.

6) Reconnect the column. Turn on the pump at a suitable flow rate, e.g.1mL/min. The system needs to equilibrate for at least 30 minutes.

3.4.2 Replacing with immiscible liquid

E.g. replacing methanol with n-hexane

Choose an intermediate washing liquid, which must be miscible with both the new and old mobile phase. In the above example, iso-propanol can be used as the intermediate washing liquid, because iso-propanol is miscible with both methanol and n-hexane.

Follow the procedures as described in section 3.4.1 using the intermediate washing liquid to replace old one.

Repeat the procedures as described in section 3.4.1 using the new mobile phase to replace intermediate washing liquid.

3.4.3 Replacing organic solvent with salt buffer

Crystalline salt may appear when buffer salts mix with an organic solvent. Crystalline salt is harmful to the seals, the plunger rod, the injection valve and the internal rotor and stator, moreover, it may block the tube. So, please transition the system with a certain proportion of water-containing organic solvent before analysis. After the experiment is finished, do transition the system again with the same method above, and save the column with organic solvent.

Chapter Four: Maintenance and Repair

4.1 Troubleshooting

Troubleshooting a pump can be frustrating and sometimes a mysterious process. This section outlines a common-sense process for troubleshooting a pump. If troubles cannot be solved when referring to this section, please contact our company post-sales service or local vendor.

4.1.1 Elimination of Air Bubbles

Air bubbles are likely to be trapped in EClassical 3100 Series pump under the following circumstances: the initial use of pump, the pump has been left idle for some time, improperly degassed mobile phase etc. It is crucial to eliminate these trapped air bubbles. Otherwise, they affect system operation in a number of ways, such as: pressure fluctuation, unstable flow rate, and damage the column.

How to eliminate trapped air bubbles

Open the relief valve and press “PURGE” key, flush with high flow rate to remove air bubbles in pump head and inlet lines.

If the pump is unable to draw mobile phase after “PURGE” key was pressed, use a syringe to withdraw mobile phase from outlet of relief valve until the liquid flow out.

If the pump is still unable to withdraw mobile phase, it is probably caused by the dirty check valve. Follow related content in maintenance manual to clean the check valve.

4.1.2 leakage of pump head

Pump head leakage is a common problem. Seal damage in the pump head is the main cause of leakage. Therefore, when the pump discharge occurs, replace worn parts in time.

4.1.3 Overpressure

In the process of operation, real-time pressure monitoring system works. When the pressure exceeds the set maximum pressure, EClassical 3100 Series pump will automatically stop and alarm. Open the vent valve to release the system pressure is a good choice at this time. Then reset the pressure cap or check the entire flow path to look for the reason of the surplus pressure.

［Caution］Setting maximum pressure should be lower than the maximum pressure the column can withstand, or the column may be damaged.

4.1.4 Pump not delivering solvent

Pump not delivering solvent is usually caused by air bubbles in pump head or blocking in solvent filter. In general, the problem can be solved by eliminating air bubbles or cleaning solvent filtering cup. But a dirty check valve can also cause the problem. So, if the pump does not suck liquid after filtering and cleaning solvent cup, please clean the check valve. Cleaning check valve refers to the related contents in the user manual. Common failures and solutions are shown in table 4-1.

Table 4-1: A summary of most common problems affecting system operation

Symptoms	Cause	Solutions
Infusion instability and the pressure fluctuation	Bubbles in pump head	1.Eliminating air bubbles through the relieve valve. 2.Spare bubbles with a syringe through the relieve valve.
	The old solvent remained in the pump cavity	Increase the flow rate to replace old solvent from the relieve valve.
	bubbles in the solvent filter and the inter line	1.Vibration the solvent filter to eliminate air bubbles. 2.If the solvent filters are dirty, clean them with ultrasonic cleaner or replace solvent filters. 3. Degas the mobile phase.
	Something wrong with the check valves	Clean or change the check valve.
	Piston rod or seal leakage	1.Replace piston rod and seal. 2.Change the faulted part.
	Pipeline leakage	1.Tighten the screw where leakage occurs 2.Replace the failure parts.
	Pipeline jam	Clean or replace the tube.
Pump is running, but no liquid out	Air bubbles in the pump cavity	1.Eliminating air bubbles through the relieve valve. 2.Spare bubbles with a syringe through the relieve valve.
	Bubbles in the pump head entering from the infusion entrance	Tighten the cap of the pump head.
	Air in the pump head	Perfuse fluid in pump head, open the relieve valve and turn on the pump under the maximum flow rate until there is no air bubbles appear.
	Incorrect check valve installation	Install the check valve correctly.
	Dirty check valve or worn check valve	Clean or exchange the check valve.
	No solvent in the reservoir	Fill up the reservoir.

Symptoms	Cause	Solutions
The actual flow rate is lower than the set value	Abnormal check valve	Clean or exchange the check valve.
	Dirty filter	Clean or exchange the filter.
No liquid delivered by the pump (the pump is not running)	Power off	Turn on the power.
	The power supply is not connected	Connect power supply.
Flow rate decreases when the pump is running	Air in the pump is gathering	Open the relieve valve, let the pump run under high velocity to eliminate air bubbles.
	Solvent filters plugged	Open the cap of the pump head, if there is no liquid out from infusion tube quickly, it means solvent filter is plugged. Please clean or replace the filter.
	Immiscible solutions in the pump	Use transition solvent to dissolve Immiscible ones.
	Plunger seal leakage	Inspect and replace the piston rod and seal.
	Compression compensation failure	Check or replace the pressure board or pressure transmitter.
Flow rate is too high	The velocity compensation failure	Inspect or replace it (see instructions).
	P.C. board failure	Replace the P.C. board.
	Compression compensation failure	Inspect or replace it.
High pressure	Tubing blockage	Screening each section of pipe to find blocking part. Replace or cut off the block tube.
	Improper pipe diameter	Replace it with proper tube.
	Online filter blocking	Clean or replace filter sieve.
	Chromatographic column plugged	Replace the chromatographic column.
No/Low pressure	No solvent in reservoir	Fill up the reservoir.
	Vent valve is not tight	Tighten the relieve valve.
	Pump pressure sensor fault	Check or replace the pressure sensor.
	Pipe joint leakage	1.Tighten the screw or ferrule where is leaking. 2.Replace the worn parts.
	Seal leakage	Clean or replace the sealing ring.
	Both the inlet and outlet of the pump have air bubbles	Open the relieve valve and let the pump run under high velocity to eliminate air bubbles.
The pump has a humming sound and can not start properly	The motor failure	Stop the pump and check it.
	Phase voltage is too low	Phase voltage is too low.

Symptoms	Cause	Solutions
Flow rate is zero	Air bubbles in pump head	Eliminate the air (refer to the above item).
	The entrance check valve plugged	Check and replace it.
	The export check valve plugged	Check and replace it.
	The direction of check valve is reverse	Install the check valve in the right direction.
The pump stops in operation.	Pressure is higher than limit pressure	a) To reset the highest limit pressure. b) Replace the column. c) Replace tubes with proper ones.
	Power cut	a) Check the power supply. b) Shut off the main power supply, check the fuse.
The pump is on, the pressure is common, but no liquid comes out.	Serious leakage in the system	Repair injection valve or pipeline and fasteners between the pump and detector.
	Fluid passage blockage	Clean injection valve or the connection between the column and detector or particles in flow cell.
	The entrance of column is plugged with particles	Clean or replace the column inlet filter or replace the column. Degas mobile phase and samples properly.
The column pressure increases, but the flow rate decreases.	Column or protect column is partially blocked	Clean or replace the column inlet filter or replace the column.
	The entrance tube of the detector is partly plugged	Remove and clean the flow cell and line.

4.2 Maintenance and repair

In order to ensure the normal operation of the high pressure constant flow pump, maintenance and repair is important. Maintenance means simple repair. Such repairs can be done from the front panel of the pump. There is no need to take out the pump from the stacked configuration. And repair is mainly referred to those which need to change the internal parts and remove the pump body from the stacked configuration and disassemble.

4.2.1 Maintenance of solvent filters

Dirty reservoir and mobile phase contamination is likely to cause blockage to solvent filter. Also, using buffer for a long time may lead to filter pollution and flow impassability. The blockage, pollution and impassability will affect pump operation. Recommended practices can extend the service life of the filter and guarantee the normal work of the pump. Replacing colorless reservoir with brown reservoir is an effective way to prevent fungi biological from growing.

Filter all solvents through a 0.45 micron (or smaller) filter.

The aqueous mobile phase needs to be replaced or filtered often.

Under the allowed condition of test, add 0.0001 to 0.001 mole of sodium azide may put an end to the growth of fungi

When the solvent filter is blocked seriously, air bubbles will appear in infusion tube even if the mobile phase was degassed. Please clean the solvent filter at this time. Cleaning steps are as follows:

1) Remove the solvent filter from the bottle-head assembly and immerse it in a beaker with 30% nitric acid (v/v). Sonicate for 15 minutes.
2) Thoroughly rinse the solvent filter with distilled water. Sonicate the solvent filter in distilled water for 10 minutes.
3) Blow-dries the filter.
4) Sonicate the solvent filter again in distilled water for 10 minutes.
5) Blow-dries the filter again.
6) Reassemble the solvent filter and put it into mobile phase bottle.

4.2.2 Cleaning the check valve

Pump outlet and inlet are equipped with check valves. The components are the same, so a check valve component can be used for any end of the pump. The appearance of the check valve is shown in figure 4-1.

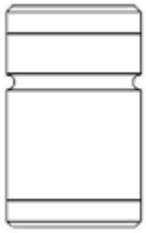

Figure 4-1: Appearance of the check valve

Usually, check valves have no need to clean. If sediment occurs in valve or valve ball and seat is adhesive, cleaning should be carried out.

- **Overall cleaning：**

When the check valve has been assembled completely, overall cleaning can improve the adhesion condition.

1) Take out the check valve at the pump entrance: remove infusion tube from the entrance pressure cap, unload entrance pressure cap using a wrench and take the check valve components out.

2) Take out the check valve at the pump exit: remove infusion tube above pump head with a wrench, then, unload the pressure cap and take the component out.

3) Put them into ethanol and clean with ultrasonic twice in 15 min Then blow off the solvent inside.

4) Assemble the cleaned check valve properly while pay attention to the direction of the check valve.

［Caution］The entrance of the check valve has ring mark nearby. If overall cleaning cannot solve the problem, deep cleaning becomes necessary.

Cleaning steps are as follows:

- **Deep cleaning:**

1) Unload the pressure cap with a wrench. Take the check valve out.

2) Make wallpaper knife into the gap between the coat and the gasket of the valve. Take the valve ball, seat and seal components out carefully. Put them into ethanol and clean with ultrasonic.

3) Observe the valve ball and seat with magnifying glass. If the valve ball or seat is damaged, please change a new one.

4) Assemble the cleaned check valve referring to figure 4-2. Roughness of different sides of the valve seat is not the same Identify them carefully before installation (the gem ball seats the smooth side).

5) Blowing is a good method to check the correction of the installation. Using a dust ball to blow the check valve from the inlet where have a ring mark nearby. You can feel airflow at the other side. Otherwise, air cannot pass through.

［Caution］It is suggested using a small container during cleaning to avoid the loss of the valve components.

Each group of the valve ball and seat is grinded in pairs; therefore, the components cannot mix between different valves.

The system should be washed with methanol and deionized water successively if no one uses the pump for more than one month, or troubles may occur while the pump is running.

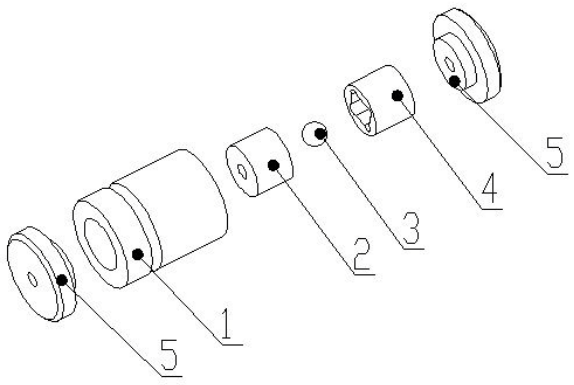

Figure 4-2: Assembly of the check valve

1.The marked valve jacket, 2. Valve seat, 3. Valve ball, 4. Seal with limit set, 5. Sealing gasket

4.2.3 Cleaning the online solvent filter

In order to prevent the particles in mobile phase coming into chromatographic system, the pump is installed an online filter in the vent valve to filter the mobile phase coming out from the pump outlet. It is recommended that users should clean the online filter in time. Use a wrench to unload the pressure cap, remove the sealing ring and the sintered stainless-steel filter, and then clean them.

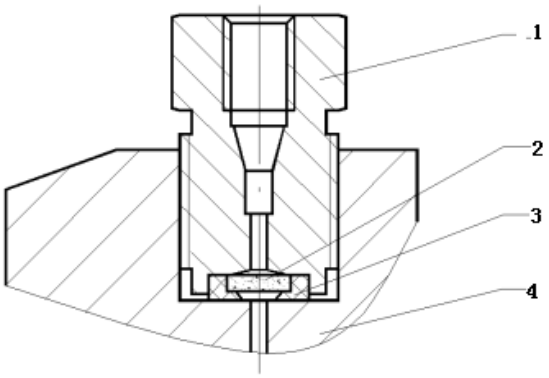

Figure 4-3: Assembly of the online filter

1.Pressing cap, 2. Filter disc, 3. Sealing ring, 4. Release valve

1) Remove the filter disc. Immerse it in a beaker with 25% nitric acid (v/v). Sonicate for 15 minutes.
2) Thoroughly rinse the solvent filter with distilled water. Sonicate the solvent filter in distilled water for 10 minutes.
3) Blow-dries the filter.
4) Sonicate the solvent filter again in distilled water for 10 minutes.
5) Blow-dries the filter again.

4.2.4 Cleaning the pump head

Crystalline salt may appear when using buffer salts for a long time. Crystalline salt is harmful to the seals and plunger rod. In order to avoid this situation, cleaning should be carried out frequently on the flow path and sealing ring. Customers can prepare a suitable cleaning fluid (such as distilled water and 10% methanol, 20% ethanol aqueous solution, etc.). Plunger rod cleaning device has been allocated as standard in the high pressure constant flow pump. Select a suitable cleaning method refer to "3.2 normal operation" according to the need.

［Caution］Add and replace the cleaning fluid in time.

4.2.5 Pump Head Assembly

There is no need to open the case cover when removing the pump head. Methods for pump head disassembly and installation are as follows:

1) Turn off the pump power.

2) Remove the infusion line connected with the pump.

3) Use 3# hexagonal key (Allen key) to unscrew the 4 pump head screws and remove the pump head body.

4) When installing the pump head, pay attention to evenly tighten the four fixed screws, referring to figure 4-3.

5) Connect the infusion line removed in step 2 above.

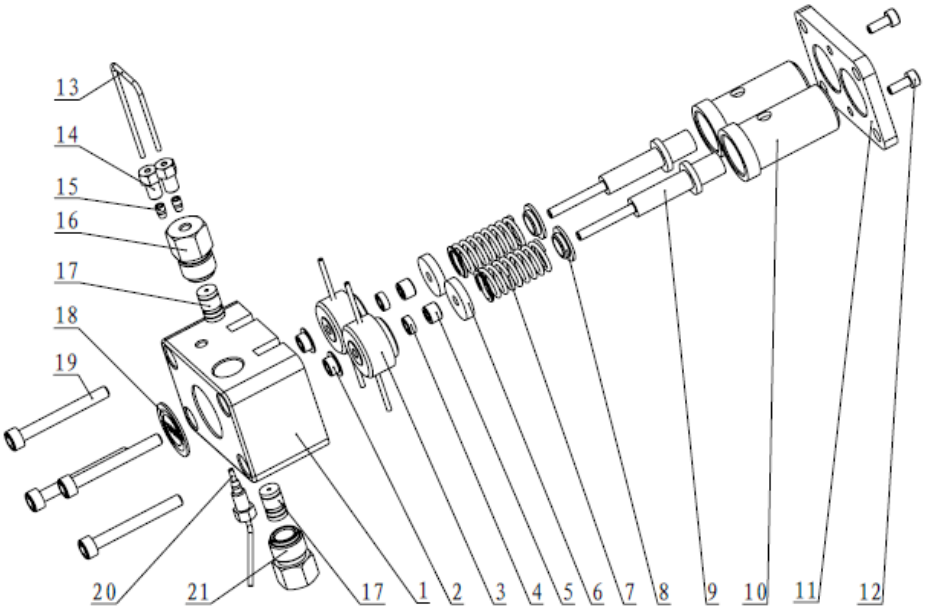

Figure 4-3: pump head assembly

1. Pump head body, 2. Plunger seal, 3. Support ring with plunger rinsing, 4. The secondary seal, 5. The secondary seal pressure ring 6. Spring outside locating sleeve, 7. Plunger spring, 8. Spring inside locating sleeve, 9. Plunger rod components, 10. Sleeve, 11. Mounting plate, 12. Mounting plate screw, 13. Stainless steel tube, 14. Tube screw, 1/16"I.D., 15. Stainless steel ferrule, 1/16"I.D., 16. Export pressure cap, 17. Check valve, 18. Badge of the pump head, 19. Pump head screw, 20. Outlet pipe, 21. Entrance pressure cap

Pump head disassembly and installation methods are as follows (Refer to figure 4-3, figure 4-4):

1) Place the pump head body on a flat surface. Use 2.5# hexagonal key to unscrew the 2 mounting plate screws, #12 on Figure 4-3. Remove the clamp (10#).

2) Unload the sleeve (figure 4-3 #10), plunger rod components (figure 4-3 #9), plunger spring (figure 4-3 #7), locating sleeve (figure 4-3 #3) etc.

3) Observe the plunger rod surface with a magnifying glass to find whether axial wear occurs on it. If there is no axial wear, clean the plunger rod, or a new plunger rod is needed.

4) Take out the primary seal carefully (figure 4-3 #2) (user should not remove it unless replace a new one is needed).

5) Put the new primary seal (the openings with spring should be in the direction of the pump head) into the pump head body (figure 4-4 #1).

6) Place all parts in order according to figure 4-4. Install the pressure plate.

7) Put the pump head on worktable, push the pressure plate slowly, press the two-pressure plunger rod into the primary sealing ring, and then tighten two fixed screws evenly.

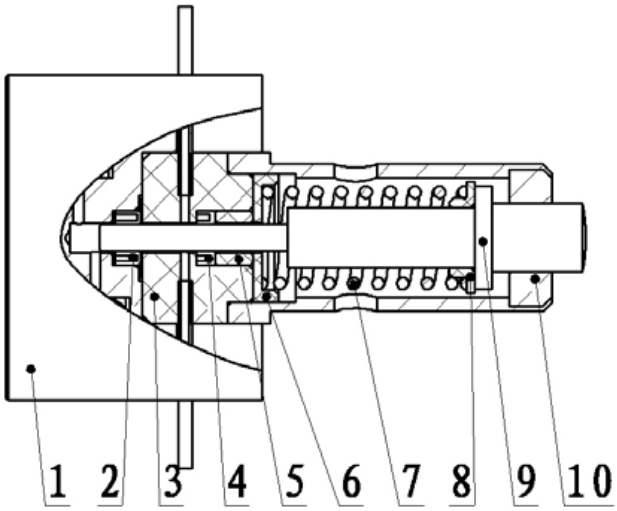

Figure 4-4: Cross-section of sapphire plunger

1. Pump head body 2. Plunger seal 3. Supporting ring with plunger rinsing 4. Primary seal 5. The secondary seal pressure ring 6. Spring outside locating sleeve 7. Plunger rod spring 8. Inside spring locating sleeve 9. Plunger components 10. sleeve

［Caution］Plunger rod is easy to break. Be careful while unloading and assembling.

4.2.6 Plunger seal replacement

Plunger and plunger seal will wear during long-term use. It is mainly related to the flow rate, the operating pressure and the kind of mobile phase. The impact of these factors is uncertain, so estimating the wear degree of those parts is difficult. It is necessary to check the surface of the plunger rod when replacing piston ring. If there is an even small scratch on the surface of the plunger rod, please replace it. The method for plunger disassembly and installation can refer to "4.2.4 pump head assembly" above.

4.2.7 Fuse replacement

The fuse replacement process is as follows:

1） Turn off the power switch.

2） Remove the power cable from the power outlet.

3） Open the fuse box with a screwdriver referring to figure 2-6.

After replacing a new fuse, lift the fuse lid.

［Caution］Please use the same model fuse.

Chapter Five: Components and Material list

5.1 Consumption parts

NO.	Describe	PN
1	Mobile phase bottle, transparent, 500mL	33110001
2	Mobile phase bottle, transparent, 1000mL	33110002
3	Mobile phase bottle, transparent, brown, 500mL	33130008
4	Mobile phase bottle, transparent, brown, 1000mL	33130009
5	PTFE tube O.D.1/16″～I.D.0.03″	13010031
6	Solvent filter	18040009
7	3/16″ Y shape straight tee	33120232
8	VM-1002 parts clamp	14992427
9	Flat wire clip	14992562
10	Green Flangeless-Nuts	3215P-305X
11	Yellow Flangeless-Ferrules	3215P-300X
12	3/16″-32 Stainless steel connection screws	14510027
13	1/16″Stainless steel ferrules	14990070
15	OD1/16″～ID0.02″stainless steel tube	12010007
16	Type A number tube	19000072
17	Type B number tube	19000073
18	Power line	17000001
19	485 line	18990075
20	*T1.25A/250V fuse	15080015

Note: * P3140 high pressure constant flow pump choose T1.5 A (250V) fuse.

5.2 Replacement Parts

NO.	Describe	PN
1	O-rings Φ3.5x1.8	14992280
2	plunger rod	14010215
3	check valve component	14010012
4	primary seal	14990076
5	secondary seal	14990074

Appendix

Introduction to the connecting tube materials

In HPLC systems, column systems, tubing, fittings, and extra-column volumes in the injectors and detectors are likely to cause peak broadening. Improper tube material will also lead to peak broadening, even cause the sample degeneration, which affects the reliability of analysis results directly.

Good connection can fully exert the function of the instrument and improve the work efficiency. Different pipeline material is needed according to the system pressure and the properties of mobile phase and samples. Commonly used pipe materials include stainless steel, polyether ether ketone (PEEK), Teflon, polytetrafluoroethylene vinylidene fluoride, polyethylene or polypropylene. The stainless-steel pipe is the most commonly used.

Outer diameter of HPLC system connecting pipe is 1/16"(1.59mm). Inside diameter can be chosen according to your need. Commonly used inside diameter includes 0.007"(0.175mm)，0.01"(0.25mm), 0.02"(0.5mm), 0.03"(0.75mm) and 0.04"(1.0mm) etc.

Stainless steel tube is generally used in high pressure part. In HPLC systems, the part from the pump to the column inlet is high pressure section. Stainless steel tube is recommended.

Stainless steel tubing has good corrosion resistance and coaxially. The bore of the pipe should match that of the fitting well while using it.

Also, polymer tubing can be used in many sections of HPLC systems, such as low-pressure parts: from the liquid bottle to the pump, the detector outlet, the sampler drainage port, the emptying valve outlet and others. Teflon is inertial to HPLC solvents and is the most commonly used plastic pipe.

When the pressure is lower than 20MPa, peek tubing is lazier than stainless steel tubing and is suitable for biological sample analysis.

Safety information

General safety information

At the different stages of the instrument operation, maintenance and repair, everyone should abide the following general safety rules. Breaking these rules may cause damage to instruments or staffs. our company does not responsible for the impact caused by non-standard operation.

Standard of security

For marked with this symbol of the equipment, the user should refer to the instruction manual, so as not to cause harm to the operator and the equipment.

Symbols	Descriptions
	Please do not operate beyond the scope of caution, unless you have been fully understood and meet the required conditions.
［Warning］	Casualties may appear. Please do not operate beyond the scope of warning, unless you have been fully understood and meet the required conditions.
［Caution］	Data loss or equipment damage may appear. Please do not operate beyond the scope of caution, unless you have been fully understood and meet the required conditions.
［Note］	Unsatisfactory experimental data and instrument failure may appear. Please do not operate beyond the scope of note, unless you have been fully understood and meet the required conditions.