



## S23 Micro Vacuum Liquid Pump Series

# User Guide

**Issue**      09  
**Date**        2020-07-10



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# About This Document

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## Purpose

This document is related to the S23 micro vacuum liquid 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, related parameters, wiring instructions

## Change History

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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	2019-2	01	XYL	First official release, initially determine the product model
02	2019-4	01	XYL	Modify some parameters
03	2019-5	01	XYL	Modify the logic wiring diagram and wire sequence
04	2019-9	01	LYZ	Modify the document format
05	2019-12	01	XYL	Add flow-height curve, cancel speed controller adaptation
06	2020-04	01	XYL	Update starting current and flow curve test conditions
07	2020-05	01	XYL	Add description of models
08	2020-06	01	XYL	Modify notes and some information on medium
09	2020-07	01	XYL	Add materials of the wetted parts

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# 1 Characteristics

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## 1.1 Compact Size

The product weighs about 80g and the overall size is about 35\*51\*56mm

## 1.2 Brush-less DC Motors

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

## 1.3 Protections

Equipped with overheating protection and overload protection function, which can extend the service life of the pump.

## 1.4 **Excellent Air Tightness**

The internal double sealing structure offers good air tightness, making this series of pumps suitable for applications requiring high air tightness.

## 1.5 **Gas-liquid Dual Purpose**

Liquid-gas dual-use, can be used as a liquid pump or a vacuum pump, can also be used to transfer gas-liquid mixed media; dry-run and self-priming.



# 2 Functions

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## 2.1 Speed Control Feature

The flow can be changed by adjusting the motor speed of the pump (by adjusting the PWM duty cycle).

## 2.2 Start-Stop Function

The start and stop of the pump can be controlled by the start and stop control level signal, which is suitable for frequent start and stop working conditions.

## 2.3 Speed Feedback

The speed of the pump can be obtained through the speed feedback signal, easy to realize working condition monitoring and closed-loop control.

# 3 Technical Specifications

## 3.1 Key Specifications

(Standard atmospheric pressure 101kPa)

Model	Voltage (VDC)	As a Vacuum Pump			As a Liquid Pump		Size (mm)	Weight (g)
		Load current (mA)	Flow Rate (L/min in)	Relative Vacuum (-kPa)	Load current (mA)	Free Flow Rate (Pure Water) (L/min)		
S23L	12	≤170	≥0.95	≥15	≤250	≥0.4	35*51*56	≈80

- Note:**
1. The input voltage requires  $12V \pm 10\%$ .
  2. Unless otherwise specified, the technical parameters are measured under the conditions of temperature  $25^{\circ}\text{C}$  and standard atmospheric pressure of 101kPa. For products with other parameters and specifications, you can contact us to customize.
  3. The parameters in the table are measured at the maximum speed of the motor.

Model	Max. Suction Height (m)	Flow Rate@ Max. Suction Height(L/min)	Max. Pressure Height (m)	Flow Rate@ Max. Pressure Height (L/min)
S23L	1.4m	250mL/min	1.2m	200mL/min

Note: The maximum suction height flow rate refers to the water flow rate at the maximum suction height.

The maximum pressure height flow rate refers to the water flow rate at the maximum pressure height.

### 3.2 Description of Versions

Version	Simplified Version	Standard Version	Premium Version
<b>Performance</b>			
Lifetime	as a gas pump > 3000h as a liquid pump >1500h	as a gas pump > 6000h as a liquid pump >4000h	as a gas pump >10000h as a liquid pump >6000h
Noise	★	★★	★★★★
Reliability	★	★★	★★★★
Parameter consistency	★	★★	★★★★

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

2. \* Indicates that the life-time of the standard version and premium version is still under test, which is expected value.

### 3.3 Working Conditions

1. Environment: The permissible ambient temperature of the pump is 0°C ~ 50°C, the pump should avoid exposure in the sun, and should work in a clean and ventilated environment.

2. Medium: Permissible gaseous media temperature range is 0°C ~ 50°C. The medium is allowed to be rich in water vapor, but cannot contain particles or oil mist. The permissible liquid medium temperature range is 5°C ~ 50°C. It is not allowed to pump oily liquid and high viscosity liquid. Do not use this product to transfer liquid that is easy to precipitate and crystallize for a long time.

3. Load: Both the inlet and outlet can run with full load (i.e. completely block the inlet), but the load applied by the inlet cannot exceed the maximum vacuum of the pump. Do not block the outlet when pumping liquid.

### 3.4 Pump Materials

The materials of the wetted parts: fiber reinforced nylon, ABS and EPDM rubber.

Except that the intake valve seat of the pump is ABS, the other plastic parts are reinforced nylon and the rubber is EPDM rubber.

If the medium is corrosive, please check the chemical resistance and compatibility of the medium according to the material of the wetted parts.

### 3.5 Lifetime

#### 1. Life-time Test Conditions

In a clean and non-corrosive laboratory, the pump continuously pumps clean water around the clock; ambient temperature: 5 °C ~ 33 °C, fluctuates with the climate; relative humidity: less than 90%, fluctuates with the climate.

2. Simplified version: as a gas pump, lifetime > 3000h; as a liquid pump, lifetime > 1500h; Standard version: as a gas pump, lifetime > 6000 hours, as a liquid pump, lifetime > 4000 hours; Premium version: as a gas pump, lifetime > 10000 hours, as a liquid pump, lifetime > 6000 hours.

**Note:** If the actual working conditions of the pump better than our test conditions, the actual lifetime of the pump will be extended.

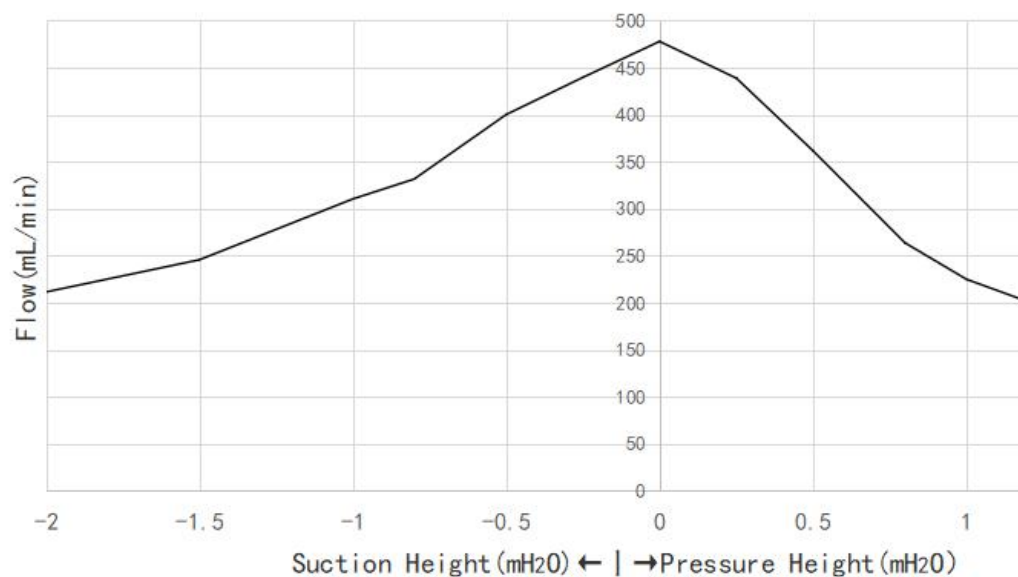
### 3.6 Flow Curve

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

Curve Test Conditions:

Medium	Temperature (°C)	Atmospheric pressure (kPa)	Material of hoses	Internal diameter of hoses (mm)	Non-test tube length (mm)	
					Outlet (Testing suction)	Inlet (Testing discharging)
Clean Water	20	101	Silicone rubber hose	4	100	100

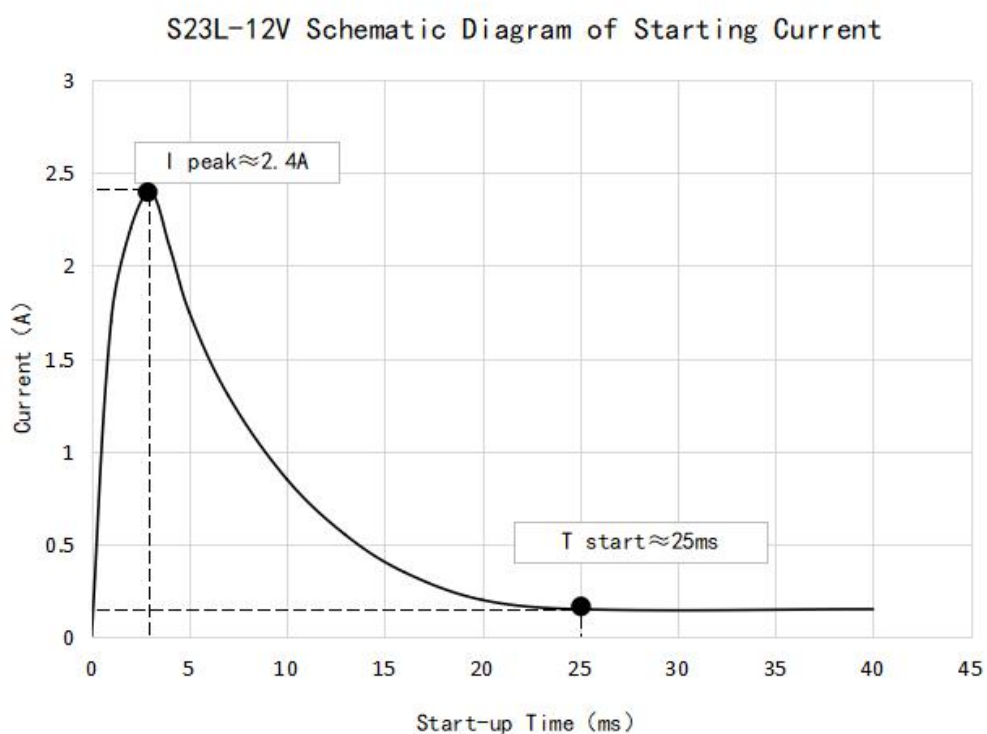
S23L Pumping Height-Flow Curve



- 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.

### 3.7 Starting Current

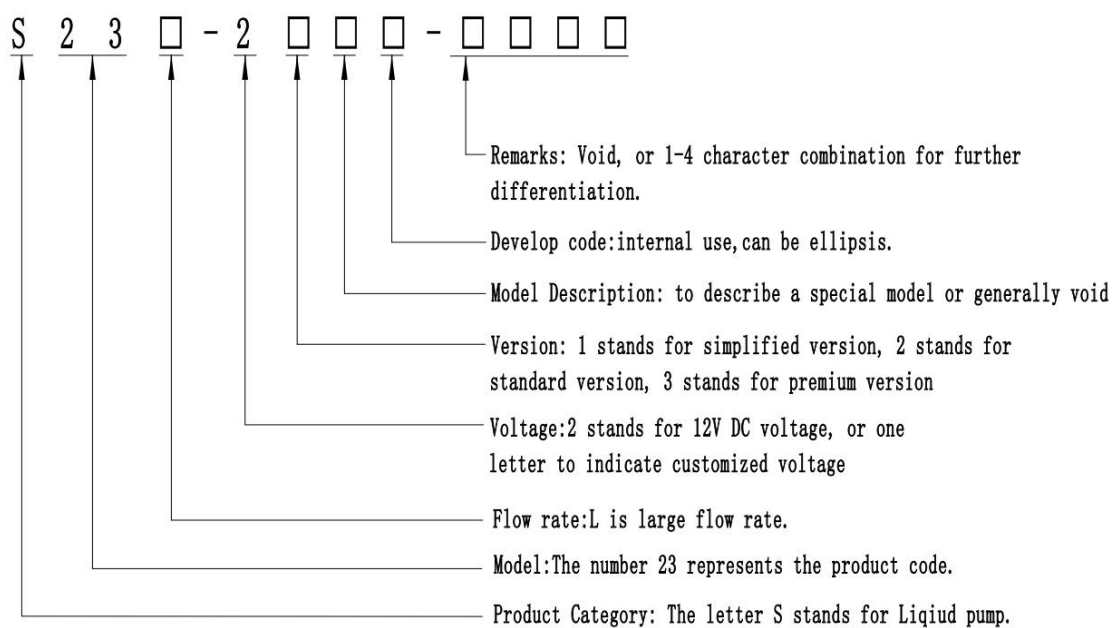
The starting current curve is measured under the working condition that the inlet and outlet are filled with water, and there are certain individual differences between different micro pumps. This curve is a statistical value, which is only used as a technical reference when users determine the power supply system, and is not for acceptance data.



# 4 Product Model Description

## 4.1 Brief Description of Model Naming

This series of products are divided into three versions: simplified version, standard version and premium version.



**Note:** If the remarks starts with a letter, it means a special custom function. For example, letter "GJ" means customized high-temperature medium function, and "GH", means customized high-temperature environment function. If it starts with a number, it means other information.

Example 1: S23L-23 (S23 large flow pump, 12V voltage simplified version)

Example 2: S23L-23-GJ (S23 large flow pump, 12V voltage premium version, customized high temperature medium function)

# 5 Electrical Connection

The electrical connection is a description of the external power supply and signal wire connection of the product. The product comes with standard connection wires, and the definitions of the wires are distinguished by colors.

## 5.1 Definition of Signals

There are 5 motor wires for this product. The wiring and usage instructions are as follows.

S.N.	Color	Function	Explanation	Remarks
1	Black	Negative pole of the power supply		
2	Red	Positive pole of the power supply	DC12V ( $\pm 10\%$ )	
3	Yellow	FG feedback signal (motor speed feedback signal, pulse signal), the motor outputs 6 pulses per rotation	Output: $4V \leq \text{High Level}$ $\text{Low Level} \leq 0.6V$ The maximum rated current of the FG feedback signal is 3mA.	The internal of the motor is open-drain, so which requires a pull-up externally. Voltage DC 5V, resistance 4.7k $\Omega$ .
4	White	Pulse Width Modulation (PWM)	Input: $0V \leq V_{IL} \leq 0.8V$ $2V \leq V_{IH} \leq 5V$ (15kHz~25kHz)	Use PWM to change the motor speed and adjust the flow. PWM input signal frequency range: 15kHz~25kHz. This port cannot be used to control the start and stop of the pump.
5	Orange	Control the start and stop of the	Input	This signal line can be used to control the start

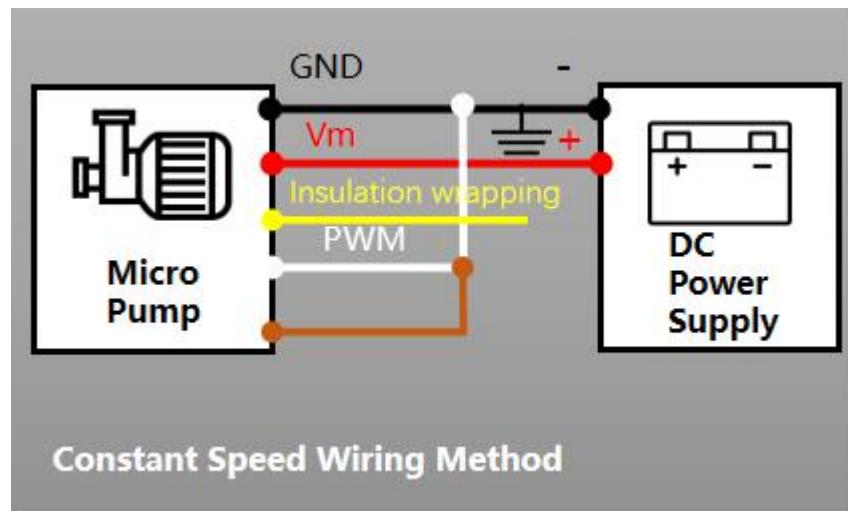


		motor.	Level Signal: $2V \leq \text{Stop} \leq 5V$ $0V \leq \text{start} \leq 0.8V$	and stop of the pump, especially for frequent start and stop. If the pump does not work for a long time, disconnect the red power cord.
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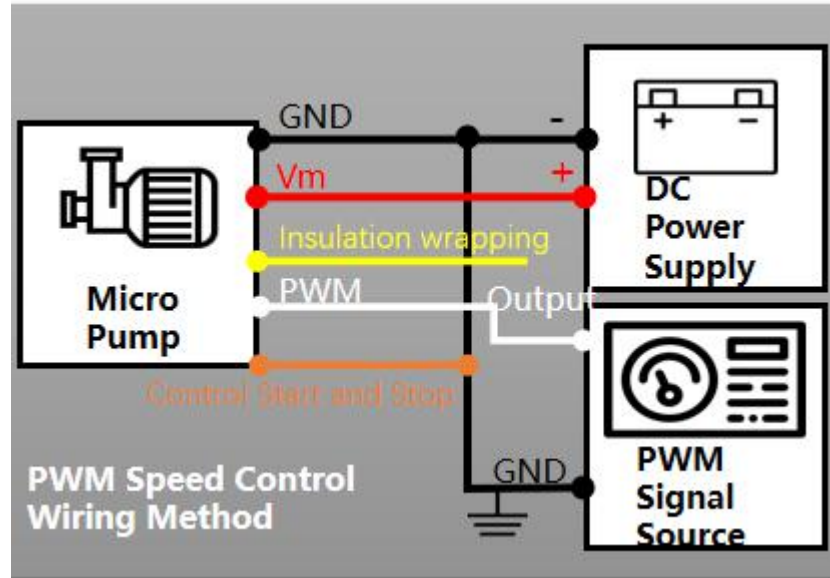
**Note:** If speed control and speed feedback are not needed, the red wire shall be connected to the positive pole of the power supply, and the black, white and orange wires connected to the negative pole of the power supply; the yellow wire shall be insulated and wrapped.

## 5.2 Logic Wiring Diagram

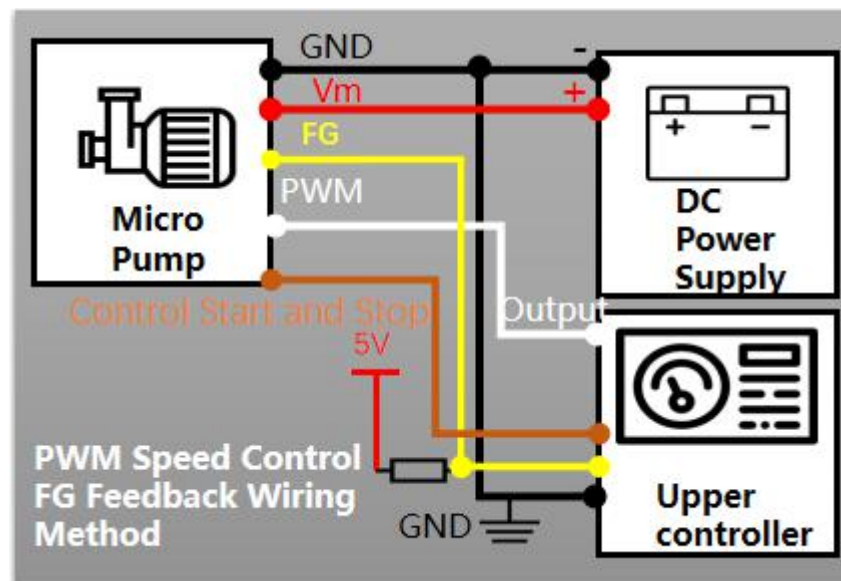
If speed control and speed feedback are not needed, the red wire shall be connected to the positive pole of the power supply, and the black, white and orange wires connected to the negative pole of the power supply; the yellow wire shall be insulated and wrapped and the pump will work at the rated speed.



When you need to use the PWM speed control function, you need to use a signal source that supports PWM signal output (function signal generator, MCU, PLC, etc.), connect the signal source output to the white PWM input cable, and connect the PWM signal source ground to the ground of the DC power supply and wrap the yellow wire with insulation.



When you need to use the PWM speed control function and monitor the pump operation or perform feedback control through the FG signal, you need to use an upper controller (MCU, PLC, host computer, etc.) that supports PWM signal output, FG signal input and start-stop control. Connect the signal source output to the white PWM input wire, and connect the PWM signal source ground to the DC power ground. The yellow FG feedback signal needs to pass a  $4.7k\ \Omega$  resistor before connecting to DC 5V for a pull-up, and then connect to the FG signal input terminal of the upper controller; if using our matching micro-pump speed controller, no additional pull-up is required.



# 6 Cautions

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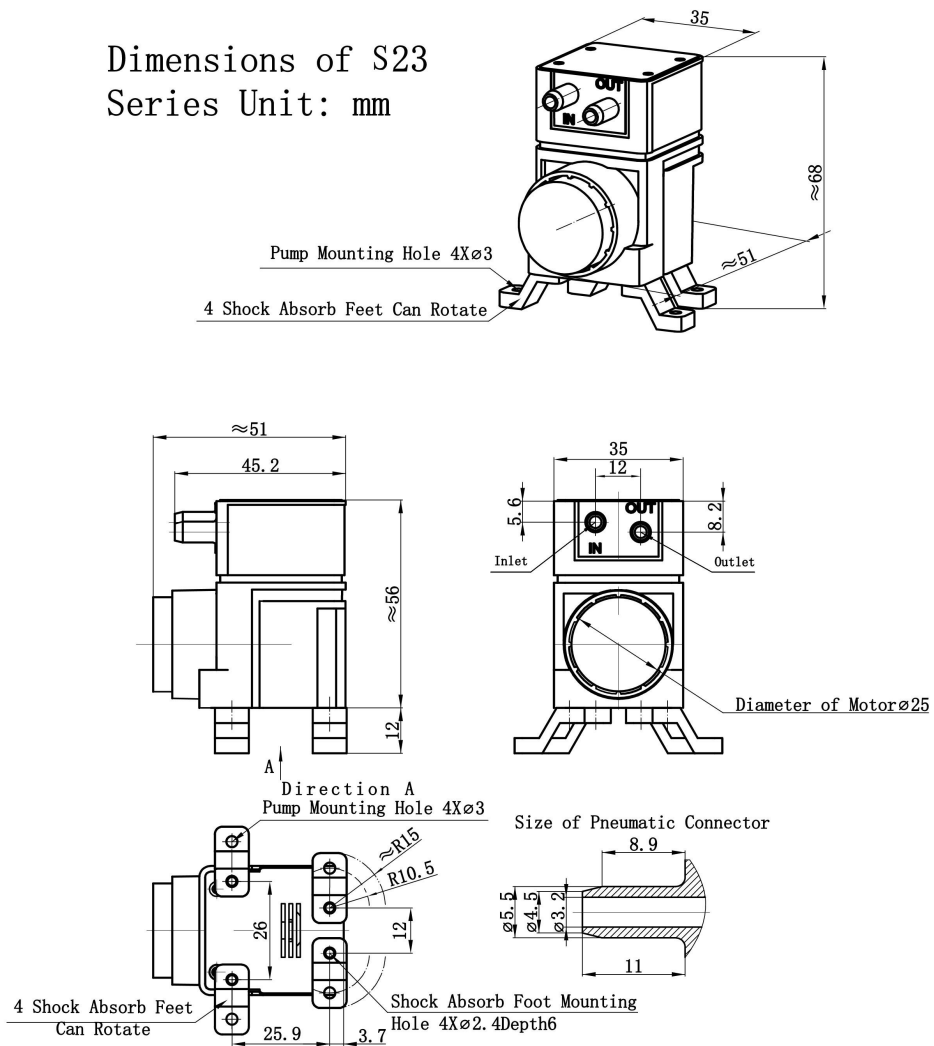


Please read the instructions in this chapter carefully and follow the instructions strictly before use.

- 1. This product has no waterproof, dust-proof, and explosion-proof functions and cannot be used in flammable and explosive environments!**
- 2. 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!**
- 3. When this product is used to transfer harmful medium, it must be double-sealed to ensure personal safety!**
- 4. The matching piping components and containers must have sufficient strength to ensure personal safety!**
- 5. Please follow the instructions strictly!**
- 6. Do not use it to pump oil mist, high-viscosity liquids or liquids easy to precipitate.**

# 7 Dimensions

Dimensions of S23 Series 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

