



D27 Micro Air Pump Series User Guide

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Hilintec

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About This Document

Purpose

This document is related to the D27 micro diaphragm 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

Premium motor, wide voltage supply, 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	20220701	1.0	First official release
02	20230401	2.0	Added the model with BLDC
03	20231219	3.0	Add D27M parameters

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1

Characteristics

1.1 No Flow Pulsation,Smooth Output

This product is specifically designed for low pulsation demand, ensuring a smooth output flow without any pulsations. This feature simplifies the gas path and sensor design in the gas sampling system.

1.2 High Flow Rate,Small Volume

The weight of D27E is about 135g, the appearance size is about 92.5×39×39.5 mm (excluding the shock absorbing feet), and can output 3.7L/min flow

The weight of D27M is about 150g, and the appearance size is about 80.5×40.5×39.5 mm (excluding shock-absorbing feet).

1.3 Long Lifespan,High Cost Performance

The brushless motor type sampling gas pump uses high-quality brushless motor, which has the advantages of long life, continuous operation day and night, no interference to surrounding electronic components, no pollution to power supply, and high reliability. At the same time, it has the low-cost and high-quality brushed motor, which can provide industrial-grade sampling gas pump with continuous operation day and night, long life, and high reliability under the condition of high cost performance.

1.4 Speed Control Function

The brushless motor type can input PWM signal, change the duty cycle, and thus change the motor speed and adjust the flow rate. The type with brushed motor can adjust the gas flow rate by changing the input voltage

1.5 Speed Feedback

The brushless motor type can know the high and low speed of the pump through the speed feedback signal. From this, the operating state of the pump can be known, which is convenient for realizing closed-loop control and making the system more intelligent

1.6 Maintenance Free,Pollution-free Transmission

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

1.7 Water Vapor Medium Available

Suitable for extracting high humidity, saturated humidity gas

1.8 Good Corrosion Resistance

The materials of the wetted parts: reinforced nylon,PP plastic (polypropylene) and EPDM rubber,which have certain corrosion resistance

1.9 Unlimited Installation

It can be installed in any direction

2 Technical Specifications

2.1 Key Specifications

Model	Voltage (V DC)	Starting Current (mA)	Load Current (mA)	Flow Rate (L/min)		Relative Vacuum (-kPa)	Max Output pressure	Weight (g)
				Peak Flow	Average Flow			
D27E-BL4	24	≤2000	≤200	≥3.7	≥3.7	≥35	/	≈135
D27E-BL2	12	≤2000	≤300					
D27M-BL4	24	≤3000	≤150	≥4	≥4	≥35	≥55	≈150
D27M-BL2	12	≤4500	≤300					
D27E-DC4								

Note: 1. The input voltage of D27E-DC4 requires 12V~27V. The input voltage requirements of D27E-BL4, D27E-BL2, D27M-BL4, and D27M-BL2DE are $24V \pm 10\%$ and $12V \pm 10\%$. Voltage changes will affect the current and flow, but the negative pressure remains basically unchanged. Hailin 220V power adapter can be purchased. If the input voltage is too low or the pump stops due to load reasons, the power should be cut off immediately!

2. Unless otherwise specified, the technical parameters are measured under the conditions of temperature 20°C and standard atmospheric pressure of 101.325kPa.

3. 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

<i>Model</i>	D27E with BLDC motor	D27M with BLDC motor
<i>Version</i>	Standard Version	Simplified Version
Full-Load(hrs)	5000	Testing
No-Load(hrs)	8000	5000
Motor(hrs)	10000	8000
Lifetime test instructions:	D27E full-load life test conditions: The pump exhaust port is blocked, and the exhaust port is directly connected to the atmosphere, so that the pump can operate continuously for 24 hours under the maximum pressure condition without stopping. D27M full load life test conditions: The pump exhaust port is blocked, and the exhaust port is directly connected to the atmosphere, so that the pump can operate continuously for 24 hours under the maximum pressure condition without stopping.	
	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;	
	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;	
	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;	
	The source of the experimental data is from Hilin Technology Aging and life laboratory and supplier laboratory	

2.3 Working Conditions

1. Environment: The working environment temperature is 0℃~50℃. The relative humidity of the working environment is ≤90%, no condensation. The pump should not be exposed to the sun outdoors, and should work in a clean, ventilated, non-corrosive environment.

2. Medium: Permissible gas medium temperature range is 0°C~50°C. The medium is allowed to contain water vapor, but cannot contain particles or oil mist. High temperature medium type (0°C~100°C) can be customized.
3. Load: The D27E suction port can operate at full load (completely blocking the suction port), but the applied load pressure cannot exceed the ultimate negative pressure of the pump; the exhaust port must remain open! At rated voltage, the pump can be started under extreme negative pressure. Both the suction port and exhaust port of D27M can operate at full load (that is, both the suction and exhaust ends can be completely blocked), but the negative pressure applied cannot exceed the ultimate negative pressure of the pump.

2.4 Pump Materials

1. Materials contacted by the medium: D27E: reinforced nylon, PP plastic (polypropylene), EPDM rubber. D27M: reinforced nylon, silicone rubber, EPDM rubber. All have certain corrosion resistance. Please judge the pump's tolerance to the transported medium based on the contact materials.
2. The material of the plastic parts of the pump body is reinforced nylon, and the material of the shock-absorbing feet is PVC.

2.5 Filtering problem

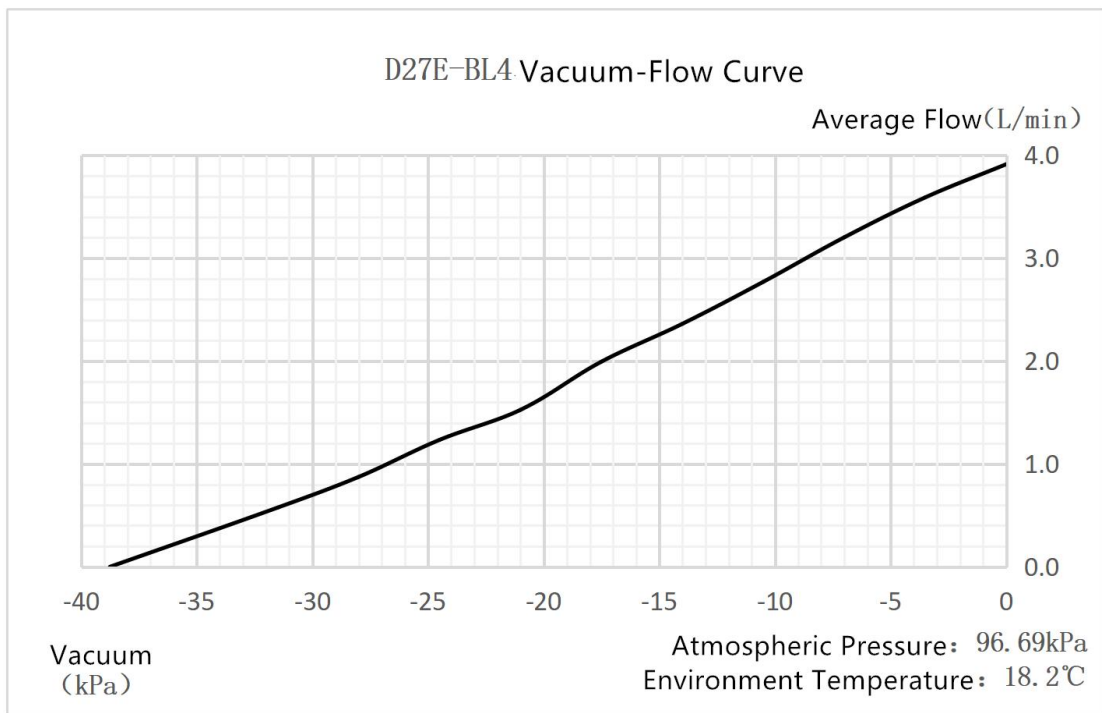
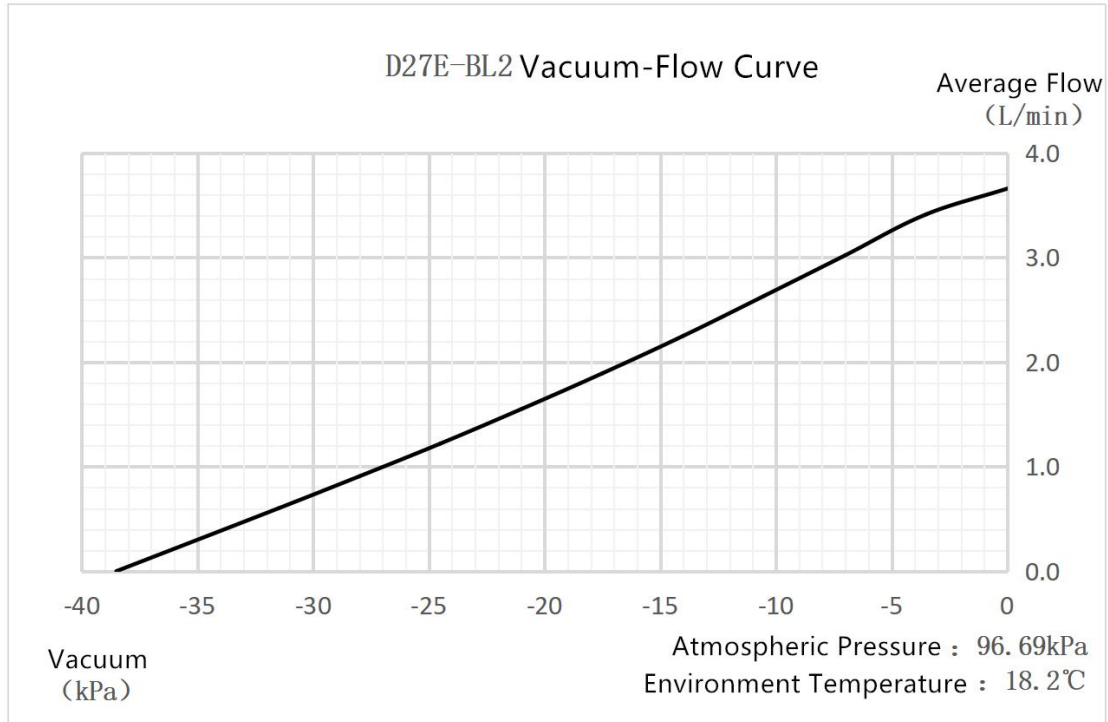
When the pump works for a period of time, the solid impurities contained in the pump cavity, which will destroy the air tightness of the pump and reduce the flow rate and vacuum degree. A filter must be installed at the pump inlet. The gas that we generally think is very clean which still contains dust 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 medium.

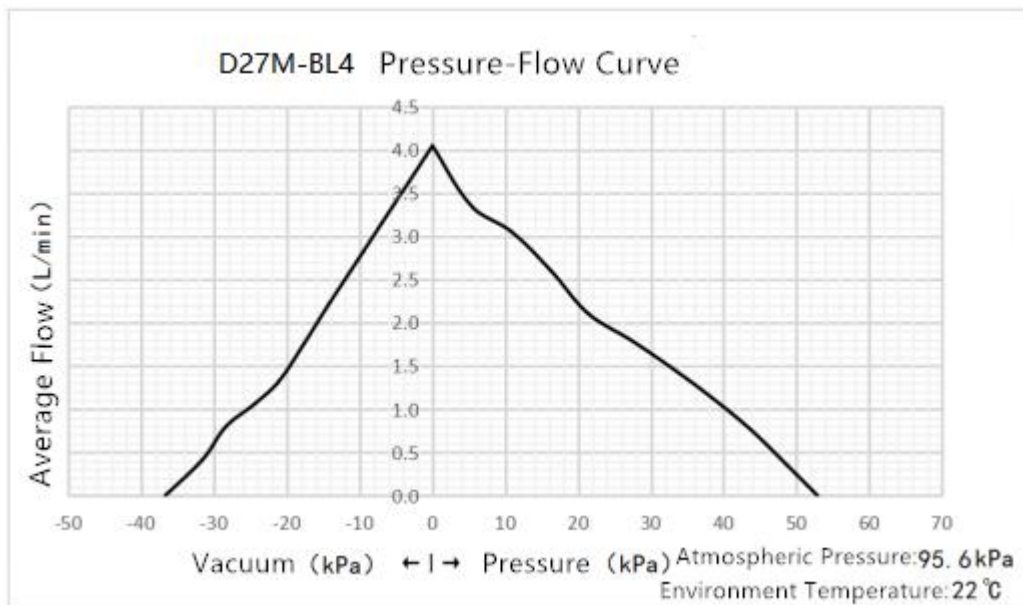
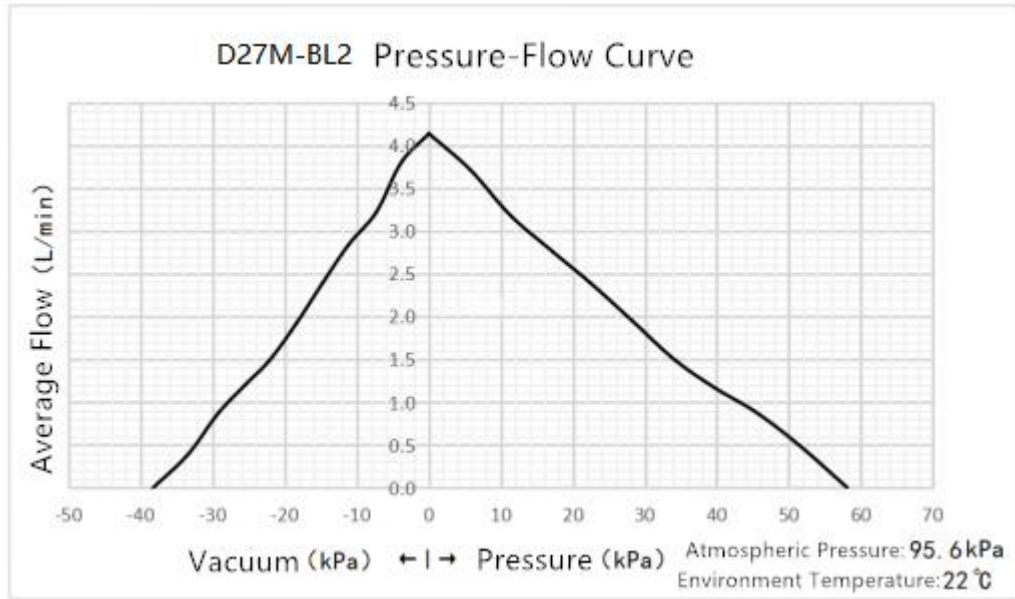
2.6 Tube diameter

Standard straight nozzle (material: reinforced nylon), can be connected with 4*8mm or 5*9mm silicone hose.

2.7 Vacuum Flow Curves

Due to the resistance introduced by the test pipeline, There are individual differences between different micro pumps, so 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".





- 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 rate;
2. The value of this curve is for reference only, not as a basis for product acceptance;

2.8 Motor Starting Current

1. For the starting current value of this series of pumps, please refer to the key parameter table in 2.1.
2. The starting current of the motor is the maximum current generated when the motor is in a static state and suddenly connected to the rated voltage. 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 are connected at the same time, such as: speed regulation, control, etc., which will generate additional surge current superimposed on the starting current of the motor, which will increase the starting current a lot .

For users who have limited starting current, for pumps with "start/stop" function terminals, they should control the "start/stop" function terminals of the motor instead of controlling the on-off of the current.

3 Electrical Connection

3.1 D27E Wire Instructions(brushed motor type)

Motor Wire	Connection
Pump top electrode (red dot)	24V DC power supply positive
Pump lower electrode	Negative pole

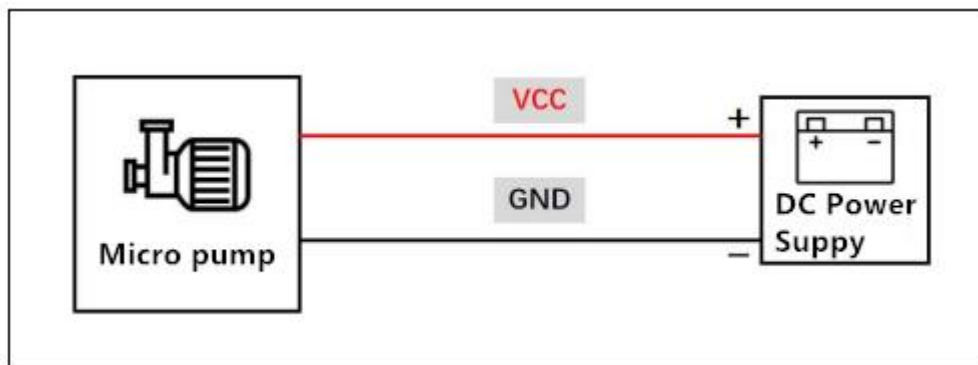


Figure 3-1 Wiring diagram of D27 brushed motor

3.2 D27E Wire Instructions(BLDC motor type)

S. N	Wire	Function	Signal Definition	Description
1	Red	Power wire, positive pole, +12V($\pm 10\%$); if choose 24V, connect +24V($\pm 5\%$)		
2	Green	FG feedback signal	VIL<0.5V; VIH<5V, It is recommended to take a high level=2.5V	motor speed feedback signal, pulse signal. The motor outputs 3 pulses per revolution
3	Yellow	Motor forward and reverse control	Suspended or high level (2 ~ 5V) reverse, grounded or low level (0 ~ 0.8V) forward	Forward and reverse rotation does not change the gas transmission direction of the pump, so this port has no practical effect
4	Black	Power wire, negative pole		
5	Blue	Pulse Width Modulation (PWM)	$0V \leq VIL \leq 0.8V$ $2V \leq VIH \leq 5V$, Duty cycle speed regulation; grounded or low level motor runs at full speed	Change the motor speed and adjust the flow by changing the duty cycle. The frequency of PWM input signal is recommended to be within this range: 10~30kHz. This port cannot be used to control the start and stop of the pump

It is equipped with a signal line at the factory, and the customer can connect his own signal line to it

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!

D27E(BLDC motor) has three operating modes: ① constant speed, ② PWM speed control, ③ PWM speed control and FG signal feedback

Constant Speed Wiring Connection:When the speed adjustment function is not needed, the red wire is connected to the positive pole of the power supply, and the black wire and the blue PWM signal wire are connected to the negative pole of the power supply; it is recommended that the ground wire be reliably grounded, and the green wire and the yellow wire must be insulated and wrapped! The micro pump will work at rated speed. The factory has been screwed together according to the fixed speed wiring

Constant Speed Simple Wiring Connection

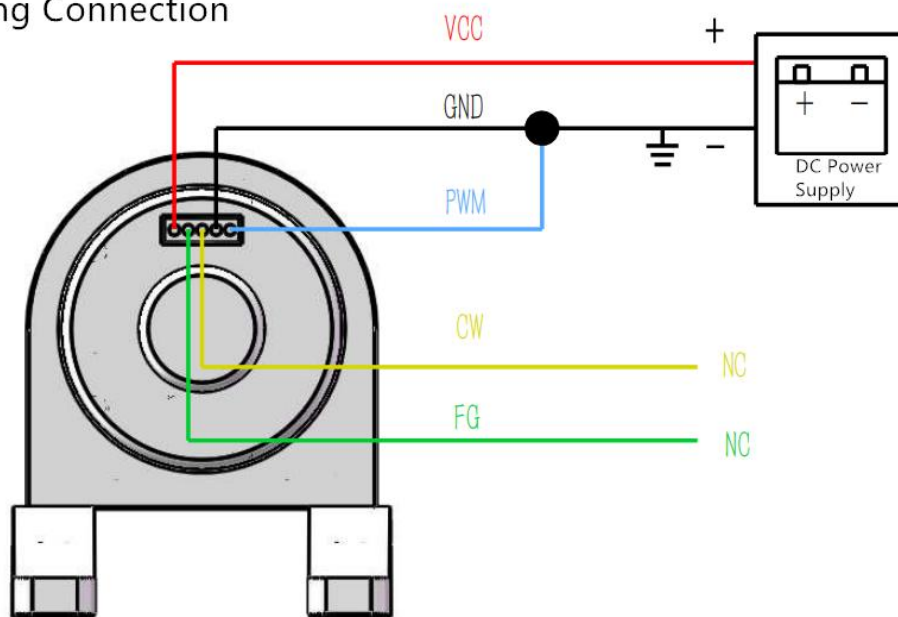


Figure 3-2 D27E Wiring Instructions for constant speed Type(BLDC motor)

PWM speed control wiring:If you need 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 to the ground. Connect to the negative pole of the DC power supply. Green and yellow wires must be insulated

PWM Speed Control
Wiring Connection

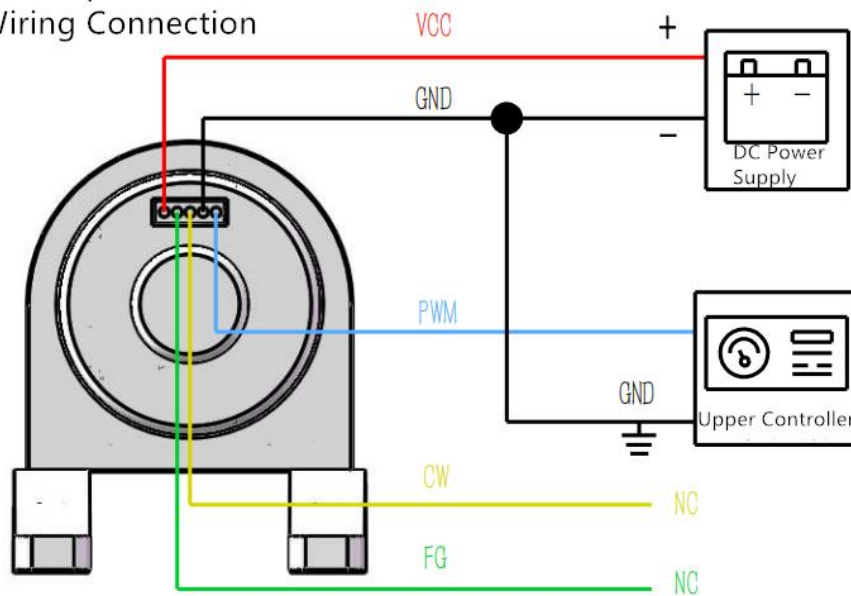


Figure 3-3 Wiring Instructions for PWM Speed Control Type(BLDC motor)

PWM speed control, FG feedback wiring:When it is necessary to use the PWM speed regulation function and monitor the pump operation or perform feedback control through the FG signal, it is necessary to use an upper controller (MCU, PLC, upper computer, etc.) that supports PWM signal output, FG signal input, and start-stop control. , connect the signal source output to the blue PWM input signal line, and connect the PWM signal source ground to the negative pole of the DC power supply, and the green FG signal feedback line to the input terminal of the host controller; the yellow line must be insulated and wrapped.

PWM Speed Control,
FG Feedback Wiring Connection

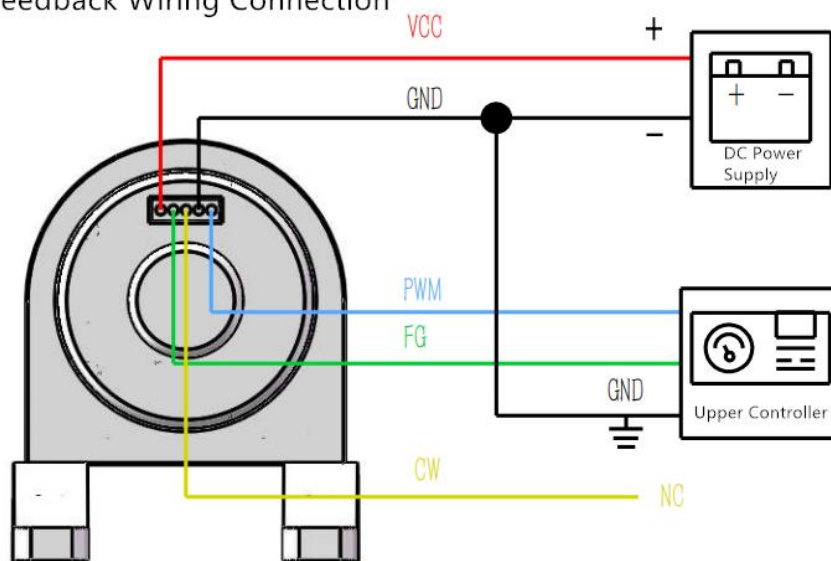


Figure 3-4 PWM Speed Control Type FG Feedback(BLDC motor)

3.3 D27M Wire Instructions(BLDC motor type)

S. N	Wire	Function	Signal Definition	Description
1	White	Control motor start and stop	Floating or high level (2~5V) to start, Stop when grounded or low level (0~0.8V)	This signal line can be used to control the start and stop of the pump, especially if it starts and stops frequently. If this wire is not used, it must be insulated and wrapped. If the pump does not work for a long time, the red power cord should be disconnected
2	Blue	Pulse Width Modulation (PWM)	$0V \leq V_{IL} \leq 0.8V$ $2V \leq V_{IH} \leq 5V$, Duty cycle speed regulation; grounded or low level motor runs at full speed	Change the motor speed and adjust the flow by changing the duty cycle. The frequency of PWM input signal is recommended to be within this range: 10~30kHz. This port cannot be used to control the start and stop of the pump
3	Yellow	FG feedback signal (motor speed feedback signal, pulse signal). The motor outputs 6 pulses per revolution	Low level < 0.5V, High level < 5V, it is recommended that the high level be 4.0V; The maximum rated current of the FG signal is 2mA	
4	Orange	Motor forward and reverse control	Floating or high level (2~5V) forward, grounded or low level (0~0.8V) reverse	Facing the motor shaft end, the clockwise direction of the motor shaft is the forward direction
5	Black	Power wire, negative pole		
6	Red	Power cord, positive pole. +12V ($\pm 10\%$); if you choose 24V specification, connect +24V ($\pm 5\%$)		

It is equipped with a signal line at the factory, and the customer can connect his own signal line to it

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!

D27M (brushless motor) has 3 operating modes: ① fixed speed, ② PWM speed control, ③ PWM speed control and FG signal feedback

Simple fixed-speed wiring: When the speed control function is not needed, the red wire is connected to the positive pole of the power supply, and the black wire, blue PWM signal wire and orange wire are connected to the negative pole of the power supply; it is recommended that the ground wire be reliably grounded, and the white wire and yellow wire must be insulated Bandage! The micro pump will work at rated speed. The wiring has been screwed together according to the fixed speed before leaving the factory.

PWM speed control wiring: If you need to use the PWM speed control function, you need to use a host controller that supports PWM signal output (function signal generator, MCU, PLC, etc. controller), 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 wire and yellow wire must be insulated and wrapped.

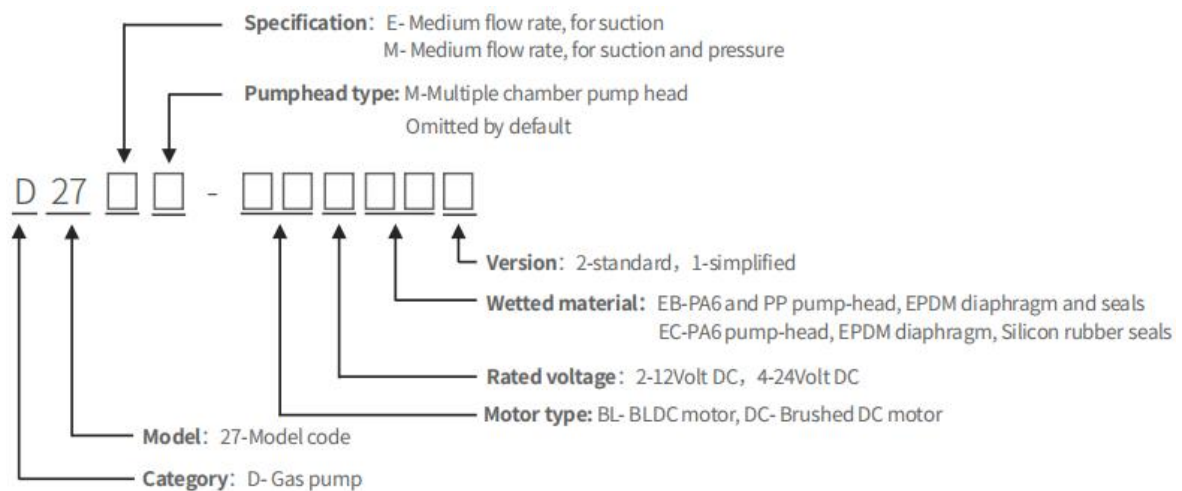
PWM speed control, FG feedback wiring: When you need to use the PWM speed regulation function and monitor the pump operation through FG signals or perform feedback control, you need to use a host controller (MCU, PLC and other controllers). Connect the signal source output to the blue PWM input signal line, and connect the PWM signal source ground to the orange line and the negative pole of the DC power supply. The yellow FG feedback signal line is connected to the FG signal input terminal of the upper controller. If you need to control the start and stop of the motor, connect the signal source level output to the white start-stop control line.

4

Product Model Description

4.1 Brief Description of Model Naming

This series of pumps can be configured with brushed DC motors, brushless DC motors, and has different quality versions



Example 1: D27E-BL4EB2 represents the D27 series pump head for medium flow pumping, equipped with a 24V brushless motor, pump head made of PA6 nylon and PP, EPDM diaphragm and seal, and the version is the standard version.

Example 2: D27E-DC4EB1 represents the D27 series pump head for medium flow pumping, equipped with a 24V brush motor, pump head made of PA6 nylon and PP, EPDM diaphragm and seal, and the version is a simplified version.

5

Cautions

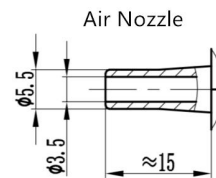
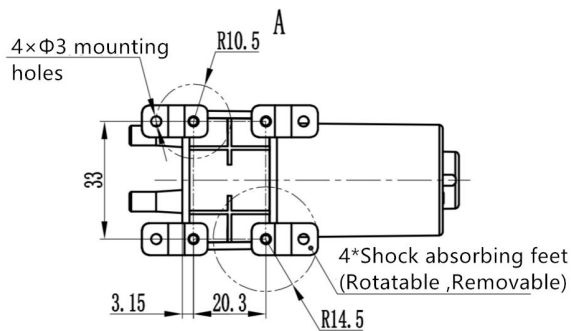
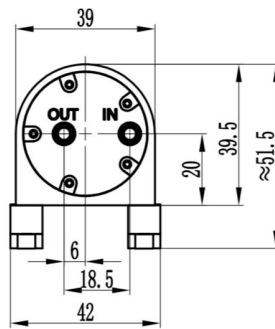
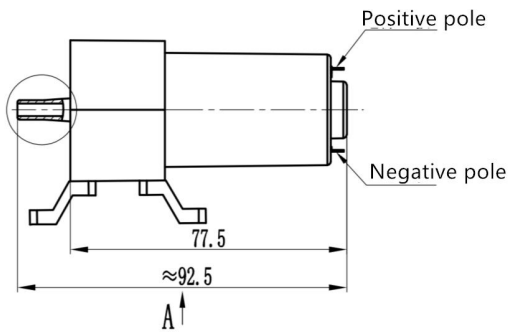
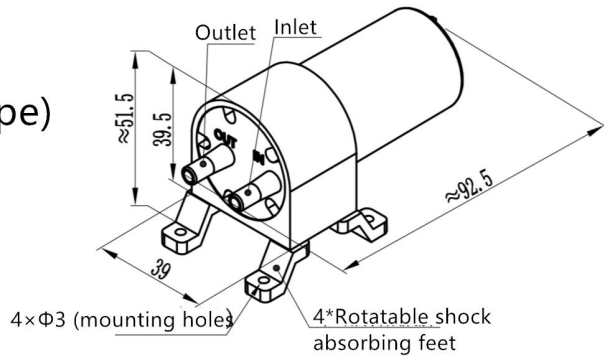


Please read the instructions in this chapter carefully and follow the instructions strictly before use.

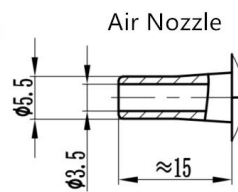
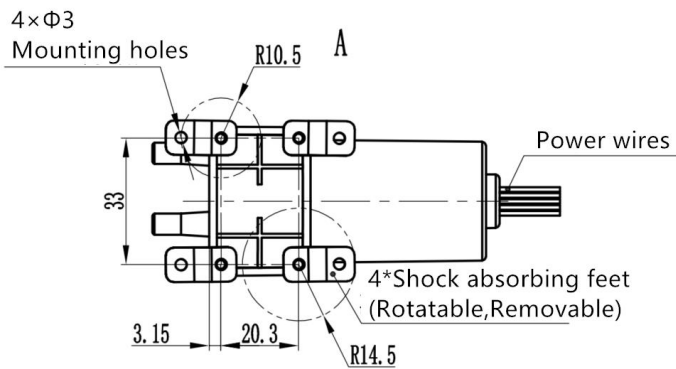
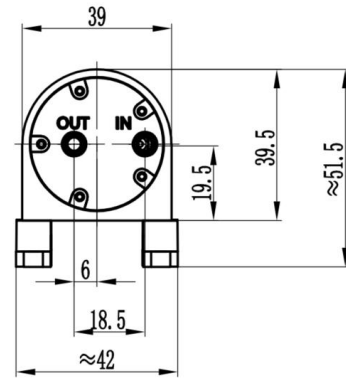
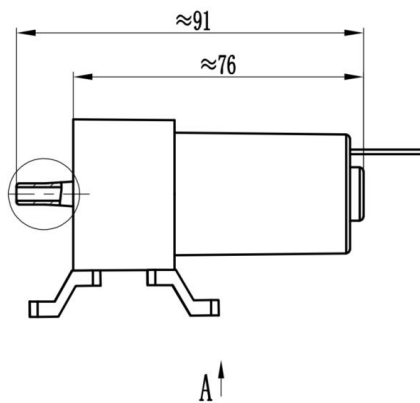
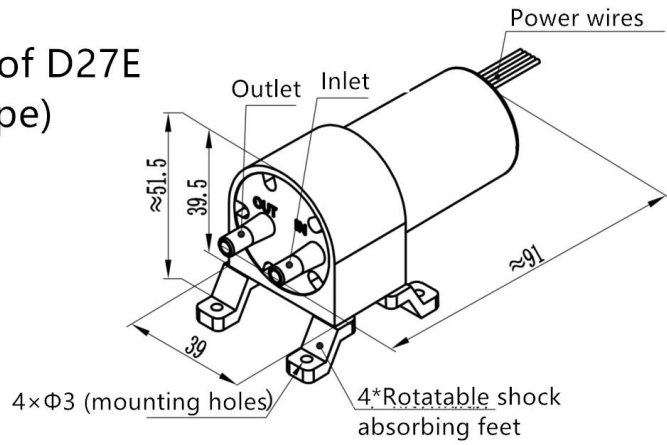
- 1. This product has no waterproof, dustproof, and explosion-proof functions, and cannot transport flammable and explosive medium! Cannot be used in flammable and explosive environment!**
- 2. Foreign matter must not fall into the air nozzle, and there must be no solid particles in the pumped medium, otherwise the micro pump will be damaged!**
- 3. The exhaust end of the pump must be unobstructed, and there must not be any resistance elements in the exhaust pipeline, otherwise the pump will be damaged.**
- 4. When this product is used to extract harmful gases, it must be sealed again to ensure personal safety!**
- 5. The supporting pipeline components and containers must have sufficient strength to ensure personal safety!**
- 6. Those in contact should take anti-static measures!**
- 7. Please operate strictly in accordance with the requirements of this manual!**

6 Dimensions

Overall Dimensions of
D27E (Brushed Motor Type)
Unit:mm

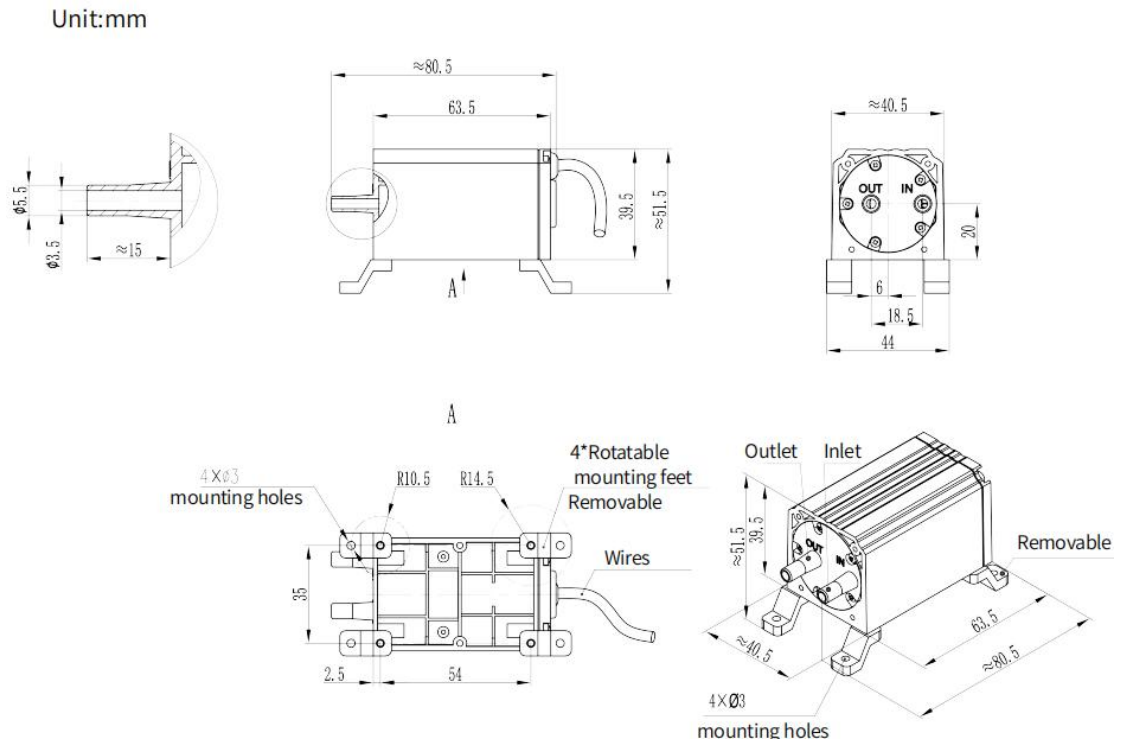


Overall Dimensions of D27E
(Brushless Motor Type)
Unit:mm



Overall Dimensions of D27M (Brushless Motor Type)

Unit:mm



Installation instructions:

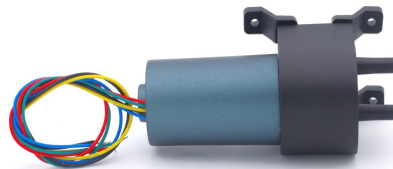
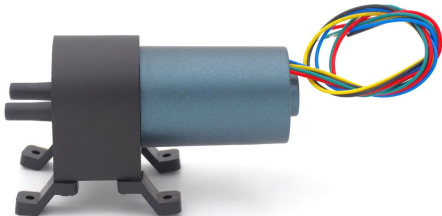
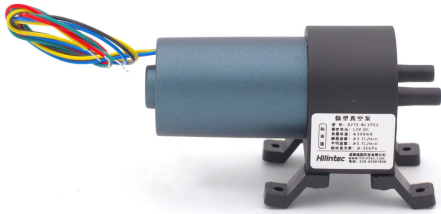
The mounting holes are self-tapping screw holes, not suitable for repeated tightening and disassembly, otherwise the installation will be loose and unreliable.

7 Appearance

D27E Brushed Motor Type



D27E Brushless Motor Type



D27M Brushless Motor Type

