VBY Micro Vacuum Pump Series

User Guide

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About This Document

Purpose

This document is related to the VBY 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

PWM speed control, protection function, speed feedback, key parameters, operation 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	Modification
01	20200511	1.0	First official release
02	20200604	1.0	Update product photos
03	20200804	1.0	Added VBY8009A
04	20210423	1.0	Added reliability parameters
05	20211110	1.0	Added vacuum - flow curve

Contents

1 Characteristics

1.1 Long Lifespan,Low Interference

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

1.2 Protections

Equipped with overheating protection, overload protection(except the simplified version), which to the greatest extent prevents accidental damage to the pump.

1.3 Speed Control Function

The motor speed can be changed and the flow can be adjusted by changing the duty cycle by inputting the PWM signal. Or by ordering Hilintec special speed controller (model: TS-C24 and TS-D12) for speed regulation.

1.4 Speed Feedback

The speed of the pump can be known through the speed feedback signal. From this, the operating status of the pump can be known, which is convenient for closed-loop control and makes the system more intelligent.

1.5 Maintenance Free,Pollution-free Transmission

There is no need to add lubricating oil and maintenance, and it does not pollute the medium.

1.6 Water Vapor Medium Available

1.7 Good Corrosion Resistance

The materials of the wetted parts: reinforced nylon and EPDM rubber,which have certain corrosion resistance

1.8 Unlimited Installation

It can be installed in any direction

2 Technical Specifications

2.1 Key Specifications

Model	Voltage (V DC)	Load Current (mA)	Flow Rate (L/min)		Relative Vacuum (-kPa)	Weight (g)
			Peak Flow	Average Flow		
VBY7505A	12	≤500	≥5	≥3.5	≥75	≈340
VBY7506A	24	≤300	≥6	≥4.5		
VBY8009A	24	≤300	≥9	≥5	≥80	

Note: 1. The input voltage requires 12V±10%, 24V±5%.

2. The air nozzle of VBY8009A has two orientations, which are remarked by code Z and Y; the default air nozzle is to the left. VBY8009A-24V-Y means: the air nozzle is to the right; see the dimension drawing for details.

3. Different types of products have slightly different weights;

4. Unless otherwise specified, the technical parameters are measured under the conditions of temperature 20℃ and standard atmospheric pressure of 101kPa.

5. 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.

6. 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.

2.2 Reliability Parameters

Model	Lifetime(Hrs)	Simplified Version	Standard Version	Premium Version
VBY7505A VBY7506A VBY8009A	Full-Load	5000	8000	12000
	No-Load	8000	12000	18000
	Motor	10000	15000	20000

Product lifetime test instructions:

1. Full-load life test conditions: block the pump suction port, and the exhaust port is directly connected to the atmosphere, so that the pump can operate continuously without stopping for 24 hours under the maximum vacuum condition;

2. No-load life test conditions ： The pump suction port and exhaust hole are directly open to the atmosphere, so that the pump works under normal pressure for 24 hours without stopping and continuous operation;

3. Motor life test conditions: under good ventilation and heat dissipation conditions, the motor does not carry a load for 24 hours without stopping Continuous operation;

4. Environmental conditions for life test: In a clean, non-corrosive laboratory, the ambient temperature is 5～33℃ fluctuates with the climate, and the relative humidity of the environment is 50%～85%, fluctuates with the climate;

5. The source of the experimental data is from Hailin Technology Aging and life laboratory and supplier laboratory

2.3 Versions Description

According to different parts quality and quality control requirements, it is divided into three versions: simplified version, standard version, and premium version; the performance of different versions is different, and the differences are as follows:

Performance \ Version			Simplified version	Standard version	Premium version
Configuration	Motor quality		BLDC ★	BLDC ★★	BLDC ★★★★
	Diaphragm performance		★	★★	★★★★
	Bearing performance		★	★★	★★★★
	EMC		▲▲▲▲	▲▲▲	▲
	Ambient temperature		0～40℃	0～50℃	0～50℃
	Speed control function		YES	YES	YES
	Speed feedback signal		YES	YES	YES
	Overheating protection		No	YES	YES
	Overload protection		No	YES	YES
	Frequent start and stop parameters	Lifespan	＞180,000times	＞ 800,000times	＞1,800,000times
		Test Conditions	Run 30sec Stop 30sec	Run 15sec Stop 15sec	Run 10sec Stop 10sec
			24hours continuously run and full-load work		
speed controller			12V equip with SC-D12,, 24V equip with SC-C24 Please pay attention to the voltages		

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

2. The less ▲, the lower EMC of this item

2.4 Working Conditions

1. Environment: This series of products can be divided into three types according to the working environment temperature: low temperature environment type, normal temperature environment type and high temperature environment type. If not specified, it is the normal temperature environment type. Low temperature environment type and high temperature environment type need to be customized. Such as VBY7505A (high temperature environment type).

Type	Permissible medium temperature range	Cautions
low temperature environment（standard version,premium version）	-10℃～50℃	It is forbidden to contain solid particles such as ice particles in the medium!
normal temperature environment（simplified version ）	0℃～40℃	
normal temperature environment（standard version ）	0℃～50℃	
normal temperature environment（premium version ）	0℃～50℃	
high temperature environment（standard version、premium version）	0℃～55℃	

1.The permissible relative humidity of all pumps in this series is ≤90%, no condensation. The pump should not be exposed to the sun, and should work in a clean and ventilated environment.

2.Medium: The permissible gas medium is allowed to be rich in water vapor, but cannot contain particles.The permissible liquid medium cannot contain particles.

This series of products are divided into two types: normal temperature medium type and high temperature medium type according to the medium temperature that can be tolerated. If not specified, it is the normal temperature medium type. The high temperature medium type needs to be customized and specified, such as VBY7505A (high temperature medium type).

Type	Permissible medium temperature range	Cautions
normal temperature medium（simplified version,standard version,premium version）	0℃～50℃	It is forbidden to contain solid
high temperature medium（standard version、	0℃～100℃	

premium version）		particles such as ice particles in the medium!

3.Load: the suction port can run with full load (ie completely block the inlet), But the applied load pressure must be between the pump's maximum vacuum,The exhaust port must be kept open! Otherwise please choose the micro compressor pump

2.5 Pump Materials

1.The materials of the wetted parts: fiber reinforced nylon, EPDM rubber,All materials have certain corrosion resistance, Please check the chemical resistance and compatibility of the medium according to the wetted material.

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

2.6 Filtering problem

When the pump works for a period of time, the solid impurities contained in the pump cavity, which will destroy the air tightness of the pump and reduce the flow rate and vacuum degree. A filter must be installed at the pump inlet. the gas that we generally think is very clean which still contains dust impurities, and it also needs to be filtered to ensure the normal operation of the precision air-tight components inside the pump. After the filter is used for a period of time, the resistance increases due to the adhesion of impurities, which makes the flow rate and vacuum degree of the system decrease significantly, and the filter should be replaced immediately. Filter life depends on the cleanliness of the media.

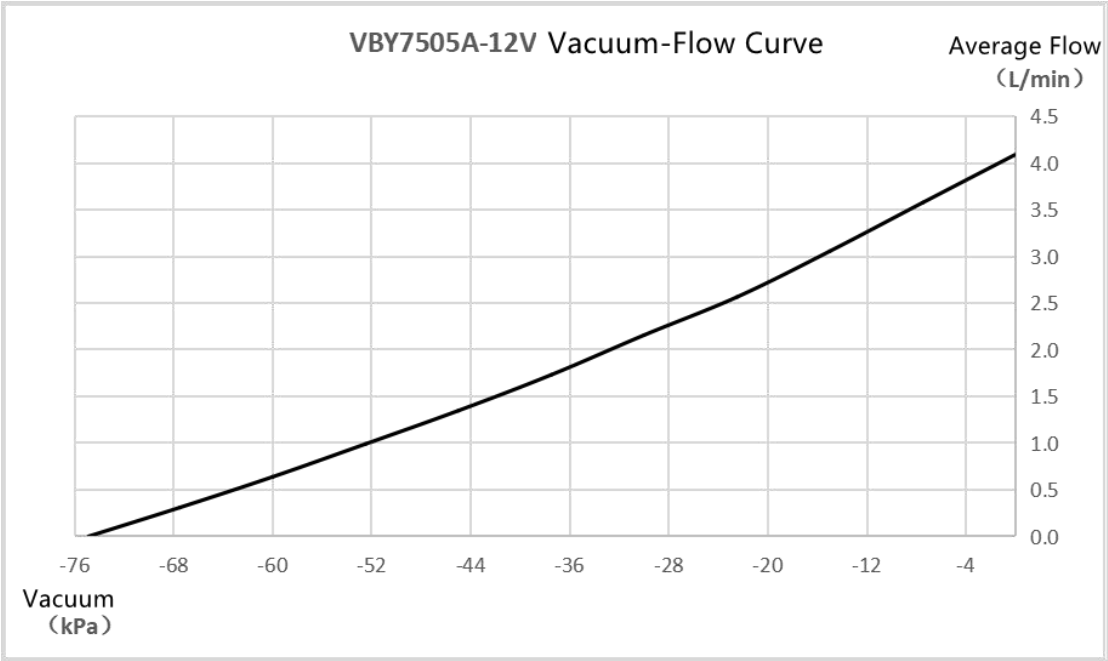
2.7 Noise and Silencer

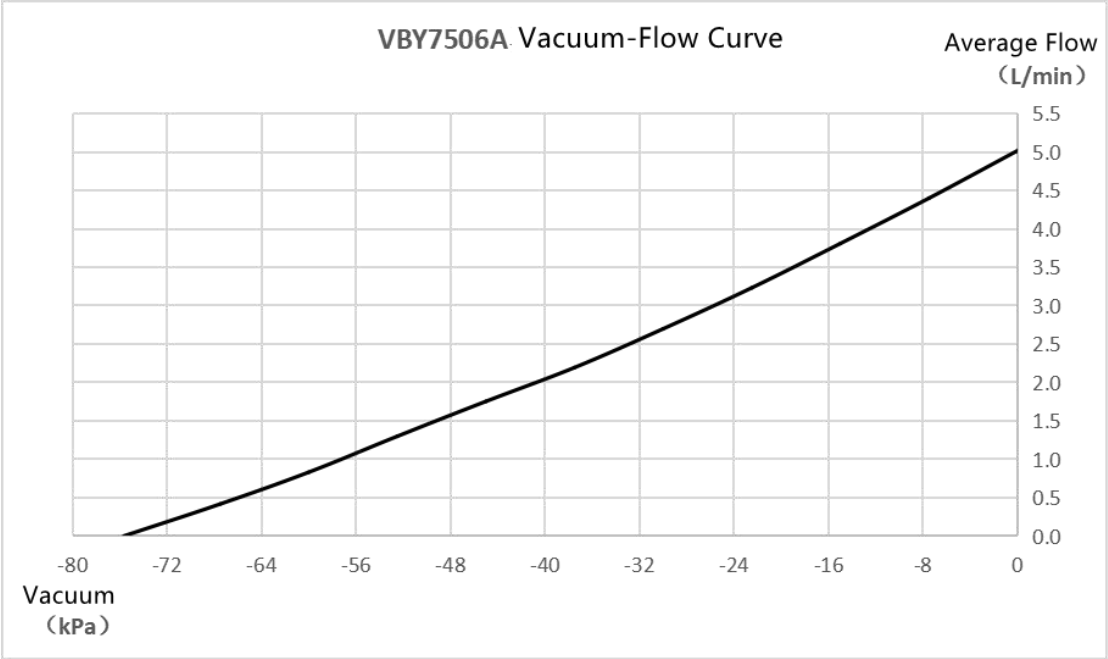
Choose high-end pump, less noise. When there is a large air flow through the pump, the noise is louder, and the noise will be reduced when the pumping is close to a vacuum. Connecting the silencer to the piping system will have a certain effect. According to the specific conditions of the pipeline system, the noise reduction effect is different.

2.8 Tube diameter

The size of the matching silicone tube: the inner diameter is about 4mm, and the outer diameter is about 8mm

2.9 Vacuum Flow Curves





3 Electrical Connection

3.1 Signal Wire Instruction

S.N	Wire	Function	Signal Definition	Description
1	White	Control motor start and stop	2V≤start≤5V 0V≤stop≤0.8V	This signal wire can be used to control the start and stop of the pump, especially for frequent start and stop. If this wire is not used, it must be insulated and wrapped. If the pump is not working for a long time, the red power wire should be disconnected.
2	Blue	Pulse Width Modulation（PWM）	0V≤start≤0.8V 2V≤stop≤5V	Change the motor speed and adjust the flow by changing the duty ratio. It is recommended that the frequency of the PWM input signal be set within this range: 20kHz to 30kHz. You cannot use this port to control the start and stop of the pump.
3	Yellow	FG feedback signal(The motor speed feedback signal, pulse signal)。the motor outputs 6 pulses per rotation.	VIL＜0.5V；VIH＜6V，It is recommended to take a high level=5V。The maximum rated current of FG signal is 2mA	The inside of the motor is open-drain status, so it needs to be pulled up externally. Voltage 5V, resistance 5.1kΩ.
4	Orange	Special control wire. Not useful for this product.	This wire should be connected to the negative pole of the power supply.	
5	Black	Power wire，negative pole。		

6	Red	Power wire，positive pole，+12V(±10%)；if choose 24V，connect +24V(±5%)		

Warning: Hot swap is prohibited! It is strictly forbidden to connect or disconnect the motor wire while the power is on! All connection or disconnection must be carried out with the power supply completely cut off! Otherwise it will burn the motor! Do not connect the positive and negative poles in reverse, otherwise the motor will be burned!

3.2 Connection Instruction

This series of products has three operating modes: ① constant speed, ②PWM speed control, ③PWM speed control and FG signal feedback

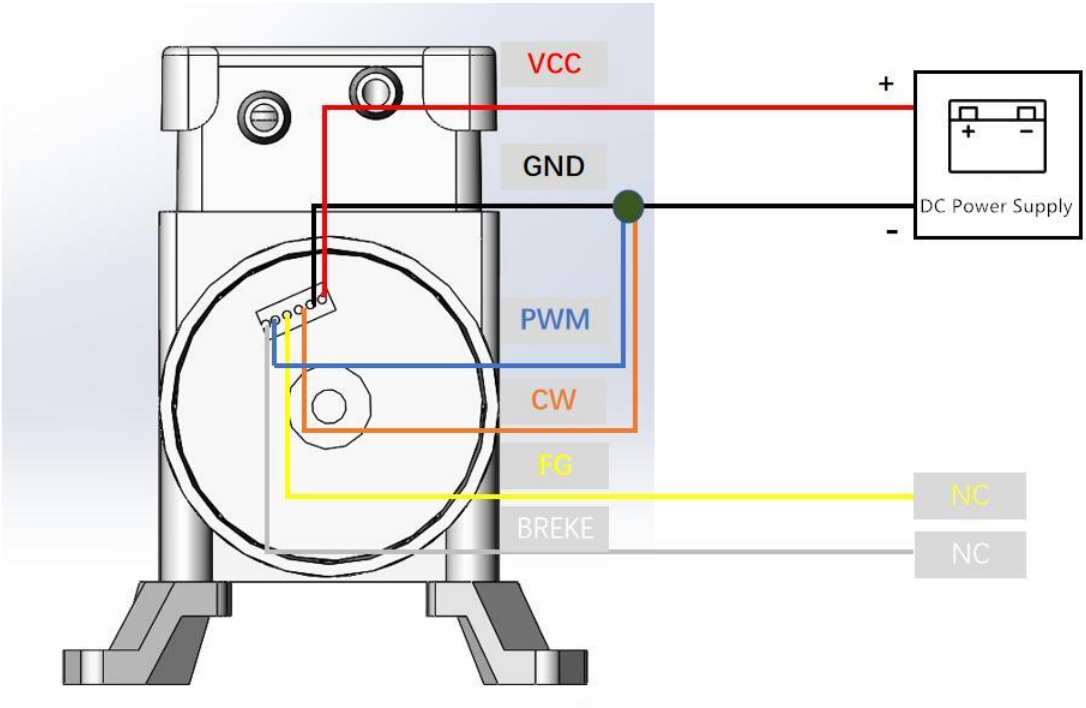


Figure 3-1 Wiring Instructions for constant speed Type

Constant Speed Wiring Connection:When the speed control function is not needed, the red line is connected to the positive pole of the power supply. and the black line, blue PWM signal line and orange line are connected to the negative pole of the power supply. It is recommended that the Earth wire be reliably grounded.The white and yellow wire must be insulated and wrapped, and the micro pump will work at the rated speed.

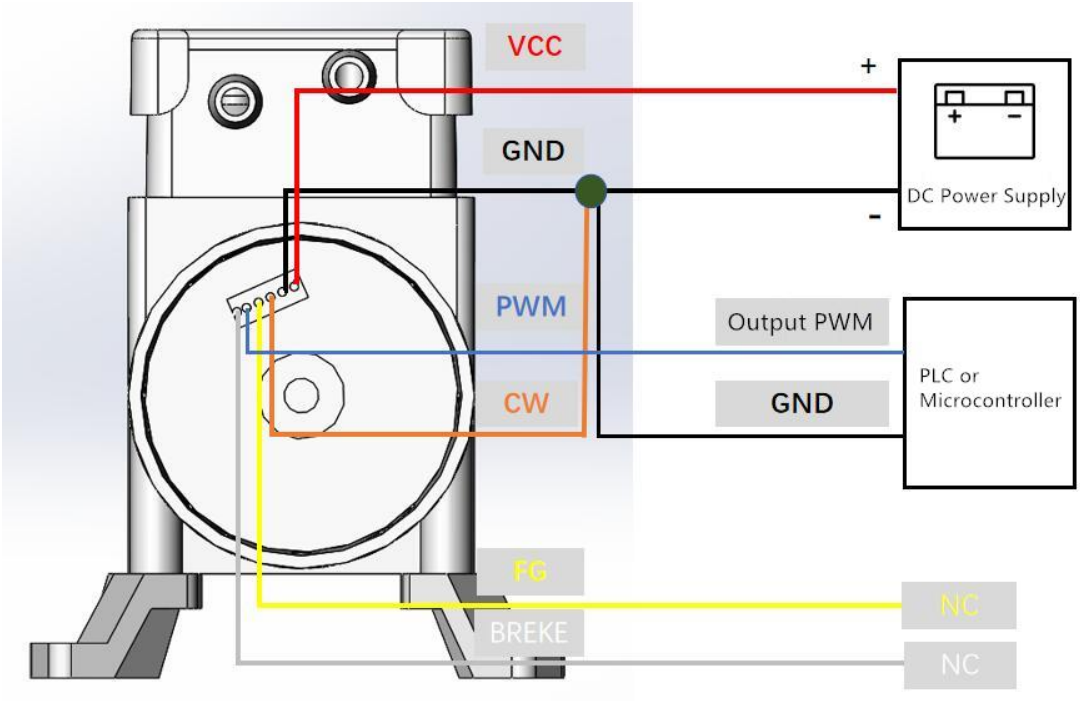


Figure 3-2 Wiring Instructions for PWM Speed Control Type

PWM speed control wiring: If you want to use the PWM speed control function, you need to use a host controller (function signal generator, MCU, PLC, etc.) that supports PWM signal output, connect the signal source output to the blue PWM input signal line, and Connect the PWM signal source ground to the orange wire and the negative pole of the DC power supply. The white and yellow wires must be insulated and wrapped.

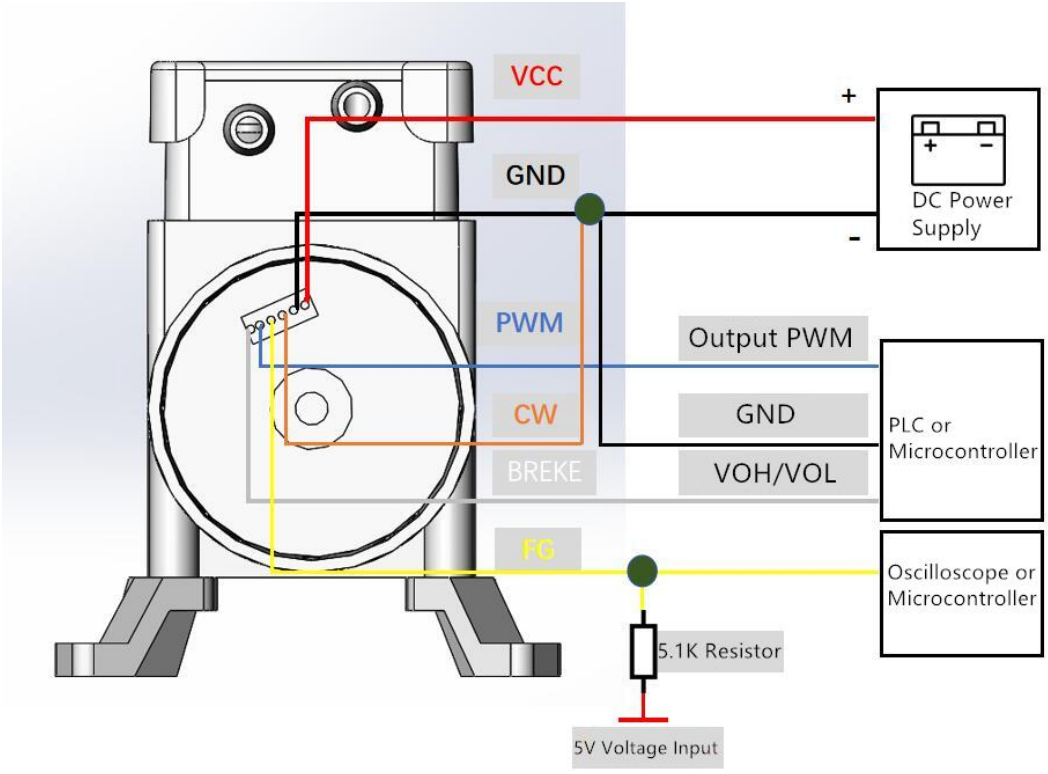


Figure 3-3 Wiring Instructions for PWM Speed Control Type,FG Feedback

PWM speed control, FG feedback wiring: When it is necessary to use the PWM speed control function and monitor the operation of the pump or perform feedback control through the FG signal, it is necessary to use a host controller (MCU, PLC, host computer and other controllers), connect the signal source output to the blue PWM input signal line, and connect the PWM signal source to the orange line and the negative pole of the DC power supply. The yellow FG feedback signal needs to pass through a 5.1kΩ resistor and then connect to DC5V Pull up, and then connect to the FG signal input terminal of the upper controller; if you use our company's special speed controller, you don't need to pull up additionally. If you need to control the motor to start and stop, connect the signal source level output to the white start-stop control line.

3.3 Motor Schematic Diagram and Description of Peripheral Circuit

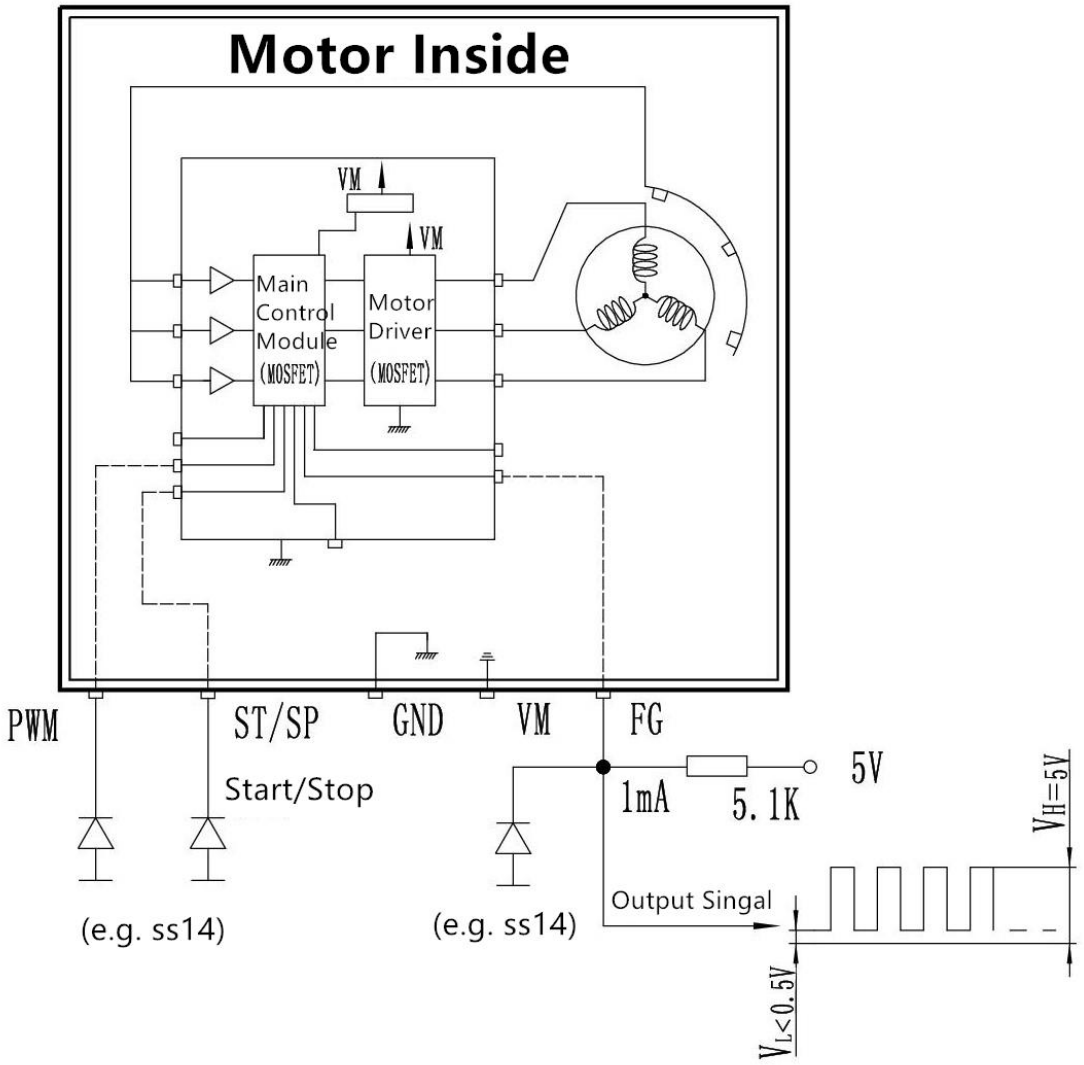


Figure 3-1 Motor Schematic Diagram

1. Several ports (as shown in the figure) must be connected to Schottky diodes.Because of the function control and drive inside the motor are all MOS tubes, and their input impedance is very high. Schottky diodes must be connected to prevent accidental serial connection of the ports. A large interference signal breaks down the MOS tube.

2. Requirements for control level: 0V≤VIL≤0.8V, 2V≤VIH≤5V.

3. The FG port is the motor speed feedback signal. In application, it should be noted that the FG signal output terminal is open-drain, and the user needs to connect a pull-up resistor, as shown in the figure, which is an application example

3.4 Starting Current Curve

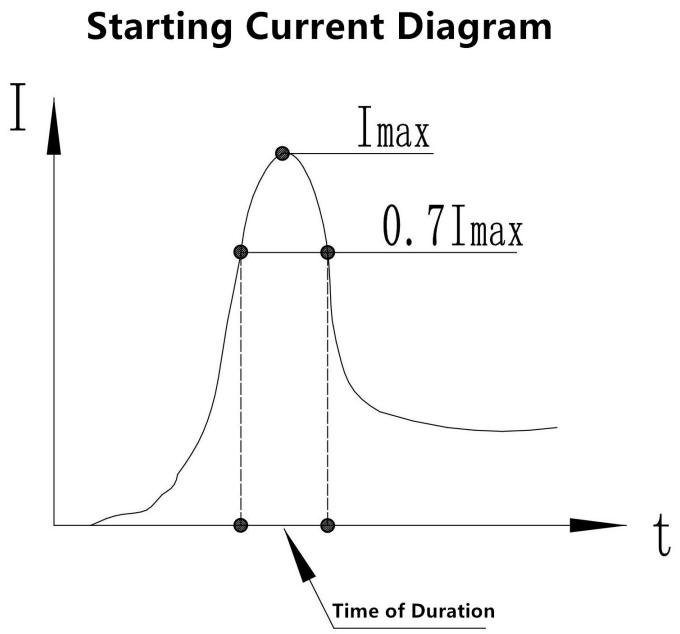


Figure 3-2 Starting Current Curve

1. The maximum starting current of this series is 3A, and the duration ＜10ms.

2. The starting current of the motor is the maximum current generated when the motor is in a static state and the rated voltage is suddenly turned on. This current is a basic parameter of the motor determined by the motor manufacturer.

3. When the motor is turned on during use, other auxiliary circuits, such as speed regulation, control, etc., will be turned on at the same time, which will generate additional inrush current superimposed on the starting current of the motor, which will increase the starting current a lot. .

Therefore, users who have limited starting current should control the "start/stop" function terminal of the motor when they need to control the start and stop of the pump, but cannot control the on-off of the current.

4 Cautions

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

1. The suction port can be operated at full load (completely blocking the suction port), but the load applied cannot exceed the maximum vacuum degree of the pump! The exhaust port must be kept open.

2. This product has no waterproof, dust-proof, and explosion-proof functions and cannot be used in flammable and explosive environments!

3. Foreign matter must not fall into the hydraulic connectors, and there should be no solid particles in the medium, otherwise the micro pump will be damaged!

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

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

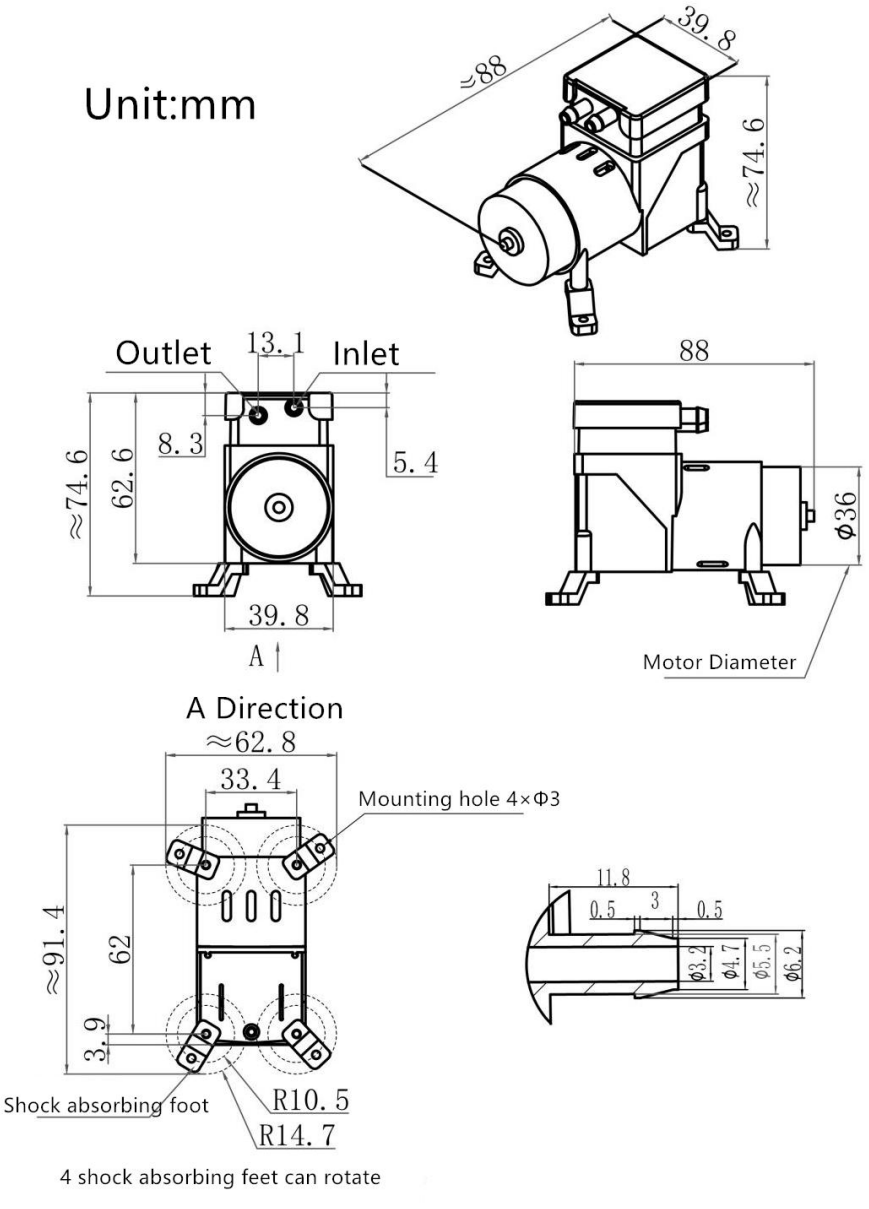
6. Built-in precision control circuit, need to use high-quality DC power supply to power the pumps!

7. Hot swap is prohibited! It is strictly forbidden to connect or disconnect the motor wire while the power is on! All connection or disconnection must be carried out with the power supply completely cut off! Otherwise it will burn the motor! Do not connect the positive and negative poles in reverse, otherwise the motor will be burned!

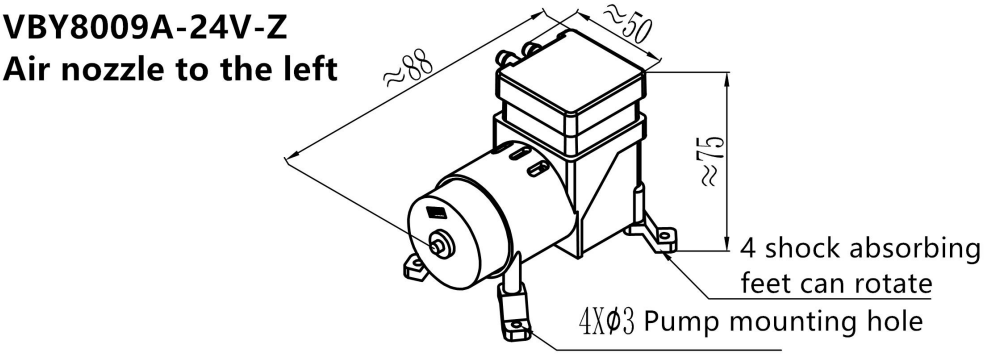
8. Users should take anti-static measures!

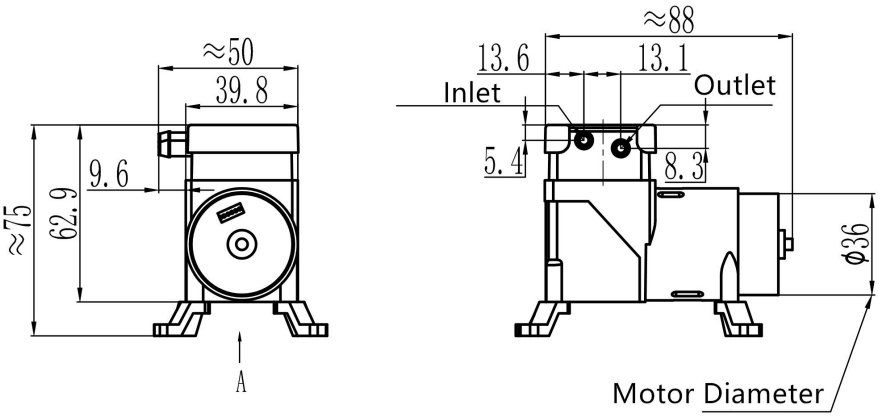
9. Please follow the instructions strictly!

5 Dimensions

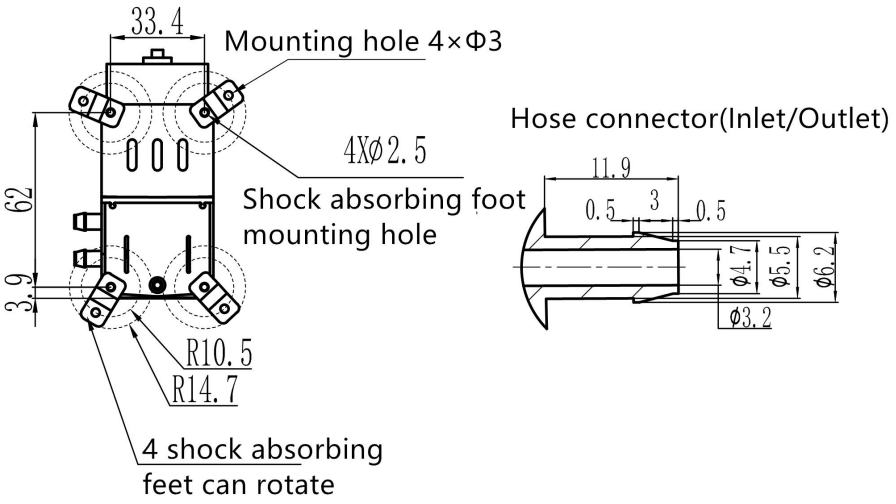


VBY8009A-24V-Z
Air nozzle to the left



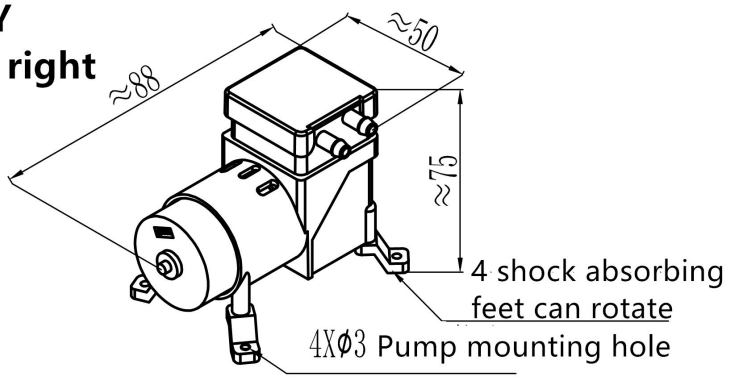


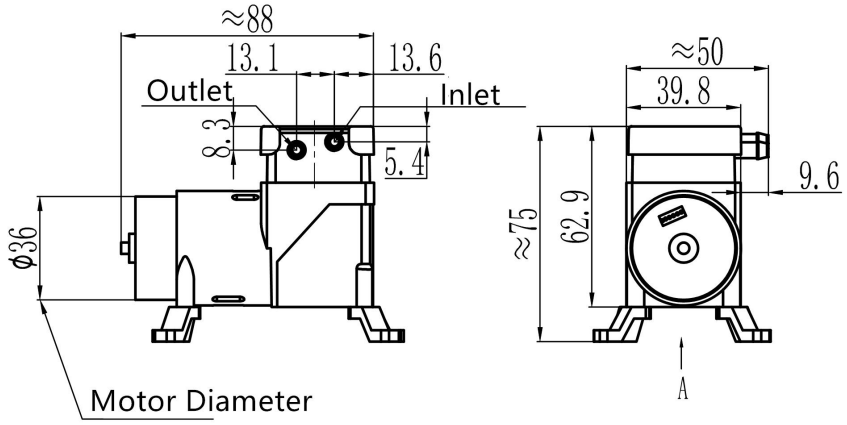
A Direction



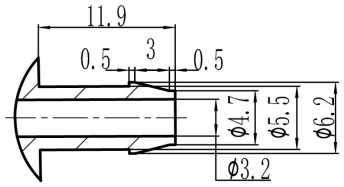
VBY8009A-24V-Y
Air nozzle to the right

Unit:mm

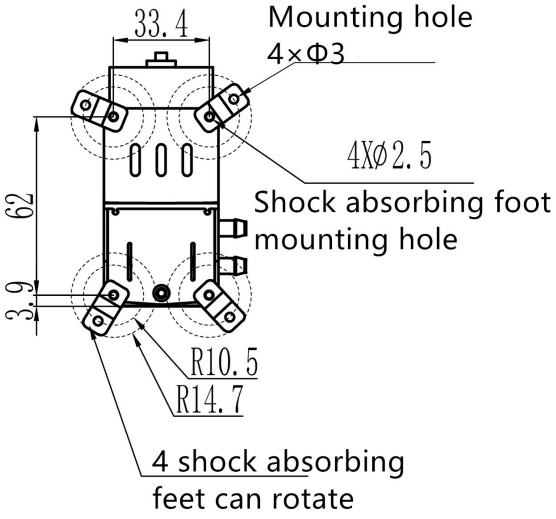




Hose connector(Inlet/Outlet)



A Direction



Installation instructions:

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

6 Appearance

VBY7505A/VBY7506A

VBY8009A-Z Air nozzle to the left

VBY8009A-Y Air nozzle to the right