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C09 Flow Control Vacuum Pump series

User Guide

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About This Document

Purpose

This document is related to the C09 flow control micro vacuum pump products,which is used to guide relevant technical personnel to initially understand the characteristics of the product.

Intended Audience

This document is intended for technical personnel. You should have a good understanding of your product and have a clear concept of the relevant parameters, specifications, and other information of the applications of the micro pump.

Keyword

Speed control function, anti-loosening connectors, working status indicator, related parameters, wiring instructions

Change History

The change history accumulates each update of this document. The latest version of the document contains all the previous updates.

Issue	Date	Product Version	Issuer	Modification
01	2018-7	1.0	XX	First official release
06	2018-12	1.0	XX	Revise the lifetime test description and warning 2
07	2018-12	1.0	XX	Add description of state memory function of the knob speed control version
08	2019-2	1.0	XX	Modify the curve graph
09	2019-3	1.0	XX	Add note 3 in the parameter description
10	2019-3	1.0	XX	Add description in the protection function
11	2019-9	1.0	LYZ	Modify the document format
12	2019-12	1.0	LJ	Add description of key specifications testing
13	2020-5	1.0	LJ	Replacement of flow curve and product outline drawing; add starting current curve
14	2020-5	1.0	LJ	Replacement of product assembly drawing
15	2020-6	1.0	LJ	Add medium and related notes

Contents

1 Characteristics

1.1 Compact Size

The product weighs about 90g, and the overall size is about 64x43x48mm (this size does not include shock-absorb feet).

1.2 Speed Control Function

There are three types of speed control functions available for this series of pumps: knob speed control, PWM speed control and frequency speed control.

1.3 Anti-loosening Connectors

The plug is connected with a buckle to make the connection part more tight and not easy to fall off.

1.4 **Working Status Indicator**

Integrated speed indication function, visually understand the running status of the pump according to the flashing frequency of the indicator light.

1.5 **Brushless Motor**

This model is driven by brush-less motors which have the advantages of long service life, low interference and high reliability.

1.6 **Protection**

Equipped with overheating protection, overload protection, power supply under-voltage, over-voltage protection and reverse connection protection function to prevent accidental damage to the pump.

1.7 **Digital Signal Control**

The circuit input adopts all digital signal control with strong anti-interference ability, stable and reliable work.

1.8 **Closed Loop Speed Control**

The internal closed-loop control algorithm is used to monitor and adjust the motor speed in real time to keep the speed and output stable.

2 Special Features

2.1 Speed Control Function

The flow rate of the pump can be changed by adjusting the motor speed. There are three types of speed control functions available for this series of pumps: knob speed control type, PWM speed control type and frequency speed control type. Please refer to Chapter 5 Electrical Connection for specific usage of different speed adjustment methods.

2.2 Warning Function

Feed back the working status through working status indicator light.

1. When the light remains green, it means that the power supply is normal and the pump is not working;

2. When the green light flashes, it means the pump is working normally; the faster the green light flashes, the higher the pump speed, the greater the output flow;

3. When the light remains red, it means the pump is working abnormally;

4. When the positive and negative poles are reversed, the indicator light is off, the pump does not work, but it will not damage the pump.

3 Technical Specifications

3.1 Key Specifications

Model	Version	Rated Voltage (V DC)	Load Current (mA)	Average Flow (L/min)	Peak Flow (L/min)	Relative Vacuum (-kpa)	Weight (g)
C09L	Premium Version	24	≤200	≥2.0	≥2.0	≥37	≈90
	Standard Version	24	≤200	≥1.7	≥1.8	≥37	
	Simplified Version	24	≤200	≥1.3	≥1.5	≥37	

Note:　1.The input voltage requires 24V±10%.The change of working voltage will affect the load current, while the flow rate and vacuum degree are basically unchanged;

2.Unless otherwise specified, the technical parameters are measured under the conditions of temperature 25℃ and standard atmospheric pressure of 101kPa.

3.The parameters in the table are measured at the maximum speed of the motor. When the motor speed changes, the vacuum level is basically unchanged.

4.The peak flow rate in the table refers to the flow value measured with a rotameter, and the average flow rate is measured with a soap film flow-meter.

3.2 **Description of Versions**

Version / Performance	Simplified Version	Standard Version	Premium Version
Life time	≥2000h	≥4500h	≥5500h
Motor	★	★★	★★★★
Reliability	★	★★	★★★★
Anti-electromagnetic Interference	★	★★	★★★★
Diaphragm Performance	★	★★	★★★★
Parameter Consistency	★	★★	★★★

Note:　1.The more ★, the better performance of this item.

2.This series of air pumps all have the characteristics of low operating vibration.

3.The noise data of the simplified version and the standard version are not specified. For the noise data of the premium version, please refer to the latest information.

3.3 **Life-time Test Conditions**

1. Lifetime test conditions: In a clean, non-corrosive laboratory, the inlet and outlet are directly connected to the atmosphere, and they operate continuously around the clock. Unless otherwise specified, the technical parameters are all measured values at 25°C and standard atmospheric pressure.

2. Laboratory conditions: The ambient temperature 5°C ～ 33°C, fluctuates with the climate; the relative humidity 50%-85%, fluctuates with the climate.

Note:　When the pump is running, the connecting pipeline should be kept as unobstructed as possible. The inlet can carry a large load, but only short-term blockage is allowed. Long-term blockage may damage the pump. The outlet

of the pump must be unobstructed, and there must be no components in the outlet hose that hinder the discharge of gas!

3.4 **Working Conditions**

1. Environment: Permissible ambient temperature range of the pump is 0 ℃ ～ 50 ℃ , permissible relative humidity is ≤ 90%, no condensation. The pump should not be exposed to the sun, and should work in a clean and ventilated environment.

2.Medium: Permissible gaseous media temperature range is 0 ℃ ～ 50 ℃ . The medium is allowed to be rich in water vapor, but cannot contain particles or oil mist.

3.5 **Materials**

1. The materials of the wetted parts: the medium will be in contact with EPDM rubber and SPS, both of which have certain corrosion resistance. Please check the chemical resistance and compatibility of the medium according to the wetted material.

2. The material of the pump body is fiber reinforced nylon, and the material of the shock absorb foot is PVC.

3.6 **Filtration**

When the pump works for a period of time, the dust contained in the medium will accumulate in the pump chamber, impair the air tightness of the pump, and reduce the flow rate and vacuum degree. A filter must be equipped at the inlet. Practice indicates that generally clean gas we regard clean still contains dust and impurities, and it also needs to be filtered to ensure the normal operation of the internal sophisticated air-tight components.

3.7 **Parameter Curve**

Vacuum degree-flow curve, there are individual differences between different micro pumps, this curve is a statistical value, only used as a technical reference for users to confirm the working point. The "flow" mentioned in this section refers to the "average flow".


C09L-24V Pressure-Flow Curve
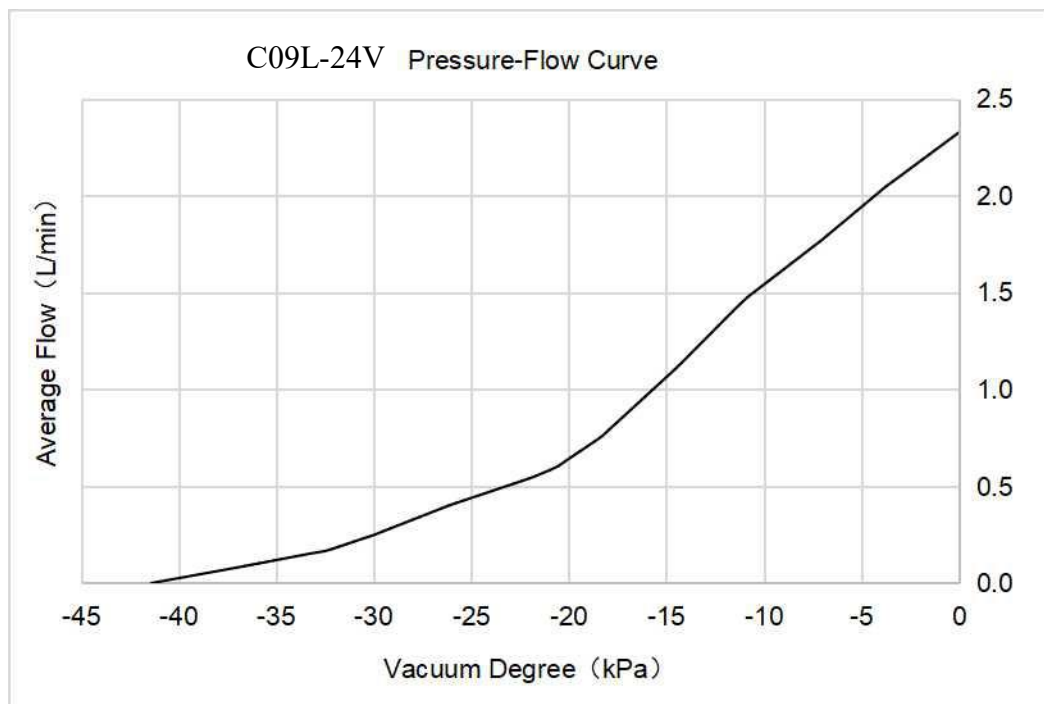
Note:

1. The maximum average flow rate of the curve will be slightly lower than the nominal value, which is due to the resistance of the test pipeline components, which leads to the attenuation of the flow;

2. The value of this curve is for reference only, not as a basis for product acceptance.
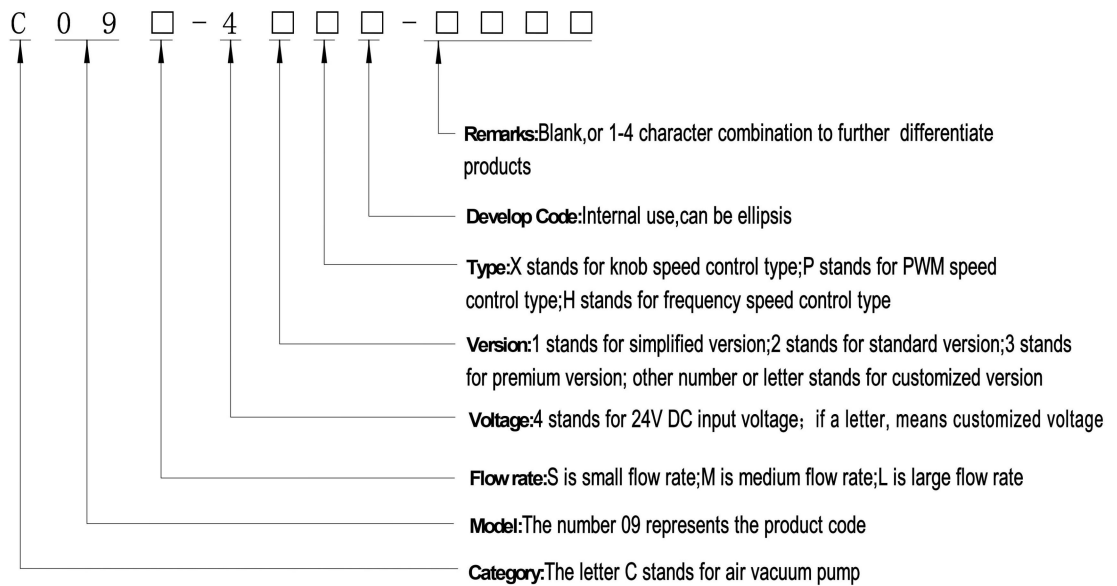
3.8 **Starting Current**

The starting current curve is measured under the working condition that the inlet and outlet are directly connected to the atmosphere, and there are certain individual differences between different micro pumps. This curve is a statistical value, which is only used as a technical reference when users determine the power supply system, and is not as acceptance data.
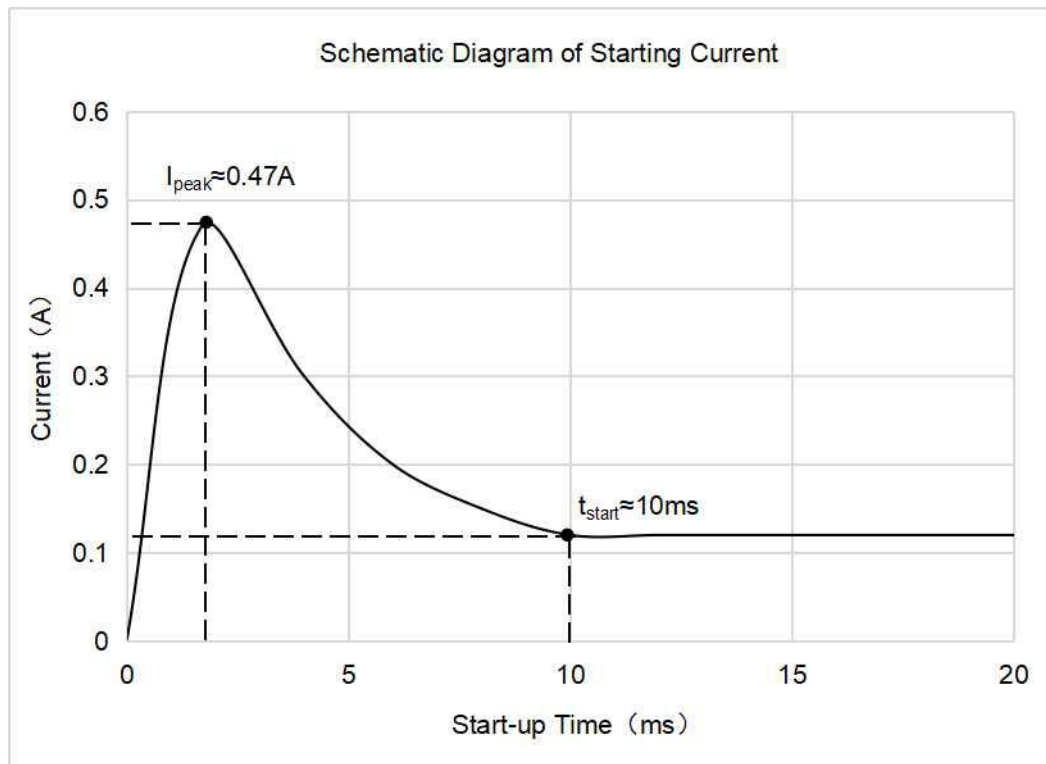
4 Product Model Description

4.1 Brief Description of Model Naming

This series of pumps are divided into three types according to the selected speed control mode: knob speed control type, PWM speed control type and frequency speed control type.

C 0 9 □ - 4 □ □ □ - □ □ □ □

Remarks: Blank,or 1-4 character combination to further differentiate products

Develop Code: Internal use,can be ellipsis

Type:X stands for knob speed control type;P stands for PWM speed control type;H stands for frequency speed control type

Version:1 stands for simplified version;2 stands for standard version;3 stands for premium version; other number or letter stands for customized version

Voltage:4 stands for 24V DC input voltage；if a letter, means customized voltage

Flow rate:S is small flow rate;M is medium flow rate;L is large flow rate

Model: The number 09 represents the product code

Category: The letter C stands for air vacuum pump

5 Electrical Connection

5.1 Brief Description of Types

1. Knob speed control type: A digital rotary encoder is used for input control to realize digital control of start and stop, acceleration and deceleration of the pump. Adjust the knob clockwise or counterclockwise to control the speed increase or decrease, and press the button to control the start and stop of the micro pump.

2. PWM speed control type: external PWM signal, realize speed control by changing the duty cycle of the signal, and built-in closed-loop control function to ensure stable speed and output.

3. Frequency speed control type: external square wave signal, realize speed control by changing the frequency of the signal, and built-in closed-loop control function to ensure stable speed and output.
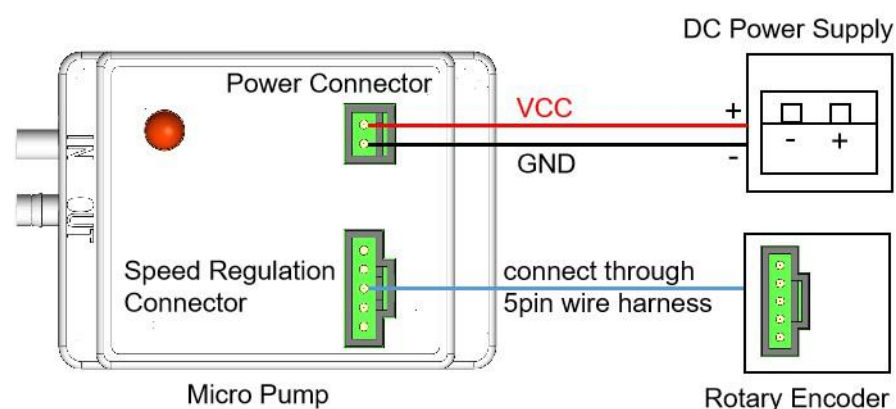
5.2 Knob Speed Control Type

Figure 5-1 Wiring Diagram of Knob Speed Control

Note: The wire color in the above figure may be different from the actual wire

color,please connect according to the above figure.

The red wire of the power connector is connected to the positive pole of the DC power supply, the black wire is connected to the negative pole of the power supply, and the speed regulation connector is connected to the knob circuit board through a wire harness. This type of pump is equipped with a speed control knob switch (rotary encoder) as standard. Rotate the knob clockwise to increase the motor speed. When it reaches the maximum speed, if continue to rotate clockwise, the motor will maintain the maximum speed. Rotate the knob counterclockwise to decrease the speed. When it decreases to the minimum speed, if continue to rotate counterclockwise, the motor will maintain the minimum speed. Press down the knob to start or stop the pump. The pump also has a state memory function, when the pump is started, it will run at the speed before the last stop.

Attachment: Installation instructions for speed control knob switch

(1) Nut installation: first make a hole with a diameter of about 7mm on the mounting plate, then unscrew the nut on the encoder and remove the gasket, insert the knob of the encoder into the opened hole on the mounting plate, and finally install the washer and screw back the nut.
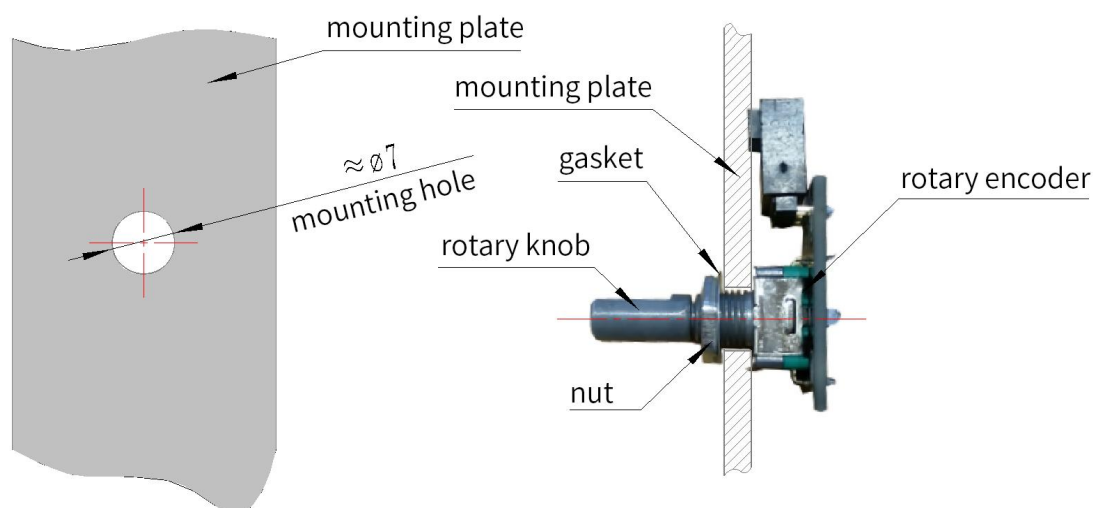

Figure 5-2 Nut Installation

(2) Screw installation: Use two M3 screws to pass through the screw holes and washers of the speed control knob switch, and then fix them to the mounting plate.
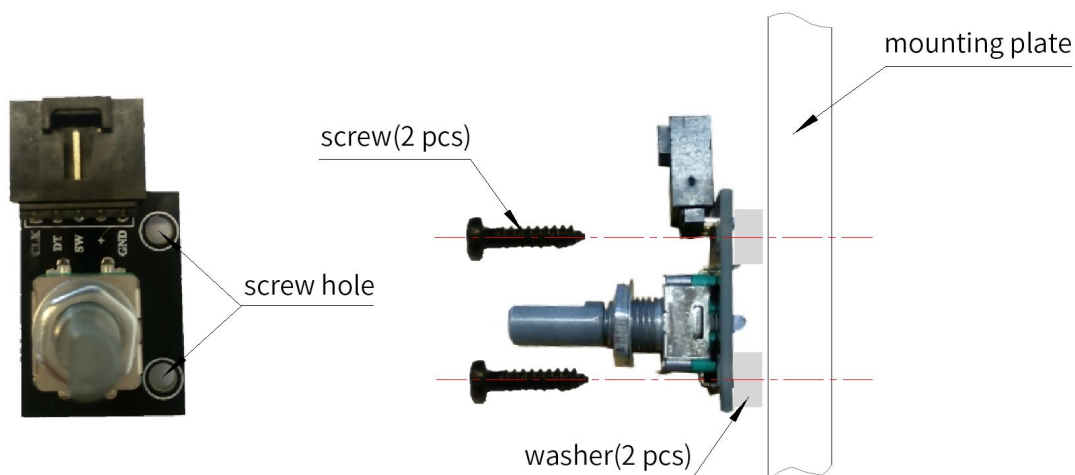

Figure 5-3 Screw Installation

Note: In order to avoid welding protrusions on the back of the speed control knob switch to affect the installation, we have attached two Φ3*Φ7*3 insulating washers in the installation accessories. Two M3 screws are usually used for the screws, which need to be prepared by the user.
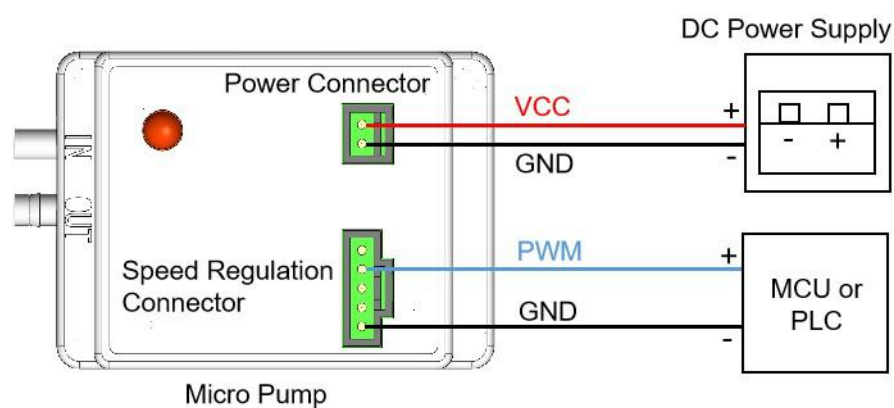
5.3 **PWM Speed Control Type**

Figure 5-4 Wiring Diagram of PWM Speed Control

Note: The wire color in the above figure may be different from the actual wire

color,please connect according to the above figure.

The red wire of the power connector is connected to the positive pole of the DC power supply, and the black wire is connected to the negative pole of the power supply. The pin sequence from top to bottom of the speed control port is the same as the real product as shown in the figure above. The black wire of pin 5 (GND) is connected to the ground of the MCU or PLC. The pin 2(PWM) blue line is connected to the PWM wave output port of the MCU or PLC.

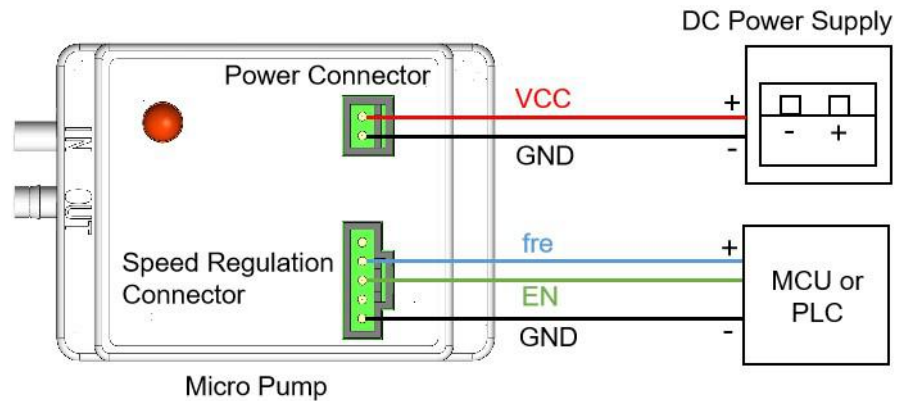| Connector	Input	Definition	Input Signal Description
1	NC	Not connected	
2	PWM	PWM speed control signal PWM carrier frequency range: 5kHz~10kHz 0V≤low level≤0.8V 3.3V≤high level≤5V **Note:** The frequency should not exceed 10kHz, otherwise it may cause the pump to run abnormally. The maximum input voltage cannot exceed 5V, otherwise it may cause permanent damage to the micro pump.	a.Adjust the speed through duty cycle and low level is effective. When grounded, the micro pump runs at the maximum speed, and when the PWM input continues to be high, the micro pump stops; b.When the duty cycle changes from low to high in the range of 0% to 90%, the speed changes from the highest speed to the lowest speed; c.When 95%<duty cycle≤100%, the micro pump will stop; d.Duty cycle, speed regulation ratio: in the speed regulation interval, when the duty cycle changes by 1%, the speed changes by about 45RPM.
3	NC	Not connected	
4	NC	Not connected	
5	GND	Power ground	Grounded

5.4 **Frequency Speed Control Type**

Figure 5-5   Wiring Diagram of Frequency Speed Control

Note: The wire color in the above figure may be different from the actual wire
color,please connect according to the above figure.

The red wire of the power connector is connected to the positive pole of the DC power supply, and the black wire is connected to the negative pole of the power supply. The pin sequence from top to bottom of the speed regulation connector is the same as the actual product as shown in the figure above. The black wire of pin 5 (GND) is connected to the ground of the MCU or PLC. The pin-3 (En) green wire is connected to the low level of the MCU or PLC, and the pin-2 (Fre) blue wire is connected to the square wave signal output port of the MCU or PLC. When the MCU or PLC passes high level En signal, it will work at the speed recorded last time.

Connector	Input	Definition	Input Signal Description
1	NC	Not connected	
2	Fre	Frequency speed control signal Frequency speed range: 1.5kHz~5.6kHz 0V≤low level≤0.8V 3.3V≤high level≤5V **Note:** Input high level>3.3V, the maximum input voltage should not exceed 5V, otherwise it may cause permanent damage to the micro pump.	a. Control speed through frequency, when 1.5kHz<frequency rate<5.6kHz, rpm=input frequency; b. When the frequency is >5.6kHz, the micro pump runs at the highest speed; c. When 0.1kHz<frequency<1.5kHz, the micro pump runs at the lowest speed; d. When the frequency is less than 0.1kHz, the micro pump stops.
3	EN	Enable signal 0V≤low level≤0.8V 3.3V≤high level≤5V	Enable signal, low level is effective to enter the speed control mode, high level or floating means running at the last recorded speed.
4	NC	Not connected	
5	GND	Ground	

**Note:** The above functions may be adjusted with product improvements without notice.

6 Cautions

Please read the instructions in this chapter carefully and follow the instructions strictly before use.

1. The outlet must be unobstructed, otherwise the micro pump will be damaged!

2. The inlet can carry a large load, but only short-term blockage is allowed, and long-term blockage can easily damage the pump.

3. Foreign matter must not fall into the hose connectors, otherwise it will damage the micro pump!

4. This product has no explosion-proof function and cannot be used in flammable and explosive environments!

5. When this product is used to transfer harmful medium, it must be double-sealed to ensure personal safety!

6. The matching piping components and containers must have sufficient strength to ensure personal safety!

7. Please operate strictly in accordance with the requirements of this user guide!

8. Oil mist, high-viscosity liquids and liquids that are easy to precipitate and crystallize are not permissible!

7 Dimensions

Overall Dimensions of C09 (Unit: mm)
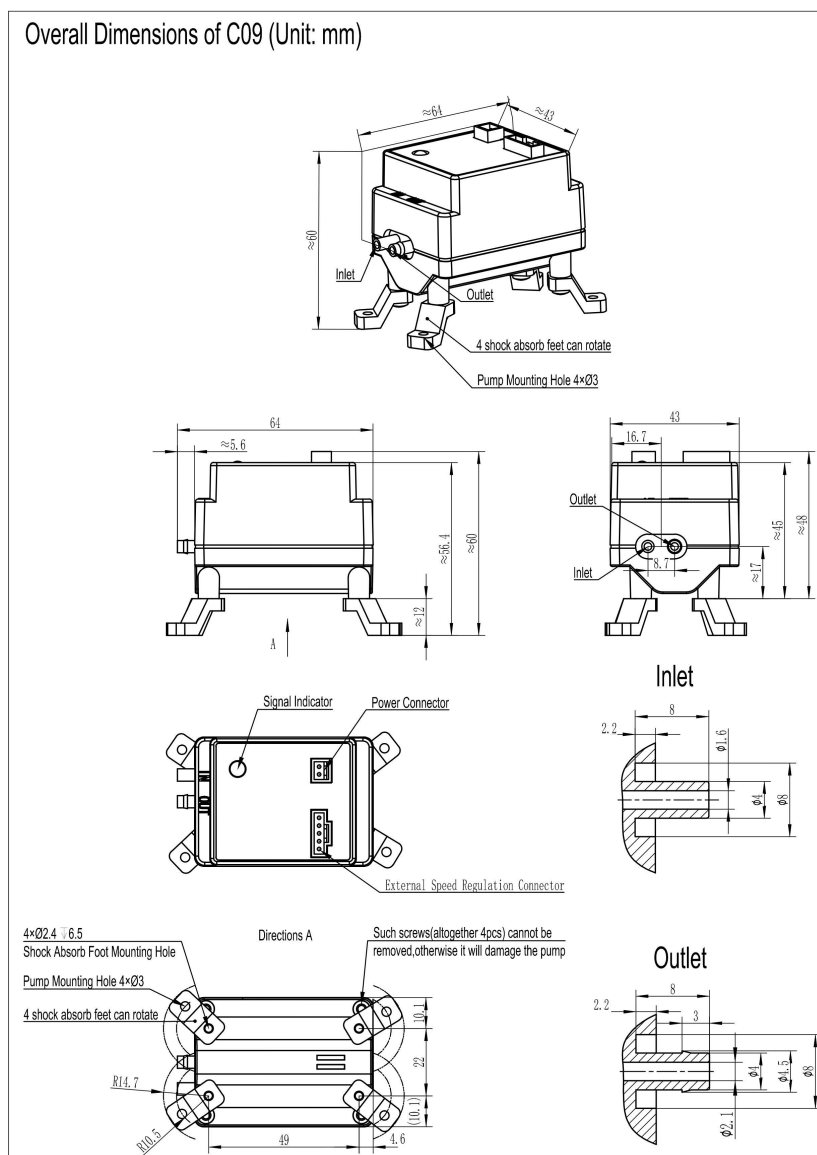
Installation instructions:

1. The screws on the pump cannot be removed, otherwise it will damage the pump;

2. The mounting holes are self-tapping screw holes, not suitable for repeated tightening and disassembly, otherwise the installation will be loose and unreliable.

8　Appearance