User Manual of PJS-100 Piezoelectric Jet System

Table of Contents

Tapp	Tappet
Tapp Num	Tappet Running Times
Lift PCT	Lift Percent; Tappet Stroke (up and down)
Jet Freqs	Jetting frequency in Unit Time
Sys Info	System Information
Config Set	Configuration Setting
Nozz	Nozzle
Nozz Num	Nozzle Running Times
PZT Num	Piezoelectric Stack Running Times
Err Code	Error Code of System Running

1 Introduction

1.1 Foreword

In this manual, the customer will understand detailed description of Mingseal jet valve operation and system running.

Please read this manual carefully before operating Mingseal jet valve system, and please contact us if the customer is still puzzled after reading.

1.2 PJS-100 Series

PJS-100 system is composed of a piezoelectric jet valve PJV-100, a controller PJC-100, optional heating modules HM-310 and HM-320, and a heating controller HC-570A/B.

1.3 Safety Instructions

To ensure safe running of PJS-100 series piezoelectric micro-jet system, operators must be familiar with this manual, undergo strict operation training, and have a good sense of potential hazards during use.

Only qualified personnel can carry out installation and maintenance, etc. of the system.

1.3.1 Overview

Before jetting any medium, please carefully study **the risk and safety data of the medium to be jetted** (whether the medium is anaerobic, toxic and corrosive, etc.); when jetting any toxic, corrosive and reactive medium, wear protective clothing, protective mask, glasses and gloves.

1.3.2 General Operation Instructions

- PJS-100 piezoelectric micro-jet system can jet high viscosity media;
- Unique heating control modules HM-310 and HM-320 can be configured;
- PJS-100 piezoelectric micro-jet system can be used in both laboratory and production environments;
- It is possible to provide high-frequency jetting (up to 1000Hz) and adjust corresponding parameter setting;
- Carry out maintenance in strict accordance with the equipment maintenance interval (refer to Chapters 6 and 7 of the manual);
- Media affecting the functions of the piezoelectric micro-jet system shall be avoided; otherwise it will cause damage to the system.

1.3.3 Details of Safety Requirements

- PJS-100 piezoelectric micro-jet system can be used at an altitude below 2000m;
- Relative humidity:40%-60%;
- The line voltage fluctuation range of rated voltage shall not exceed ±10%;
- The power cord must be equipped with a grounding terminal, and the power socket must meet corresponding safety regulations;
- During installation and operation, please ensure that there is sufficient air circulation on the site: keep at least 1.5cm above and below the system (valve and controller);
- When using the heating systems, please pay attention that too high surface temperature of the heating modules may cause burns;
- The safety device configured in the system may be affected by components, operation of hazardous substances or operation in harsh environments.

1.3.4 Precautions

- It is strictly forbidden to use the system without medium and nozzle bushing;
- **It is strictly forbidden to disconnect the cable during jetting; otherwise any damage to the system is at your own risk;**
- Avoid continuous and fast start and stop of the controller;
- **Avoid long-term standby after startup of the system;**
- PJS-100 series is of modular structure, if there is any defective module affecting the results, you can replace it with other modules, while sending it to Mingseal Company for repair;
- Avoid impact against the working surface during disassembly and assembly of the valve body;
- After use of the valve body, clean all parts in contact with the fluid medium, and then place the valve body in a special box where the valve body can be fixed so as to protect the valve body from shock and impact;
- Clean the valve body with lint-free cloth(alcohol) to ensure that there is no fluid adhesion in the valve body (e.g. through the connector);
- Make sure that all parts among which the fluid flows through have been connected and sealed well;
- Make sure that all parts among which the fluid flows through have been connected firmly;
- Make sure that all cable joints have been connected and locked;
- Make sure that the air source pressure does not exceed the allowable range (7 bar at most depending on the configuration structure);
- Depending on the air pressure limits of the valve body and its connecting pieces, the pressure with standing value of the system shall not exceed any limit;
- Before using the heating device, make sure that the medium to be jetted does not experience any adverse reactions at high temperatures;
- When using the heating device, make sure that the set temperature does not exceed 80% of the boiling point temperature (℃) of the medium;
- When using the heating device, because of changes in pressure, carefully observe whether the fluid feed line and parts have any abnormality at the upper limit of the temperature;
- HM-310 flow channel shall not be heated to exceed 140℃, and **HM-320 glue barrel shall not be heated to exceed 90℃** (otherwise the glue barrel will soften and crack);
- If **the heating temperature exceeds 45℃** when using the heating device or the valve body **operates continuously at high frequency**, it is recommended to **conduct air cooling** for the valve body; cooling air source must undergo **oil-water separation and filtration**, and it is OK that **the air pressure** of filter valve **reaches 0.02MPa**.
- PJV-100 valve is normally open under normal conditions; in order to avoid medium leakage in the non-energized state, **please be sure to** cut off the air source and release the air pressure before shutting down the system.

2 Installation and Startup

2.1 General Configuration

Please check whether spare parts are complete after receipt. Some standard components of PJS-100 series are shown in the following table.

PJV-100 jet valve	Power signal cable (red)	PJC-100 controller

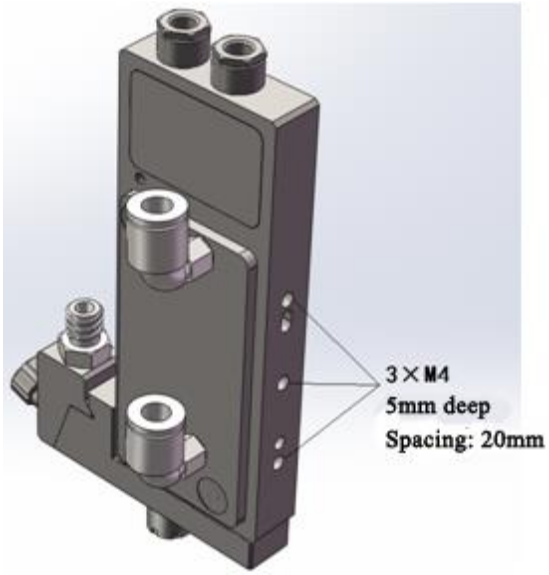
Controller power cord (black)	Control signal cable (black)	Fluid cavity
Tappet guiding part	Nozzle bushing*	Nozzle device
Removal push rod	Removal wrench	User Manual
Removal sleeve	Thread insert wrench	

Optional parts are shown in the following table.

Optional parts	HM-310 heater, connecting cable for heating, HM-320 glue barrel heater, and HC-570A/B heating controller
Recommended parts	A complete set of cleaning tools, and tappet protective jacket

2.2 PJS-100 On-site Installation

Connect with the movement mechanism by **three M4 threaded holes on the narrow side** of PJV-100, requiring the connection surface of the movement mechanism and the valve body to be smooth; see the following figure.



All parts (bolts and fixtures, etc.) connected to PJV-100 valve body must be of **stainless steel, non-ferrous metal or galvanized steel**. Use of materials which have not undergone fine machining to connect the valve body can cause corrosion.

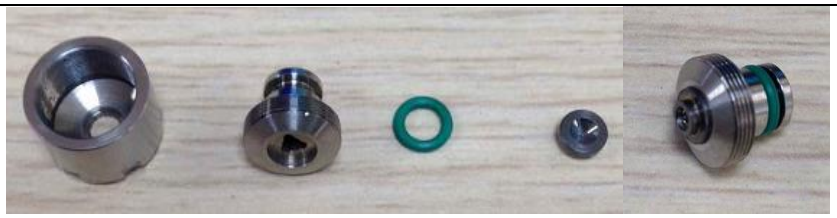
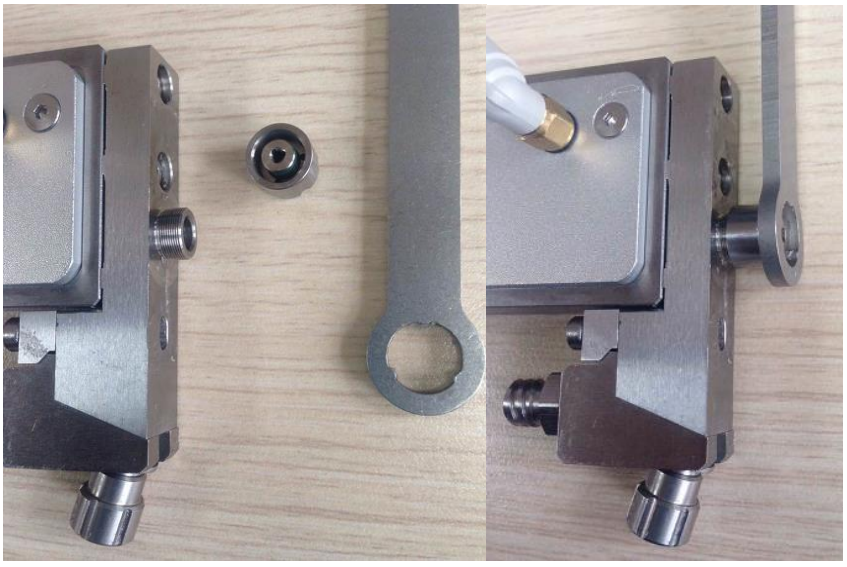
PJC-100 piezoelectric micro-jet valve controller adopts modular design, so it can be placed in a proper position as needed during use; maintain good ventilation and adequately ensure that setting and adjustment of front panel and cable connection of rear panel can be easily conducted. Guided connection is adopted among cables, connectors must be tightened, and fool-proofing design is adopted between the plug and socket to ensure no wrong insertion occurs.

PJV-100 valve body and PJC-100 controller are connected by the 4-pin plug on the upper part at the bottom of the valve body, and **red dots** on the plug and the socket must be **corresponding**. The cable marked in red is used to

provide the power supply required for piezoelectric stack operation (bipolar operation can be achieved), and can be disconnected by axially pulling back the riffled bushing coil. **(Note: Do not disconnect the cable when the system is jetting; otherwise it can cause damage to the valve body and the controller. <u>After turning off the power of the controller</u>, disconnect the valve body from the controller.)**

2.3 Start and Jetting

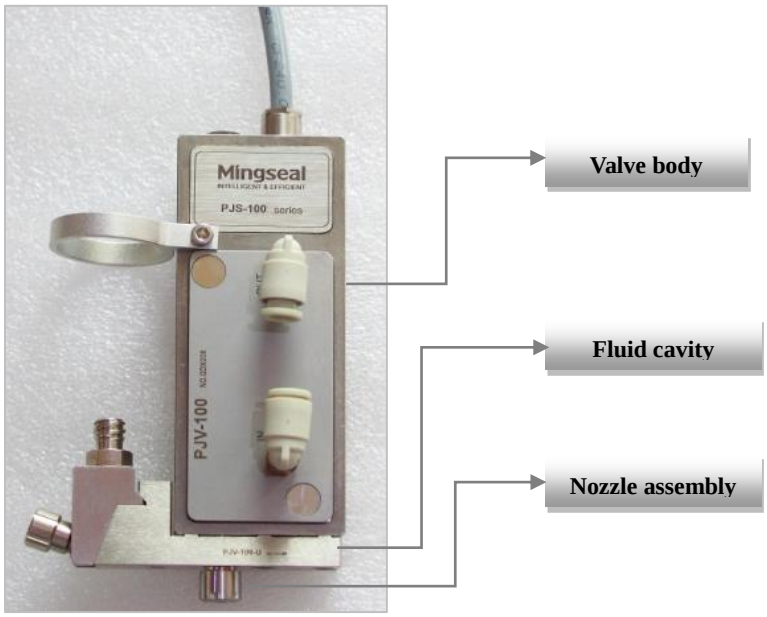
Step 1: Install the syringe bracket, which is connected to the valve body by one M3 screw and tightened.	 

Step 2: Connect the controller and the valve body, connect the controller power cord to the controller, and turn on the power switch.	
Step 3: Install the nozzle and O-ring into the nozzle bushing, and then use the removal sleeve to screw the nozzle bushing assembly into the nozzle adjustment nut to form a nozzle assembly.	 
Step 4: Screw the nozzle assembly into the fluid cavity so that the nozzle in the nozzle assembly contacts the tappet in the valve body, and properly adjust the contact force value to start commissioning.	

3 PJV-100 Piezoelectric Jet Valve

3.1 Composition

PJV-100 piezoelectric jet valve is of modular structure, and is composed of the following three basic modules: 1. valve body; 2. fluid cavity; 3. nozzle assembly.



The valve body is the main component of the piezoelectric jet valve, including stack brake and tappet drive mechanism, and its whole structure is fully sealed to avoid adverse effects on the piezoelectric jet valve from pollution and humidity. An external cable plug is on the top of the valve body, and can be connected to the controller via the connecting cable.

The fluid cavity is an independent part and can be easily separated from the valve body by removing two M3 screws, so that it is easy to clean the fluid cavity part.

In accordance with the instructions in Section 6.1, the components of the nozzle assembly can be quickly replaced and cleaned, so that the glue jetting system can quickly change to different glue jetting jobs.

3.2 Technical Parameters

Property	**Value**
Supply pressure range	0.1~8 Bar
Viscosity of media to be jetted	Up to 200000mpasfor medium or high viscosity media
Maximum jetting frequency	1000Hz
Operating temperature range	10~50℃
Corrosion resistance	All aqueous media, organic solvents, weak acids and weak alkalis
Specification& size	100×40×15mm (without flow channel) 116×75×15mm (with flow channel)
Weight	240 g

3.3 Features

3.3.1 Normal Conditions

When the jet valve is in the non-energized state, the tappet and nozzle are normally open, so it is necessary to

pay attention to leakage of fluid medium with low viscosity, and timely put the glue jetting system in the energized state, so that the tappet and nozzle are in the closed state; before powering off the glue jetting system, it is necessary to adjust the air source pressure in the fluid medium to at least the same as or lower than the ambient pressure to prevent medium leakage after power-off.

3.3.2 Maintainability

The structure is simple, and disassembly is convenient. Each component (nozzle locking insert, tappet guiding seat, O-ring and nozzle sealing seat) are of standardized design, and can be replaced rapidly according to the needs of glue jetting, thereby significantly reducing maintenance cost and time.

3.3.3 Operability

The modular design facilitates installation and placement, and the motion platform can be connected and installed rapidly. Easy and simple operation can be achieved in all installation positions.

4 PJC-100 Piezoelectric Jet Valve Control System

PJV-100 piezoelectric glue jetting system can achieve high-speed, precision and non-contact jetting of low, medium and high viscosity media. The system in combination with the motion control platform can achieve high-precision glue jetting jobs.

4.1 Product Functions and Characteristics

1) Flexible pulse parameter setting function to support jetting of various-viscosity glue media;
2) Work mode selection function to select one of three modes - point, line and cleaning;
3) **Parameter memory function (10 sets of parameters)**to maintain and switch multiple sets of glue matching parameters;
4) Maintenance reminder function to **provide maintenance reminders of core parts**, thus ensuring that the glue jetting valve is in good working condition;
5) Error message prompt function to ensure that the piezoelectric valve is in the correct state to work;
6) Flow channel heating and glue barrel heating functions;
7) Support serial communication, and be able to read the parameters and state information relevant to the controller externally and read and write the working parameters of the system;
8) Parameterized control and simple operation.

4.1.1 Technical Parameters

Function Indexes of PJC-100 Controller	
AC power input	100~240V AC
Pulse parameter and resolution	0.01ms~1000.00ms, 0.01ms
Glue dispensing frequency	1~1000HZ
Parameter and setting display	TFT color screen
Parameter memory	10 groups
Reserved interfaces	2 serial communication interfaces and 8 I/Os
Weight of main machine	3KG
Overall dimensions	92×185×280mm

4.2 Guide for Equipment Installation and Operation

4.2.1 Equipment Installation

- Please connect the "TRIG" signal socket of the glue dispensing controller with the glue dispensing motion platform through the aviation plug cable.
- Use PJV-100 special power cable to connect the "ACTOR" socket of the controller and the red power socket of the valve body.
- Connect the power cord of the glue dispensing controller and start up (press the rocker switch on the rear panel).

4.2.2 Description of Control Parameters

Note: Before using this product, please ensure that the power supply is reliable, and the jet valve controller does not interfere with surrounding other devices.

The jet valve controller receives the glue dispensing trigger signal sent out by the motion control platform, and produces corresponding valve-opening signal according to different glue dispensing mode to control the glue liquid jetted by the piezoelectric valve. The controller works according to the following control curve.

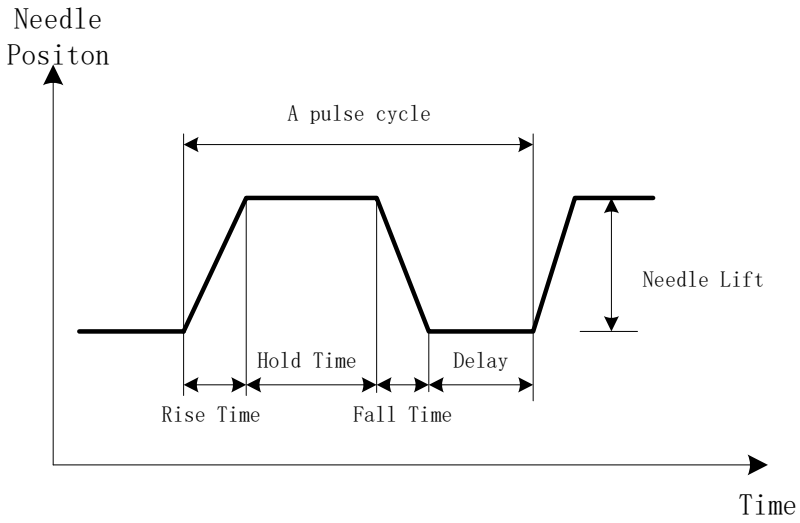


Table 1 Description about Glue Dispensing Pulse Parameter Setting of Controller

Rise Time	The time for the tappet to rise from the nozzle. The increment is 0.01ms. The minimum set time is 0.02ms, and the maximum set time is 100ms (Setting of rise time is related to the bubble effect of glue jetted. In case of more bubbles, you can increase the rise time. The default setting is 0.3ms).
Hold Time	The hold time of the valve body in open state, i.e. the tappet at rising position. The increment is 0.1ms. The minimum hold time is 0.2ms, and the maximum hold time is 1000ms (The longer the hold time is, the more glue output will be).
Fall Time	The time for the tappet to impact and fall from the rising position to the nozzle. The increment is 0.01ms. The minimum time is 0.01ms, and the maximum time is 25ms (The shorter the fall time of the tappet is, the bigger the impact force of the tappet will be. The higher the viscosity of glue liquid is, the bigger the impact force will be needed).

Delay	The time delay between pulse points, equivalent to the valve closing time. The increment is 0.1ms. The minimum delay is 0.5ms, and the maximum delay is 1000ms (The smaller the set delay is, the higher the glue jetting frequency of the system will be).
Tappet Stroke	This value indicates the stroke of the tappet, and its range is 10%-100%, representing the percentage of the maximum tappet stroke. The higher the tappet stroke is, the bigger the impact force will be (The higher the viscosity is, the bigger the impact force will be needed).

During actual use, **Fall Time and Tappet Stroke have a greater influence on the impact force of the Tappet**. If the viscosity of the medium is higher, it is necessary to increase Tappet Stroke and decrease Fall Time. Rise Time and Hold time have a greater influence on the single glue dispensing, and the longer the time is, the bigger the glue output will be. If glue hanging occurs during glue jetting in the condition that the impact force is satisfied, the glue output shall be reduced.

4.2.3 Control Panel

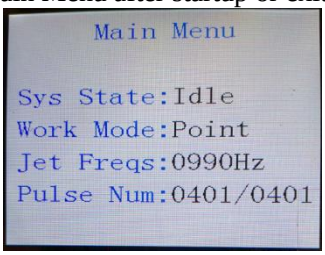
Schematic diagram of operation panel of controller:

The front control panel consists of combined function keys and TFT color LCD. Description about function keys:

	Glue jetting trigger key: Press this button to make the system carry out glue jetting jobs according to the set pulse parameter value.
	Nozzle calibration key: Press this button to start the nozzle position calibration procedure (this function is not supported temporarily).
	Setting/OK key: Press this button to enter the system setting screen. In case of value setting, press this button to confirm and save the value.
	Return key: Press this button to return to the previous menu screen. In case of value setting, press this button to exit the setting state and return to the original value.
	UP arrow key: Press this button to switch upward the number of rows selected in the current screen. In case of value setting, press this button to add 1 digit to the currently selected digit.
	DOWN arrow key: Press this button to switch downward the number of rows selected in the current screen. In case of value setting, press this button to deduct 1 digit from the currently selected digit.
	LEFT arrow key: In case of value setting, press this button to move the currently selected digit leftward by 1 digit.
	RIGHT arrow key: In case of value setting, press this button to move the currently selected digit rightward by 1 digit.

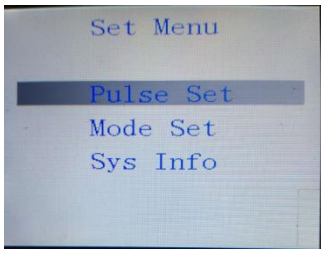
4.2.4 Screen Operation

Main Menu: The system enters the Main Menu after startup or exiting the setting screen.



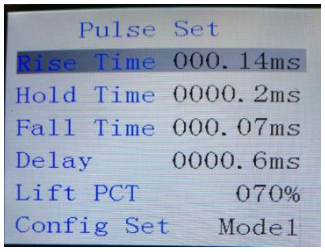
- **Sys State** indicates the current work state of the controller. The common state is idle, glue jetting, maintenance and fault, etc.;
- **Work Mode** indicates the current glue jetting mode of the controller, and there are three modes, namely point, line and cleaning. In “point” mode, the system executes glue jetting according to the set pulse number; in “line” mode, the system executes glue jetting according to the effective time of trigger signal; and in “cleaning” mode, if the trigger signal is effective, the tappet of the valve body will rise completely;
- **Jet Freqs** indicates that the frequency corresponding to the set pulse parameter of the controller;
- **Pulse Num** indicates the number of pulse points output by the current glue jetting. The value after "/" indicates the set pulse number in “point” mode.

Set Menu: When the system is in idle state, press the [SET] key to enter the Set Menu screen of the system:



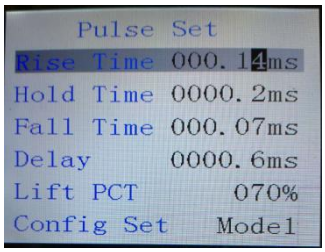
After entering the Set Menu, Pulse Set in the first line is selected in default. The background of the selected line is displayed in grey. Press the UP/DOWN arrow keys to switch the selected line.

Pulse Set menu: Select the Pulse Set in the Set Menu, and then press the [SET] to enter the Pulse Set menu screen:



The pulse setting parameters include Rise Time, Hold Time, Fall Time, Delay, Tappet Stroke and Config Set. Please refer to Table 1 for description about pulse parameters and limit values.

After selection of parameter line, press the [SET] to enter the value setting state. At this time, the background of the selected digit is displayed in black:

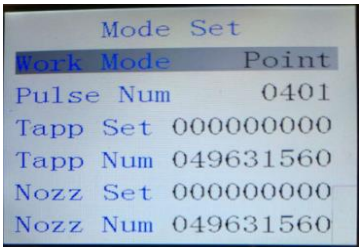


Please refer to the description about function keys for the value modification method.

Config Set indicates the currently selected parameter configuration number. Each set of configuration includes the set values of seven independent parameters, namely rise time, hold time, fall time, delay, tappet stroke, pulse number and work mode. Parameter configuration may save and load 10 sets of pulse parameters to facilitate configuration of various-viscosity glue media. The operation of configuration selection is the same as that of values. After selection of a new mode, the pulse parameters saved in this mode will be loaded as the working pulse parameters of the system, and change of the pulse parameters will also be saved in the current mode.

On the Pulse Set screen, glue jetting jobs can be carried out so as to adjust the parameters according to the glue output effect. After adjustment of the parameters, it is necessary to exit the Pulse Set screen and return to the Main Menu, in order to observe the work state of the system. **Note: During value setting, glue jetting jobs cannot be started since the parameter values are not determined.**

Mode Set menu: Select the Mode Set in the Set Menu, and then press the [SET] to enter the Mode Set menu screen.

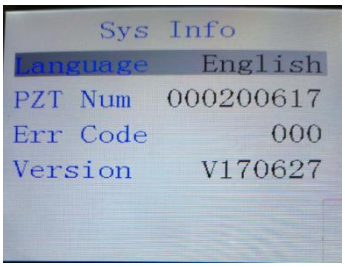


For Work Mode, please refer to the description about Main Menu. Pulse Num indicates the number of pulses operated in a fixed way by the controller in “point” mode.

Description about and setting method of other parameters:

- Tappet Set value indicates the service life value of the tappet. If the set value is 0, the system will not prompt maintenance when the service life is exceeded (the service life value has been set before delivery, and cannot be changed by common operation);
- Tappet Num value indicates the current usage times of the tappet. This value will be added 1 each time when a pulse is jetted. After selection of Tappet Num line, press the UP/DOWN arrow keys to reset the number, and then press the [SET] to confirm and save.
- On the Mode Set screen, Nozzle Set value indicates the service life value of the nozzle. If the set value is 0, the system will not prompt maintenance when the service life is exceeded (the service life value has been set before delivery, and cannot be changed by common operation);
- Nozzle Num value indicates the current usage times of the nozzle. This value will be added 1 each time when a pulse is jetted. The operation of nozzle number resetting is the same as that of tappet number resetting.

Sys Info menu: Select the Sys Info in the Set Menu, and then press the [SET] to enter the Sys Info screen:



- **Language:** Display the current screen language of the system, and support switching between Simplified Chinese and English;
- **PZT Num:** Total number of piezoelectric stack operation of the system; this number cannot be reset by common operation;
- **Err Code:** Current fault/maintenance code of the system. The maintenance code is only readable. After maintenance and replacement or troubleshooting, the maintenance code will be reset automatically. Information about maintenance/fault code is described as follows:

Maintenance/fault code	Error message
001	The usage times of the tappet reach the service life value, and it is suggested to maintain the tappet. The main screen of the system will prompt “Maintenance”, and the system can continue working.
002	The usage times of the nozzle reach the service life value, and it is suggested to maintain the nozzle. The main screen of the system will prompt “Maintenance”, and the system can continue working.
003	Valve body over-temperature alarm. The main screen of the system will prompt “Fault”, and the system will stop working before troubleshooting.
004	Abnormal connection of valve body. The main screen of the system will prompt “Fault”, and the system will stop working before troubleshooting.

- **Version:** Firmware version number of the system.

4.2.5 Serial Communication

The system adopts RS232 serial communication, has a communication baud rate of 115200, 8 data bits, 1 stop bit, and has no check bit and flow control. The system supports MODBUS-RTU communication protocol, and adopts "question and answer" for communication. Each command of the protocol is subject to MODBUS CRC check. The command protocol is described in the following table.

1) Write pulse parameter information

Write to parameter register			
Recipient address	1 byte	0x01 (Controller address)	
Function code	1 byte	0x10 (Function code)	
Register address Hi	1 byte	0x00	
Register address Lo	1 byte	0x10	
Register quantity Hi	1 byte	0x00	
Register quantity Lo	1 byte	0x07	
Register value Hi	1 byte	Rise Time Hi	
Register value Lo	1 byte	Rise Time Lo (1-1000)*(0.01ms)	
Register value Hi	1 byte	Hold Time Hi	
Register value Lo	1 byte	Hold Time Lo (1-10000)*(0.1ms)	
Register value Hi	1 byte	Fall Time Hi	
Register value Lo	1 byte	Fall Time Lo (1-1000)*(0.01ms)	
Register value Hi	1 byte	Delay Hi	
Register value Lo	1 byte	Delay Lo (1-10000)*(0.1ms)	
Register value Hi	1 byte	Tappet Stroke Hi	
Register value Lo	1 byte	Tappet Stroke Lo (1-100)(%)	
Register value Hi	1 byte	Pulse Number Hi	
Register value Lo	1 byte	Pulse Number Lo (1-9999)	
Register value Hi	1 byte	Work Mode Hi	
Register value Lo	1 byte	Work Mode Lo	0x01: Point mode
			0x02: Line mode
			0x03: Cleaning mode
CRC	1 byte	CRC low 8 bits	
CRC	1 byte	CRC high 8 bits	
Controller response command			
Sender address	1 byte	0x01 (Controller address)	
Function code	1 byte	0x10 (Function code)	
Register address Hi	1 byte	0x00	
Register address Lo	1 byte	0x10	
Register quantity Hi	1 byte	0x00	
Register quantity Lo	1 byte	0x07	
CRC	1 byte	CRC low 8 bits	
CRC	1 byte	CRC high 8 bits	

2) Readpulse parameter information

Read parameter register		
Recipient address	1 byte	0x01 (Controller address)
Function code	1 byte	0x03 (Function code)
Register address Hi	1 byte	0x00
Register address Lo	1 byte	0x10
Register quantity Hi	1 byte	0x00
Register quantity Lo	1 byte	0x07
CRC	1 byte	CRC low 8 bits
CRC	1 byte	CRC high 8 bits
Controller response		
Sender address	1 byte	0x01 (Controller address)
Function code	1 byte	0x03 (Function code)
Number of bytes Hi	1 byte	0x00
Number of bytes Lo	1 byte	0x0E
Register value 0 Hi	1 byte	Rise Time Hi
Register value 0 Lo	1 byte	Rise Time Lo (1-1000)*(0.01ms)
Register value 1 Hi	1 byte	Hold Time Hi
Register value 1 Lo	1 byte	Hold Time Lo(1-10000)*(0.1ms)
Register value 2 Hi	1 byte	Fall Time Hi
Register value 2 Lo	1 byte	Fall Time Lo(1-1000)*(0.01ms)
Register value 3 Hi	1 byte	Delay Hi
Register value 3 Lo	1 byte	Delay Lo(1-10000)*(0.1ms)
Register value 4 Hi	1 byte	Tappet Stroke Hi
Register value 4 Lo	1 byte	Tappet Stroke Lo(1-100)(%)
Register value 5 Hi	1 byte	Pulse Number Hi
Register value 5 Lo	1 byte	Pulse Number Lo(1-9999)
Register value 6 Hi	1 byte	Work Mode Hi
Register value 6 Lo	1 byte	Work Mode Lo
CRC	1 byte	CRC low 8 bits
CRC	1 byte	CRC high 8 bits

3) Read system state

Read state register		
Recipient address	1 byte	0x01 (Controller address)
Function code	1 byte	0x03 (Function code)
Register address Hi	1 byte	0x00
Register address Lo	1 byte	0x00
Register quantity Hi	1 byte	0x00
Register quantity Lo	1 byte	0x02
CRC	1 byte	CRC low 8 bits
CRC	1 byte	CRC high 8 bits
Controller response		
Sender address	1 byte	0x01 (Controller address)
Function code	1 byte	0x03 (Function code)

Number of bytes Hi	1 byte	0x00
Number of bytes Lo	1 byte	0x04
Register value 0 Hi	1 byte	System state Hi
Register value 0 Lo	1 byte	System state Lo 0x01: Idle 0x02: Running 0x03: Fault 0x04: Tappet calibration in process 0x05: Parameter setting in process 0x06:Maintenance required
Register value 1 Hi	1 byte	Fault code Hi
Register value 1 Lo	1 byte	Fault code Lo
CRC	1 byte	CRC low 8 bits
CRC	1 byte	CRC high 8 bits

4) Start/stop calibration function

Read state register		
Recipient address	1 byte	0x01 (Controller address)
Function code	1 byte	0x10 (Function code)
Register address Hi	1 byte	0x00
Register address Lo	1 byte	0x25
Register quantity Hi	1 byte	0x00
Register quantity Lo	1 byte	0x01
Register value Hi	1 byte	0x00
Register value Lo	1 byte	0xFF: Start calibration 0x00: Stop calibration
CRC	1 byte	CRC low 8 bits
CRC	1 byte	CRC high 8 bits
Controller response		
Sender address	1 byte	0x01 (Controller address)
Function code	1 byte	0x10 (Function code)
Register address Hi	1 byte	0x00
Register address Lo	1 byte	0x25
Register quantity Hi	1 byte	0x00
Register quantity Lo	1 byte	0x01
CRC	1 byte	CRC low 8 bits
CRC	1 byte	CRC high 8 bits

5) Calibration function reading

Read data register		
Recipient address	1 byte	0x01 (Controller address)
Function code	1 byte	0x03 (Function code)

Register address Hi	1 byte	0x00
Register address Lo	1 byte	0x24
Register quantity Hi	1 byte	0x00
Register quantity Lo	1 byte	0x01
CRC	1 byte	CRC low 8 bits
CRC	1 byte	CRC high 8 bits
Controller response		
Sender address	1 byte	0x01 (Controller address)
Function code	1 byte	0x03 (Function code)
Number of bytes Hi	1 byte	0x00
Number of bytes Lo	1 byte	0x02
Register value 0 Hi	1 byte	Calibration reading Hi
Register value 0 Lo	1 byte	Calibration reading Lo
CRC	1 byte	CRC low 8 bits
CRC	1 byte	CRC high 8 bits

5 HM Heating Modules

5.1 Introduction

When jetting any medium with high dynamic viscosity, the customer can choose to use HM-310 nozzle heating system and HM-320 glue barrel heating system, which are helpful to reduce the dynamic viscosity of the fluid medium, and normal jetting can be carried out only after configuration of the heating systems. It is recommended to use the heating systems in the processes requiring constant temperature or temperature higher than the ambient temperature.

Required accessories: HM-310flow channel heater, HM-320glue barrel heater, HC-570A/B temperature controller and connecting cables

Note: The flow channel heater only acts on the nozzle assembly; the glue barrel heater only acts on the syringe assembly.

5.2 Safety Guide

- The personnel who use the heating systems must undergo strict training;
- Safety parameters and risks of the fluid medium to be jetted shall be fully considered before use;
- Please ensure operation protection (such as protective clothing and protective goggles, etc.) when jetting any corrosive fluid medium;
- Make sure that the fluid medium to be jetted is suitable for the heating systems.

Precautions:

When the heating systems are used, the temperature parameter set on the temperature controller shall not exceed 80% of the boiling point temperature of the medium jetted. The flow channel heater and nozzle assembly, and glue barrel heater and glue barrel assembly must be installed correctly. In the absence of protective equipment, do not touch the surface of the heaters to avoid burns.

5.3 Functions

The temperature displayed by the temperature controller is the temperature collected by the heating sensor. The temperature of medium jetted inside the nozzle assembly is somewhat lower than the temperature displayed.

The flow channel heating module conducts heat to the nozzle assembly, and thus conducts heat to the fluid medium though close combination with the nozzle assembly; the glue barrel heating module conducts heat to the fluid medium inside the glue barrel by means of radiation.

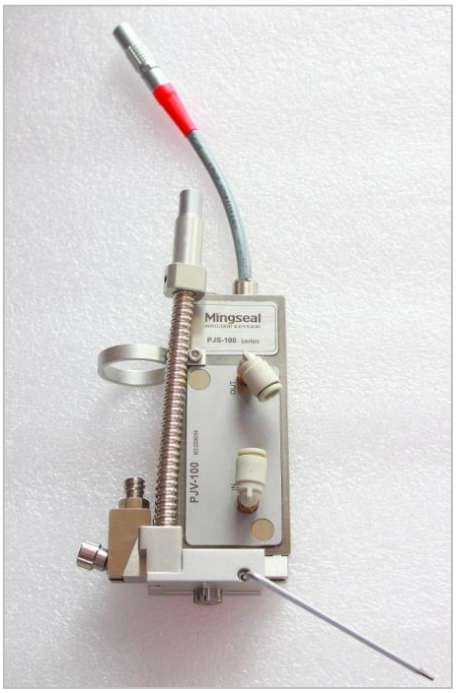
5.4 Technical Parameters

AC power input	100~240V AC
Temperature control accuracy	±2℃
Temperature heating range	Normal temperature~200℃
Controller weight	0.5kg
Controller size	60×82×160mm

5.5 Installation of HM-310Flow Channel Heater

Step 1: PlaceHM-310flow channel heater to the bottom of the fluid cavity, and connect the heating module and the valve body correctly through the nozzle adjustment cap and the guiding slot on the heating module.

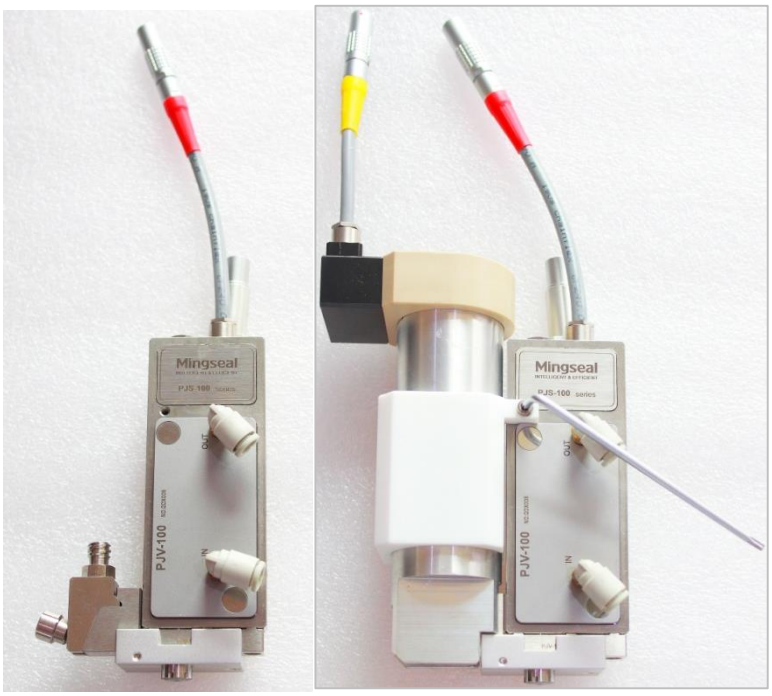
Step 2: Lock the fastening bolt of the flow channel heater. Note: Fastening of the heater may affect the adjusted programs of the original system, so it is necessary to make adjustments again.



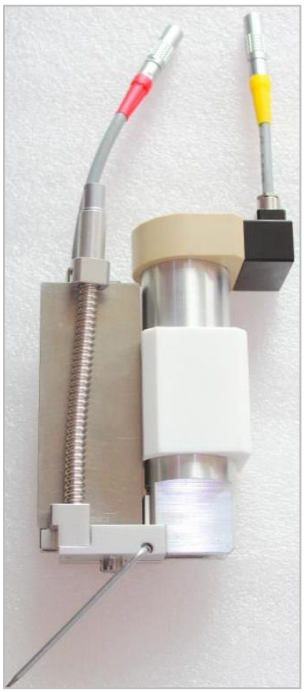
Step 3: Use the heater cable to connect the flow channel heater with the temperature controller: connect the flow channel heater to the 5-core socket (Flow) on the temperature controller.

5.6 Installation of HM-320 Glue Barrel Heater

Step 1: Placethe flow channel heating module to the bottom of the fluid cavity first according to the following figure, and connect the flow channel heating module and the valve body correctly through the nozzle adjustment cap and the guiding slot on the heating module; and then place the glue barrel heating module to the top of the flow channel according to the following figure, and use one M3 screw to lock it with the valve body.



Step 2: Lock the fastening bolt of the flow channel heater. Note: Fastening of the heater may affect the adjusted programs of the original system, so it is necessary to make adjustments again.



Step 3: Use the heater cables to connect the flow channel heater and glue barrel heater with the temperature controller: connect the flow channel heater to the 5-core socket (Flow) on the temperature controller, and connect the

glue barrel heater to the 5-core socket (Barrel) on the temperature controller.

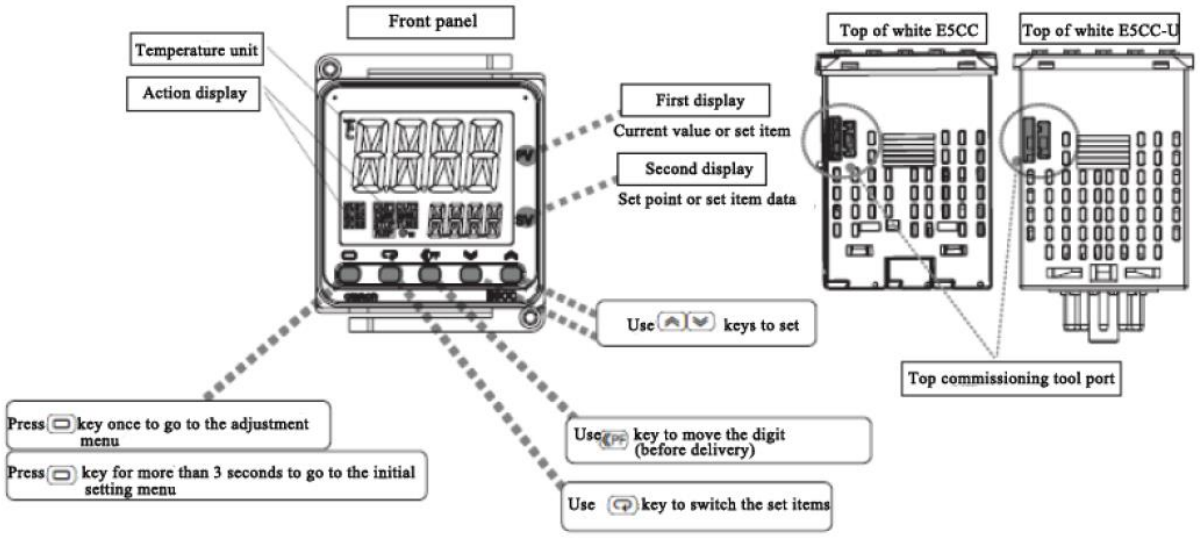
5.7 HC-570A/B Temperature Controller

The real object of HC-570Atemperature controller is as shown below. The front panel in the figure mainly consists of PID temperature meter, pressure indicator and precision pressure-regulating valve. This temperature controller is used to control the temperature of HM-310flow channel heating module, and is mainly used for configuration of standard piezoelectric valve and anaerobic glue piezoelectric valve.

The real object of HC-570B temperature controller is as shown below. The front panel in the figure mainly consists of PID temperature meter, pressure indicator and precision pressure-regulating valve. This temperature controller is used to simultaneously control the temperature of HM-310flow channel heating module and HM-320 glue barrel heating module, and is mainly used for configuration of hot-melt glue piezoelectric valve.

HC-570ATemperature ControllerHC-570BTemperature Controller

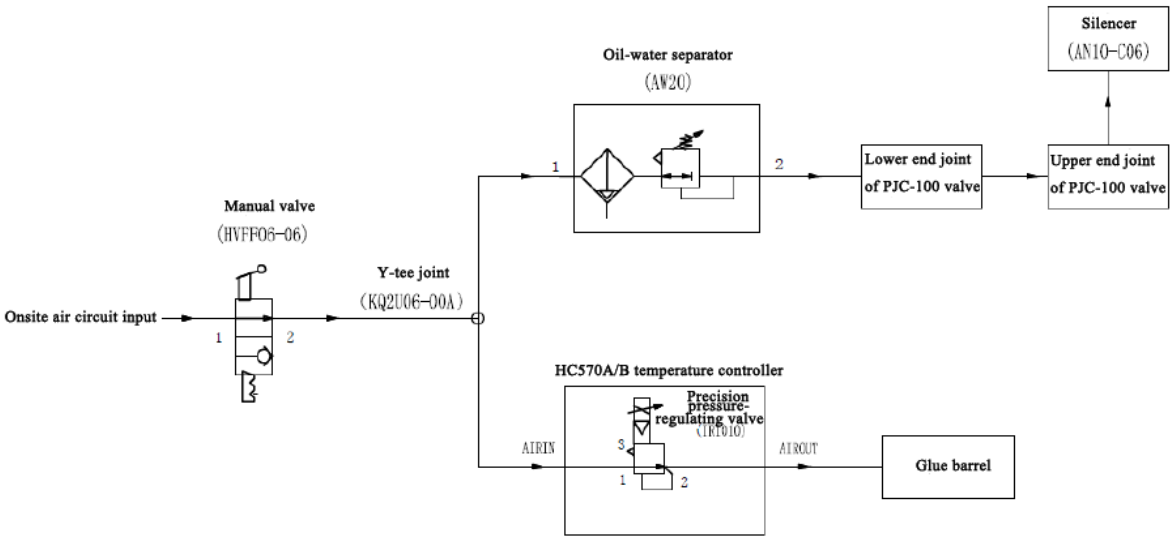
The parameter setting of PID temperature meter is as shown below.



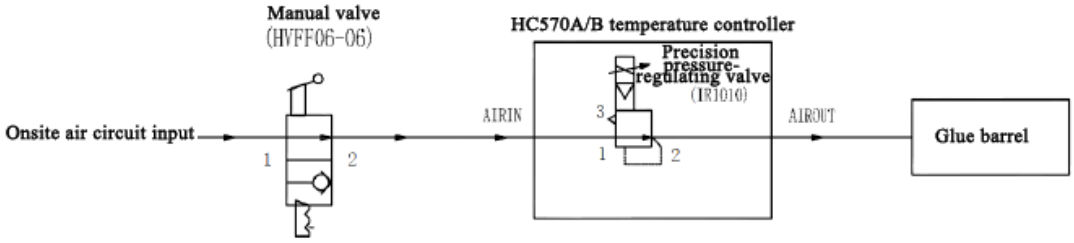
When it is necessary to adjust the **set temperature value (SV)**, please press the **"UP/DOWN Adjustment Keys" at the right side** of the meter. At this time, the SV digital display screen will turn to the **flashing state**. When it is necessary to change the "tens digit" or "hundreds digit" of the temperature displayed, please move the digit through the **"PF Key"**, and then change the set temperature parameter through the "UP/DOWN Adjustment Keys".

5.8 Reference for Connection of Pneumatic Parts

The piezoelectric jet system also includes some pneumatic parts, such as precision pressure-regulating valve and oil-water separator, etc. The detailed connection diagram of pneumatic parts is as shown in the following figure.



A. Connection diagram of pneumatic parts when the heating temperatureis greater than 60℃



B. Connection diagram of pneumatic parts when the heating temperature is less than 60℃

6 Replacement and Maintenance of Consumables

After the piezoelectric valve completes the glue jetting job, in order to ensure that the fluid medium does not leak from the piezoelectric valve, reduce the air pressure of the fluid medium feeding container to be the same as the surrounding ambient pressure, and meanwhile, disconnect the piezoelectric valve and the feeding container, or empty the fluid medium inside the feeding container. Turn off the controller, disconnect the cables, loose the connecting screws between the valve body and the mounting support, and remove the piezoelectric valve from the motion mechanism while ensuring that no components get loose or drop during removal. The removed piezoelectric valve can have components replaced according to the actual needs, and then be installed according to Section 2.3.

6.1 Replacement of Nozzle and Seal Ring

Before removing the nozzle assembly, it is necessary to reduce the pressure of the medium to the ambient atmospheric pressure or remove the feeding system, so as to prevent leakage of the fluid medium. Screw off the nozzle assembly from the valve body, and use the front end of the special removal sleeve to separate the nozzle assembly and press out the nozzle; if the fluid medium leaks from the nozzle assembly during glue jetting, it is necessary to replace the seal ring inside the nozzle assembly. After the nozzle assembly is separated, use the tweezers to remove the seal ring from the nozzle sealing seat. After the nozzle and seal ring are replaced with new ones, use the removal sleeve tool to assemble and screw down the nozzle assembly, adjust the air source and pressure of the

medium, connect the system and finish adjustment according to Section 2.3, so that the system can carry out jetting jobs. If possible, clean the nozzle assembly thoroughly.

6.2 Replacement of Tappet

It is necessary to remove the fluid cavity and nozzle assembly before replacing the tappet. Firstly, screw off the nozzle assembly; then, use the supporting socket head wrench to loosen two M3 socket hexagon screws which are used to fix the fluid cavity, and then pull out the fluid cavity along the direction parallel to the tappet. **Note: During removal of the fluid cavity, ensure that the fluid cavity is parallel to the direction of the tappet, and avoid tilting of the fluid cavity; otherwise there will be the risk that the tappet is broken or the seal ring of the tappet is damaged.**

Align and match the rear end of the removal sleeve with the middle slot of the tappet guiding seat, until the removal sleeve is firmly buckled onto the tappet guiding seat. Use a constant force to unscrew the tappet guiding seat towards the left through the removal sleeve, and screw off the tappet guiding seat and tappet assembly from the valve body. **Note: The spring is provided on the tappet assembly inside the valve body, and is used to make the tappet closely contact the execution part of the piezoelectric valve and adjust the tension force. This part may cause some obstruction during removal of the tappet.**

Select an appropriate tappet (1.5/1.0/0.8) for replacement from optional accessories. Note: The top of the tappet is lubricated. Place the tappet inside the mounting hole of the actuator cavity carefully, with the lubricated section inward. Buckle the rear end of the tappet removal sleeve onto the middle slot of the tappet guiding seat and screw it down. **This operation shall be executed very carefully** in order to overcome the reverse pressure produced by the spring. Pull out the removal sleeve in the direction parallel to the tappet, and install the fluid cavity and nozzle assembly according to the above description; after making adjustments according to the adjustment method, the glue jetting job can be continued.

After a certain period of operation of the system, it is recommended to replace the nozzle seal ring in the fluid cavity. If the tappet passes through the seal ring without any resistance, the nozzle seal ring must be replaced. Please use the removal push rod supplied with the valve to replace the seal ring.

When removing the fluid cavity and nozzle assembly, it is necessary to install the protective block on the valve body in time to prevent damage to the tappet (for device cleaning, repair or valve body storage), as shown below:

6.3 Replacement of Flow Channel Seal Ring

Before replacing the flow channel seal ring, it is necessary to reduce the pressure of the fluid medium to the ambient atmospheric pressure and remove the feeding system, so as to prevent leakage of the fluid medium, and then remove the fluid cavity and nozzle assembly. Use the removal wrench to unscrew the mounting screws of the connecting block and remove the connecting block, and then use the tweezers to remove the seal ring from the fluid cavity. After the seal ring is replaced with a new one, use the removal wrench to connect the connecting block and the fluid cavity through the screws tightly.

Use theremoval wrench to remove the Luer taper on the connecting seat, and use the tweezers to remove the seal ring from the connecting block. After the seal ring is replaced with a new one, use the removal wrench to connect the Luer taper and the connecting block tightly.

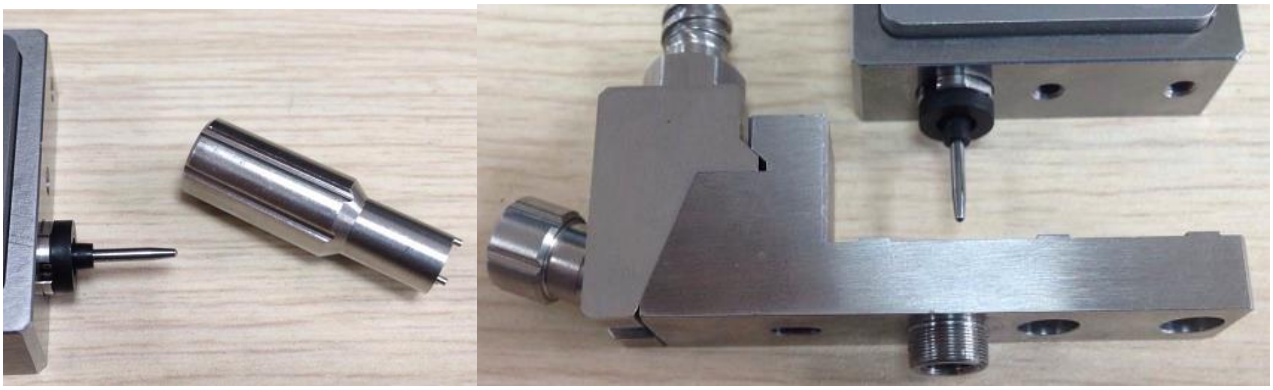
6.4 Replacement of Fluid Cavity Seal Ring

Before replacing the fluid cavity seal ring, it is necessary to reduce the pressure of the fluid medium to the ambient atmospheric pressure and remove the feeding system, so as to prevent leakage of the fluid medium, and then remove the nozzle assembly, and use the socket head wrench to screw off two screws which are used to install the fluid cavity.

Different fluid cavity seal rings are used depending on different fluids to be jetted, and their installation and replacement methods are different.

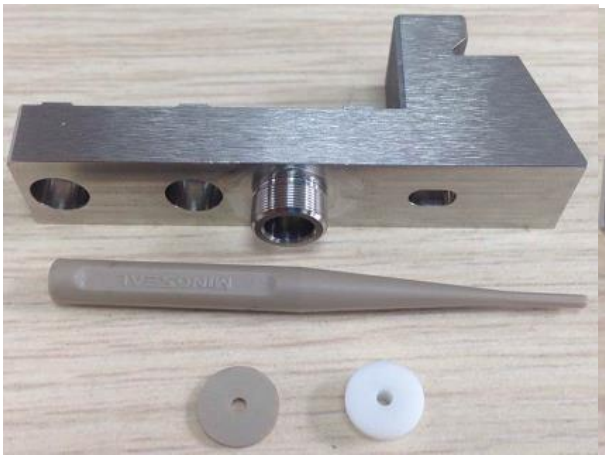
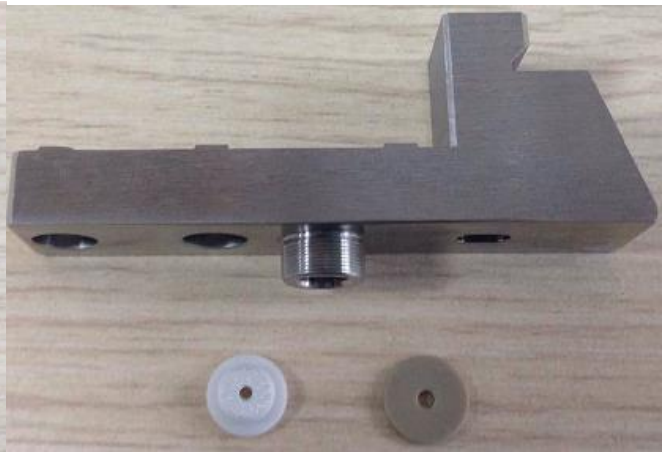
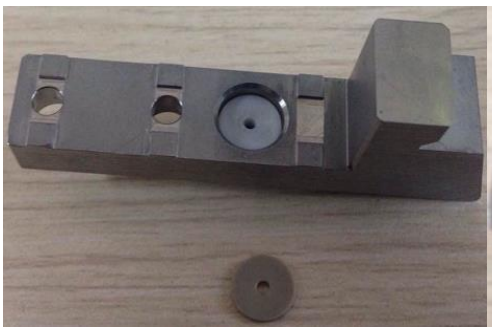
Replacement of fluid cavity seal ring for hot-melt glue: After removing the fluid cavity from the valve body, extend the removal push rod into the fluid cavity to gently prop the outer edge of the seal ring; meanwhile, gradually move the fluid cavity downwards, and adjust the position where the removal push rod contacts the seal ring to ensure that the seal ring is evenly moved out of the fluid cavity; hold the small section that the seal ring matches with the tappet, and remove the seal ring from the tappet.

Install a new seal ring into the groove at the lower end of the removal sleeve, and then push the tappet into the removal sleeve to make the seal ring fit with the tappet guiding seat, make the inner hole of the seal ring match with the tappet, and complete the installation of the seal ring; then use the screws to connect the fluid cavity and the valve body tightly.



Replacement of other fluid cavity seal rings: After removing the fluid cavity from the valve body, use the removal push rod to prop out the seal ring inside the fluid cavity, and complete removal of the seal ring. After installing a new seal ring inside the fluid cavity, use the screws to connect the fluid cavity and the valve body tightly.




7 Troubleshooting and Daily Maintenance

7.1 Troubleshooting

- **Fault/Maintenance Code 001: Exceeding service life of tappet.**

Remove and replace the worn tappet, and then reset the tappet number on the Mode Set screen.

- **Fault/Maintenance Code 002: Exceeding service life of nozzle.**

Remove and replace the worn nozzle, and then reset the nozzle number on the Mode Set screen.

- **Fault/Maintenance Code 003: Valve body over-temperature alarm.**

Stop the system, check the heat-radiation air source of the valve body, confirm that the air source is normal, and adjust the air pressure to 0.1~0.2MPa.

- **Fault/Maintenance Code 004: Abnormal connection of valve body.**

It is necessary to return the product for repair. Do not remove the controller and valve body by yourself.

7.2 Daily Maintenance

Each time after use of the piezoelectric jet valve, dismantle and clean it in time. In order to avoid surface abrasion of each part, it is forbidden to use metallic brushes or mechanical parts to clean. The parts must be cleaned thoroughly each time; otherwise residual media may damage the valve body. If any super-corrosive cleaning solution or solvent is used to clean the parts, please confirm whether all the parts contacting the cleaning media, especially the sealing elements (O-ring and seal ring, etc.), can resist corrosion before cleaning. During removal of the fluid cavity, be careful not to damage the tappet.

7.2.1 Cleaning

- Cleaning method

For cleaning of the piezoelectric jet valve (especially the parts contacting the fluid medium), it is recommended to use the cleaning tool assembly provided by us.

Before cleaning, it is necessary to remove the feeding system of the medium jetted, connect a clean empty barrel to the system, and apply air pressure to remove the residual medium jetted inside the system.

- Selection of appropriate cleaning solution

In order to remove the residue of the medium jetted, choose appropriate cleaning solution (please check the safety data of the fluid medium jetted and select appropriate cleaning solution). Fill the cleaning solution into the barrel and conduct some point jetting or a certain cycle of cycled jetting through the micro-jet system.

- Cleaning of independent parts

If necessary, please remove the piezoelectric jet valve from the motion mechanism according to Section 2.2, and wipe clean the valve body with lint-free cloth dipped with alcohol.

Independent parts have undergone pre-cleaning during the above-mentioned steps. Place independent parts in a big enough container, then place the container in an ultrasonic cleaning machine, add sufficient acetone, and clean the parts for at least 10min. This can basically ensure that each part is cleaned up. At this time, the parts can be placed in air or compressed air for drying, and can be eassembled after drying.

If the parts are severely polluted, they shall be subject to mechanical pre-cleaning. During this pre-cleaning process, please use our cleaning tool assembly. The mechanical cleaning shall be conducted with acetone in the ultrasonic equipment. In the middle of the nozzle cleaner tool, there is a special fine tappet which can be used to clean many parts difficult to clean (please note whether the nozzle assembly matches with the diameter of the nozzle cleaner).

7.2.2 Compatibility of Different Fluid Sealing Materials

Materials	**Fluoro rubber**	**EPDM**	**NBR**	**Corrosionresistant materials**
Acetone	Not corrosion resistant	Corrosion resistant	Not corrosion resistant	
Aqueous ammonia	Not corrosion resistant	Not corrosion resistant	Not corrosion resistant	PEEK, PTFE
Trichloromethane	Corrosion resistant	Not corrosion resistant	Not corrosion resistant	
Cyclohexane	Corrosion resistant	Not corrosion resistant	Corrosion resistant	
Cyclohexanol	Corrosion resistant	Not corrosion	Corrosion resistant	

		resistant		
DMF	Not corrosion resistant	Corrosion resistant	Not corrosion resistant	PEEK
Acetic acid	Not corrosion resistant	Not corrosion resistant	Not corrosion resistant	PTFE
Ethyl alcohol	Not corrosion resistant	Corrosion resistant	Not corrosion resistant	
Heptane	Corrosion resistant	Not corrosion resistant	Corrosion resistant	
Hexane	Corrosion resistant	Not corrosion resistant	Corrosion resistant	
Isopropanol	Corrosion resistant	Corrosion resistant	Partly corrosion resistant	
Dichloromethane	Partly corrosion resistant	Not corrosion resistant	Not corrosion resistant	PEEK, PTFE
Nitromethane	Not corrosion resistant	Partly corrosion resistant	Not corrosion resistant	PTFE
Pentane	Corrosion resistant	Not corrosion resistant	Not corrosion resistant	
Mercury	Corrosion resistant	Corrosion resistant	Corrosion resistant	
Silicone oil	Corrosion resistant	Corrosion resistant	Corrosion resistant	
Methylbenzene	Not corrosion resistant	Not corrosion resistant	Corrosion resistant	PEEK, PTFE
Water	No data	No data	No data	PEEK, PTFE
Xylene	Corrosion resistant	Not corrosion resistant	Not corrosion resistant	