



C60 Vacuum Pump Series

User Guide

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About This Document

Purpose

This document is related to the C60 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

Remote control, LCD touchscreen speed control, frequency speed control, voltage speed control, 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	2018-12	0.5	LT	Prototype introduction
02	2018-12	1.0	LT	Parameter update
03	2019.1	1.0	LT	Correct parameters, appearance announcement
04	2019-3	1.0	XX	Add illustration note 2
05	2019-4	1.0	XX	Modify the minimum RPM and signal description
06	2019-5	1.0	FB	Correct an error in 'Brief Description of Model Naming'
07	2019-9	1.0	GZM	Change 'indicator light flashes red' to 'indicator light constantly on'
08	2019-9	1.0	LYZ	Modify document format
09	2019-10	1.0	WJM	Modify signal description
10	2019-12	1.0	FB	Update the remarks in section 3.1
11	2019-12	1.0	FB	Revise parameters of C60L
12	2020-02	1.0	FB	Update outline drawing
13	2020-04	1.0	FB	Update parameter curve and the description of pneumatic connectors; correct some illustration
14	2020-06	1.0	FB	Update description of the medium

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1 Characteristics



1.1 Working Status Indicator

Only the remote control type and basic type are equipped with working status indicator lights, which can visually feed back the working status of the pump. The touch control type and top configuration type are equipped with an LCD touch screen that can display working status and fault codes.

1.2 Brush-less DC Motors

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

1.3 Protections

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

1. 4 Modular Pneumatic Connectors

The design of this series of pumps adopts modular connectors, using non-detachable reinforced nylon hose connectors as standard accessory. Customers can also choose Rc1/8 internal thread interface (materials can be reinforced nylon or stainless steel). This interface can be used with PC6 or PC8 stainless steel quick-change connectors, plastic (PP) hose connector, and stainless steel hose connectors.

The standard non-detachable reinforced nylon hose connectors and stainless steel hose connectors are recommended to be used with 7*13mm hoses; there are two options for quick-change connectors, matching hard tubes with outer diameters of 6mm and 8mm; plastic hose connectors are recommended to match 6*10mm hoses; customers can choose corresponding pneumatic connectors when ordering according to the specific pipeline situation. For ordering options, see section 3.5.

1. 5 Speed Control Function

Only the touch control type and top configuration type are equipped with an LCD touch screen, which can control the start-stop and speed of the pump through the LCD touch screen. Flow rate can be easily adjusted through the speed control function. In addition, the top configuration type is also equipped with remote frequency speed control and remote voltage speed control functions.

1. 6 RS-485 Communication Function (Top Configuration Type Only)

With RS-485 serial port communication function, the running status of the pump can be monitored in real time through the serial port, which is convenient for checking working conditions and fault history query and control.

The Modbus communication protocol based on RS-485 can be customized for top configuration type products, through which users can monitor the pump speed, start-stop control and working status.

1.7 State Memory Function

When the pump is stopped due to abnormal power failure, it will continue to run according to the state and speed of the last power-off when the power supply is recovered. When the pump can work normally, touch the screen to start the pump, it will continue to run at the speed before the last shutdown. (**Note:** This function is only valid on the touch control type and top configuration type.)

2 Special Functions

2.1 Speed Control Function

The flow rate of the pump can be changed by adjusting the motor speed. The touch control type and top configuration type are equipped with an LCD touch screen which can realize the start-stop control and motor speed control. In addition, the top configuration type also supports remote frequency speed control and remote voltage speed control. Through the wiring of the speed regulation connector (refer to Chapter 5 Electrical Connection), remote start-stop and speed control of the pump can be realized.

2.2 Working Status Indication and Warning

1.The basic type and remote control type are equipped with working status indicator lights. Users can understand the working status of the equipment through the color change of the indicator lights:

- a. When the green light is constantly on, it means that the power supply is normal and the pump is not working;
- b. When the green light flashes, it means the pump is working normally;
- c. When the red light is constantly on, it means the pump is working abnormally;
- d. 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.

2.The touch control type and top configuration type are equipped with an LCD touch screen. Alarm codes will be displayed when different faults occur, which makes fault handling more convenient.

(The figure below is for illustration only, please refer to Chapter 5 Alarms and Troubleshooting for details.)



3 Technical Specifications

3.1 Key Specifications

Model	Voltage (VDC)	Load Current (A)	Flow (L/min)		Relative Vacuum (-kPa)	Weight (g)
			Peak Flow	Average Flow		
C60L	24	≤1.6	≥28	≥18	≥88	≈850

Note: 1. The input voltage requires $24V \pm 10\%$.

Unless otherwise specified, the technical parameters are measured under the conditions of temperature 25°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. When the motor speed changes, the pressure/vacuum level is basically unchanged.

4. The above parameters are measured under the configuration of standard connectors. If other types of connectors are configured, the parameters may change slightly.

5. The peak flow in the table refers to the flow value measured with a rotameter, and the average flow is the flow value measured with a soap film flowmeter.

3.2 Versions Description

Version Performance	Simplified Version	Standard Version	Premium Version
Lifetime	≥2500h	≥6000h	≥9500h
Noise	★	★★	★★★
Reliability	★	★★	★★★
Parameter consistency	★	★★	★★★
EMC	★	★★	★★★
Ambient temperature	0~40℃	0~50℃	0~50℃

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

2. 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 Description of Types

Types	Function and Configurations
Basic Type	Only equipped with indicator lights and start-stop switch.
Remote Control Type	Besides the indicator light and start-stop switch of the basic type, it is also equipped with a remote control connector, from which the user can control the start and stop of the pump from a remote location. Note: If you want to use the remote control function, the start-stop switch on the panel should be set to the "on" position.
Touch Control Type	Equipped with LCD touchscreen speed control function. You can control the start-stop of the pump and adjust the motor speed by touching the touch screen display button. It also has a fault display function.

Top Configuration Type	Not only equipped with LCD touch screen speed control and fault display function, but also equipped with remote frequency speed control, remote voltage speed control and RS-485 communication function.
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3.4 List of Models Combination for Sale

Version Type	Simplified Version	Standard Version	Premium Version
Basic Type	√	Customizable	Customizable
Remote Control Type	√	√	Customizable
Touch Control Type		√	√
Top Configuration Type			√

Note: '√' in the above table means that there is a corresponding product for sale, and unchecked means that there is no corresponding product. 'Customizable' means it can be customized according to needs.

3.5 Options of Modular Pneumatic Connectors

Connector Option	Material	Recommended Hose/Tube
Default hose connector	reinforced nylon	Silicone hose with inner diameter 7~8mm
Rc1/8 internal thread interface	Stainless steel	Match the following pneumatic connectors and other types of tube connectors
Nylon Rc1/8 internal thread interface	reinforced nylon	Match the following pneumatic connectors and other types of tube connectors
Stainless steel hose connector	Stainless steel	Silicone hose with inner diameter 7~8mm
Plastic hose connector	PP	Silicone hose with inner diameter

		6~7mm
PC6 quick-change connector	Stainless steel	6mm outer diameter hard tube
PC8 quick-change connector	Stainless steel	8mm outer diameter hard tube

Note: Plastic hose connectors, stainless steel hose connectors, PC6 quick-change connector and PC8 quick-change connectors are to be matched with the nylon Rc1/8 threaded connectors by default.

3.6 Life-time Test Conditions

In a clean, non-corrosive laboratory, the pump carries a full load (the inlet is blocked and the outlet directly connected to the atmosphere), and operates continuously around the clock. The ambient temperature is 5°C ~ 33°C, fluctuates with the climate; the relative humidity is 30% ~ 85%, which fluctuates with the climate.

3.7 Working Conditions

1.Environment: Permissible ambient temperature range of the simplified version products is 0 °C ~ 40 °C , and the permissible ambient temperature of the standard and premium versions is 0 °C ~ 50 °C . 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: 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.

3. Load: The inlet can be operated at full load (i.e. completely block the inlet), but the applied load cannot exceed the maximum vacuum of the pump; the outlet must keep unobstructed.

4. Large pumping load may lead to the pump's failure in start, it is necessary to remove part of the load or start without load!

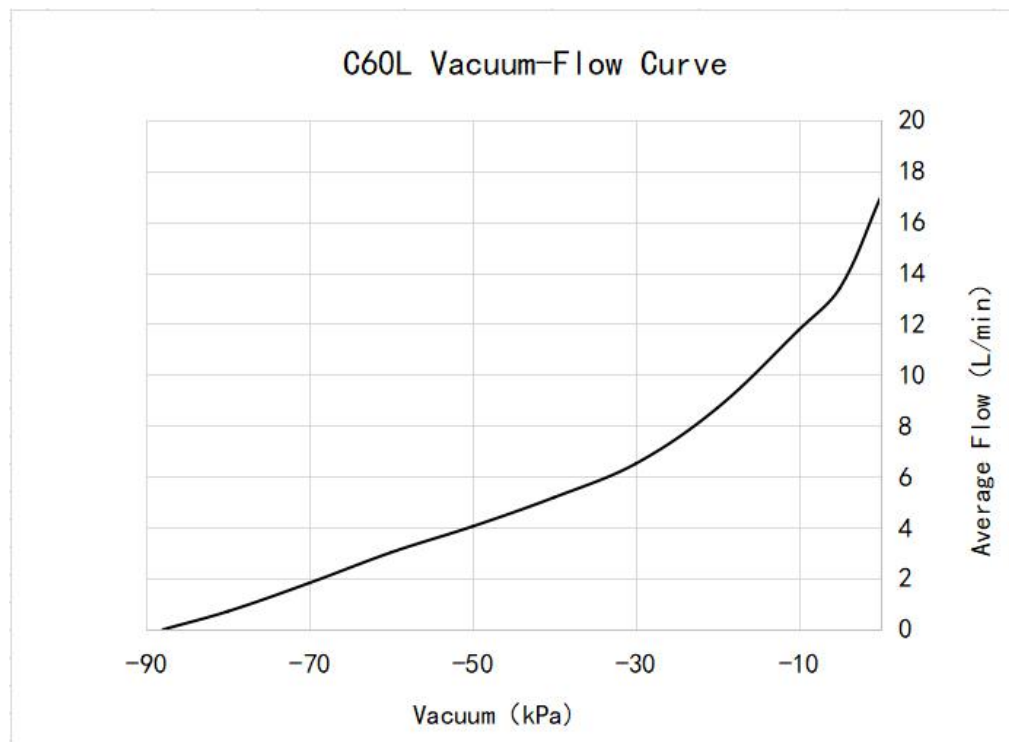
3.8 Pump Materials

1. The materials of the wetted parts: reinforced nylon, nitrile rubber, EPDM and silicone rubber. Please check the tolerance 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.

3.9 Parameter Curve

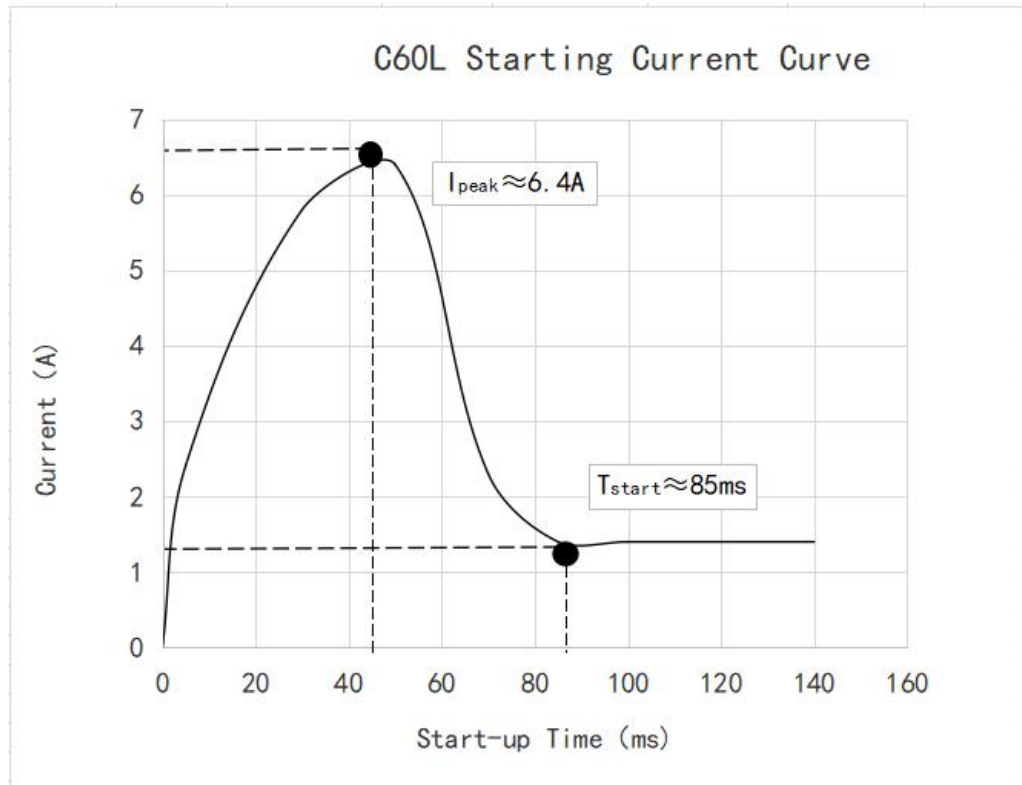
Vacuum degree-flow rate curve, there are individual differences between different micro pumps, so this curve is a statistical value, only as a technical reference for users to confirm the working point. The "flow" mentioned in this section refers to the "average flow".



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

3. 10 Starting Current Curve

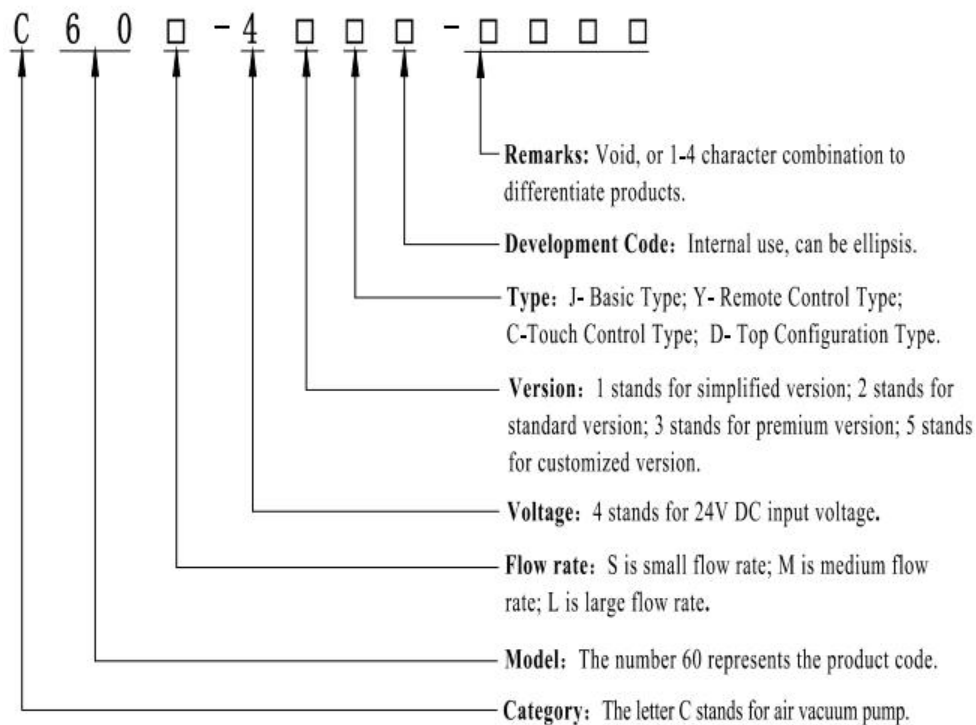
The starting current curve is measured under the working condition that the inlet and outlet are directly connected to the atmosphere, and there are certain individual differences between different micro pumps. This curve is a statistical value, which is only used as a technical reference when users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



4 Product Model Description

4.1 Brief Description of Model Naming

This series of pumps are divided into four types: basic type, remote control type, touch control type and top configuration type.



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: C60L-41J (C60L pump, 24V voltage basic type simplified version)

Example 2: C60L-43D-GJ (C60L pump, 24V voltage top configuration type premium version, customized high temperature medium function)

5 Electrical Connection

5.1 Basic Type

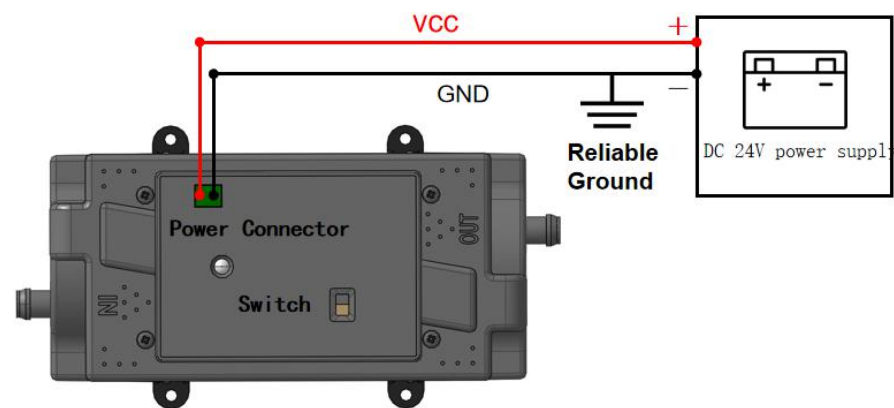


Figure 5-1 Wiring Instructions for Basic Type

Instruction: 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. Control the start and stop of the pump by the toggle switch.

Note: 1. The start and stop of the pump is not allowed by cutting off/connecting the 24V power supply, otherwise it may cause damage to the micro pump motor; if you need to control the start and stop of the micro pump through a signal, please choose a remote control product.

5.2 Remote Control Type

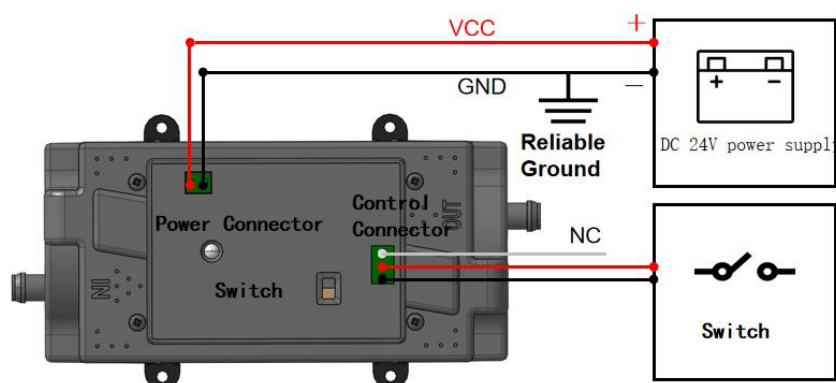


Figure 5-2 Wiring Instructions for Remote Control Type

Instruction: The red wire of the power connector is connected to the positive pole of the 24V DC power supply, and the black wire is connected to the negative pole of the power supply. When using the remote control function, you need to set the toggle switch to the "on" position. The red wire and black wire of the control connector are connected to the hardware switch. If the red wire and the black wire are connected, the pump will stop; if disconnected, the pump will start.

5.3 Touch Control Type

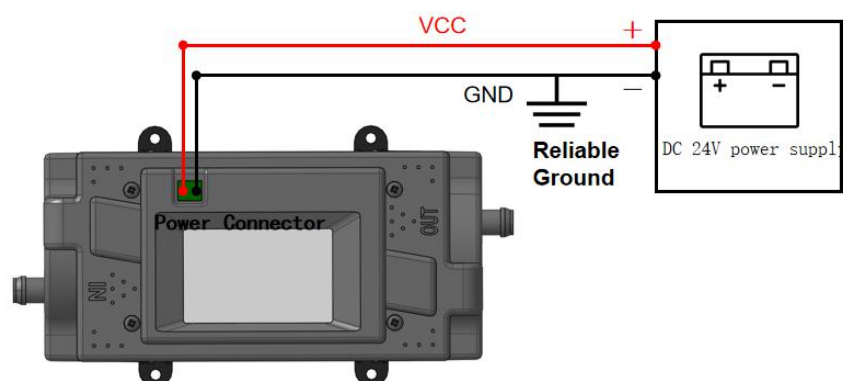


Figure 5-3 Wiring Instructions for Touch Control Type

Instruction: 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. Control the running of the pump by the LCD touch screen.

- Note:**
1. In order to prevent the start-stop button on the touch screen from being accidentally touched, it is necessary to hold a certain area during operation and long press to trigger.
 2. If the user who purchases the touch control type or top configuration type does not use our matching power supply, it may cause interference to the operation of the pump or damage it. It is strongly recommended that the ground wire from the power connector is reliably grounded, which helps to improve the reliability of operation!

5.4 Top Configuration Type

The top configuration type is not only equipped with LCD touch screen speed control and fault display function, but also equipped with remote frequency speed control, remote voltage speed control and RS-485 communication function. The following is a description of the corresponding signals at the wire terminal.

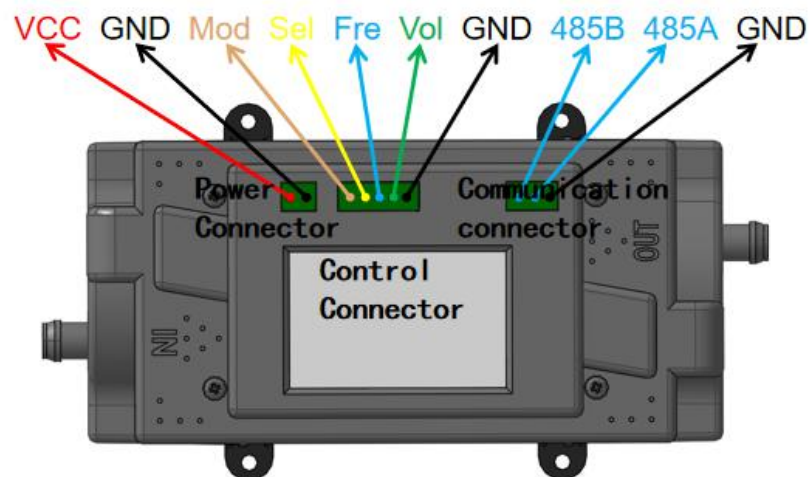


Figure 5-4 Interface Definition of Top Configuration Type

Interface Definition of Top Configuration Type

Connector	Wire	Input	Signal Definition	Description
Power connector	1Red	VCC	24v power input	Rated Voltage 24V, range 22-27V
	2Black	GND	Power ground	
Control connector	1Brown	Mod	Working Mode Selection $3.3V \leq \text{high level} \leq 5V$ $0 \leq \text{low level} < 0.8V$	Mod signal connected to high level means the pump is controlled by voltage or frequency; when connected to low level, the motor stops running; when suspended (without connecting any wire), the pump is controlled by LCD screen.
	2 Yellow	Sel	Speed Control Mode Selection $3.3V \leq \text{high level} \leq 5V$ $0 \leq \text{low level} < 0.8V$	Sel signal inputs high level means frequency speed control, low level means voltage speed control.
	3 Blue	Fre	Frequency Speed Control $3.3V \leq \text{high level} \leq 5V$ $0 \leq \text{low level} < 0.8V$	Input square wave, the recommended amplitude value is 5V, the duty ratio 50%, and the DC bias voltage 2.5V. Frequency speed control range 1333Hz-3333Hz corresponds to 1333-3333rpm, when $100\text{Hz} < \text{frequency} < 1333\text{Hz}$, it runs at the minimum speed, when frequency $> 3333\text{Hz}$ it runs at the maximum motor speed, and when the frequency $\leq 100\text{Hz}$, the pump stops running.
	4 Green	Vol	Voltage speed control $0 \leq \text{Vol} \leq 5V$	Voltage range 0-5V, when input 0V, it runs at the minimum speed, as the voltage increases, the speed correspondingly increase. Do not input negative voltage (less than 0V), otherwise it may cause permanent damage!
	5 Black	GND	ground	Control signal ground
Communication connector	1	485B	RS-485 communication	RS-485 serial communication interface, outputs motor running time, real-time speed, alarm code and number of occurrences.
	2	485A		
	3	GND		

- Note:**
1. In order to prevent the start-stop button on the touch screen from being accidentally touched, it is necessary to hold a certain area during operation and long press to trigger.
 2. If the user who purchases the touch control type or top configuration type does not use our matching power supply, it may cause interference to the operation of the pump or damage it. It is strongly recommended that the ground wire from the power connector is reliably grounded, which helps to improve the reliability of operation!
 3. If the color of the accessory wire sequence does not correspond to that in the table, please check the wire definition and sequence number according to the interface sequence number!

1. Wiring Instructions for Frequency Speed Control Function

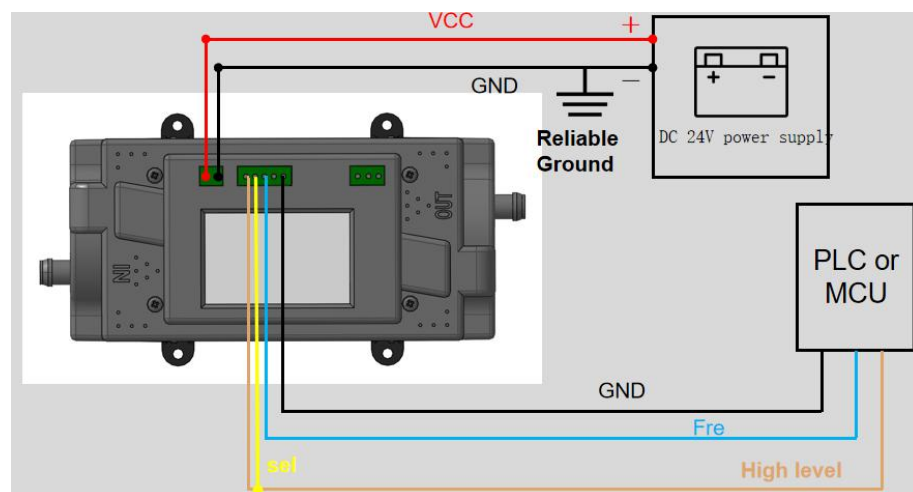


Figure 5-5 Wiring instructions for Frequency Speed Control

Instruction: 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. Speed control wire Mod, Sel connected to the high level, Fre connected to MCU or PLC square wave output port, GND connected to low level port of the MCU or PLC. Control the pump running speed by adjusting the frequency of the square wave.

Description of frequency signal:

Frequency speed control range of 1333Hz-3333Hz corresponds to 1333-3333rpm, when $100\text{Hz} < \text{frequency} < 1333\text{Hz}$, it runs at the minimum speed, when $\text{frequency} > 3333\text{Hz}$, it runs at the maximum motor speed, and when the $\text{frequency} \leq 100\text{Hz}$, the pump stops running. $3.3\text{V} \leq \text{high level} \leq 5\text{V}$

2. Wiring Instructions for Voltage Speed Control Function

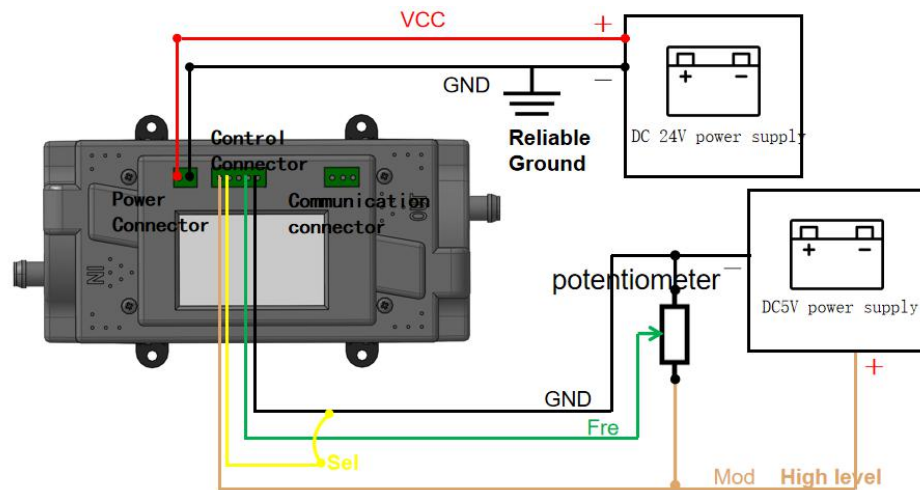


Figure 5-6 Wiring instructions for Voltage Speed control

Instruction: 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 control terminal Mod is connected to the high level port of the host computer or the positive pole of the 5V DC power supply. Sel and GND are connected to the low level port of the host computer, the ground port or the negative pole of the DC 5V power supply. The positive pole of the potentiometer is connected to the positive pole of the 5V DC power supply, and the negative pole of the potentiometer is connected to the negative pole of the DC 5V power supply. The voltage divider output terminal of the potentiometer is connected to Vol at the control connector. Control output voltage at the Vol port (voltage regulation range 0-5V, the speed will increase correspondingly with the increase of the voltage) to control the pump running speed.

Before disconnecting the 24V power supply, please pull down the Mod signal to stop the motor before powering off. It is recommended to wait for a time $> 500\text{ms}$, otherwise it may affect the product life!

Note: Do not input negative voltage (less than 0V) or voltage >5.5V, otherwise it may cause permanent damage!

3. Wiring Instructions for RS-485 Communication Function

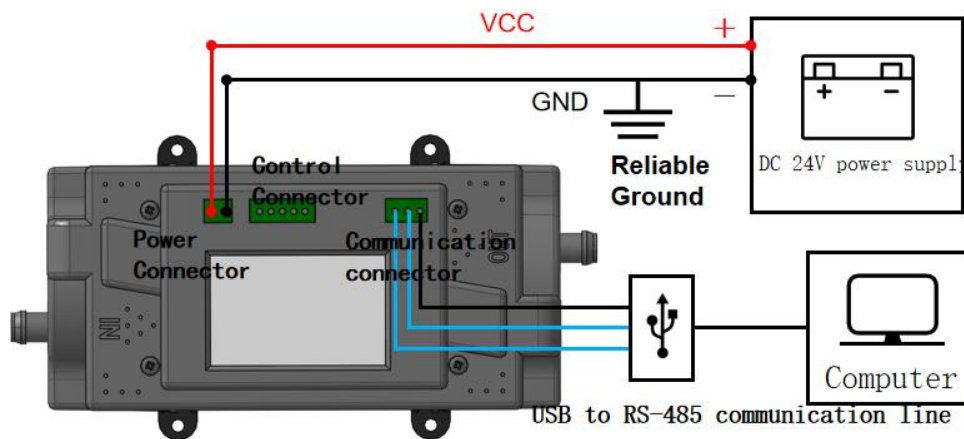


Figure 5-7 Wiring Instructions for RS-485 Communication Function

Instruction: 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 communication terminals are respectively connected to RS485B, RS485A, GND or connected via USB to RS-485 communication line. Among them, the baud rate is 115200, the data bit is 8, the start/stop bit is 1, and there is no parity bit. Control the pump operation by controlling the LCD screen. Can monitor important information such as running time, running speed, and fault records.

Baud rate	Data bit	Start/stop bit	Parity bit
115200	8bit	1	None

5.5 Alarms and Troubleshooting

Working Condition	Alarm definition	Error code	Possible reason	Troubleshooting
Power supply over voltage	'power' flashing	EE01	The output voltage of the DC power supply is greater than the normal voltage range.	1. Check whether the output voltage of the power supply is consistent with the product label, and power on again. 2. If there are frequent alarms, please contact customer service.
Power supply under voltage	'power' flashing	EE02	The output voltage of the DC power supply is less than the normal voltage range.	1. Check whether the output voltage of the power supply is consistent with the product label, and power on again. 2. If there are frequent alarms, please contact customer service.
Insufficient output power	'Power' flashing	EE03	The output power of the DC power supply cannot meet the pump running power requirements or power supply output stability is poor.	1. Replace the DC power supply with higher output power. 2. If there are frequent alarms, please contact customer service.
Pump overload	'Overload' flashing	EE11	Excessive work load, may cause permanent damage to the pump.	1. Check whether the pipeline load is normal (reduce the running load of the pump), and power on again. 2.If there are frequent alarms, please contact customer service.
Reach pump lifetime, work normally	'Life' flashing		The cumulative working time exceeds the design lifetime of the pump, which reduces the reliability of the pump without other failures.	Contact Hilintec to order replacement products or accessories.
Reach motor lifetime, abnormal stall	'motor' flashing	EE21	Motor life reached, abnormal stall	Contact Hilintec to order replacement products or accessories.
Abnormal motor stop	'motor' flashing	EE31	Motor stalls, abnormal speed feedback.	1. Check whether the pipeline load is normal (reduce the running load of the pump), and power on again. 2.If there are frequent alarms, please contact customer service.
Large motor speed deviation	'motor' flashing	EE32	The deviation between the actual motor speed and the set speed is too large.	1. Check whether the pipeline load is normal (reduce the running load of the pump), and power on again. 2.If there are frequent alarms, please contact customer service.
Voltage speed control signal over-voltage	'motor' flashing	EE41	Voltage speed control signal voltage is too high, which may cause the permanent damage.	1. Check whether the Vol input voltage range is within the range of 0-5V. 2. For frequent alarms, please contact Hilintec customer service.

6 Cautions



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. Please be sure to keep the exhaust end unobstructed, otherwise the micro pump will be damaged!**
- 4. Large pumping load may lead to the pump start failure, it is necessary to remove part of the load or start without load!**
- 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. Built-in precision control circuit, need to use high-quality switching power supply or DC stabilized power supply!**
- 8. This series of products are not allowed to shut down by directly cutting off the 24V power supply. To stop the machine, the user shall perform a soft shutdown through the panel toggle switch, remote control switch, touch screen switch or control signal before cutting off the power supply, otherwise it may affect the motor life!**
- 9. For top configuration type products, when frequency speed control working mode or voltage speed control working mode is used, the Mod**

signal must be pulled down before the 24V power supply is cut off. Stop the motor first, and wait for 500ms before cutting off the power, otherwise it may affect motor life!

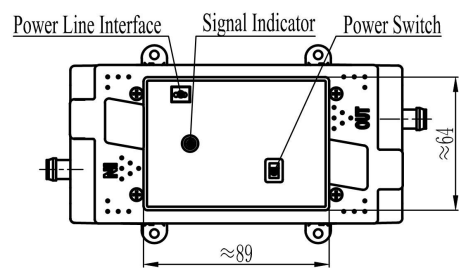
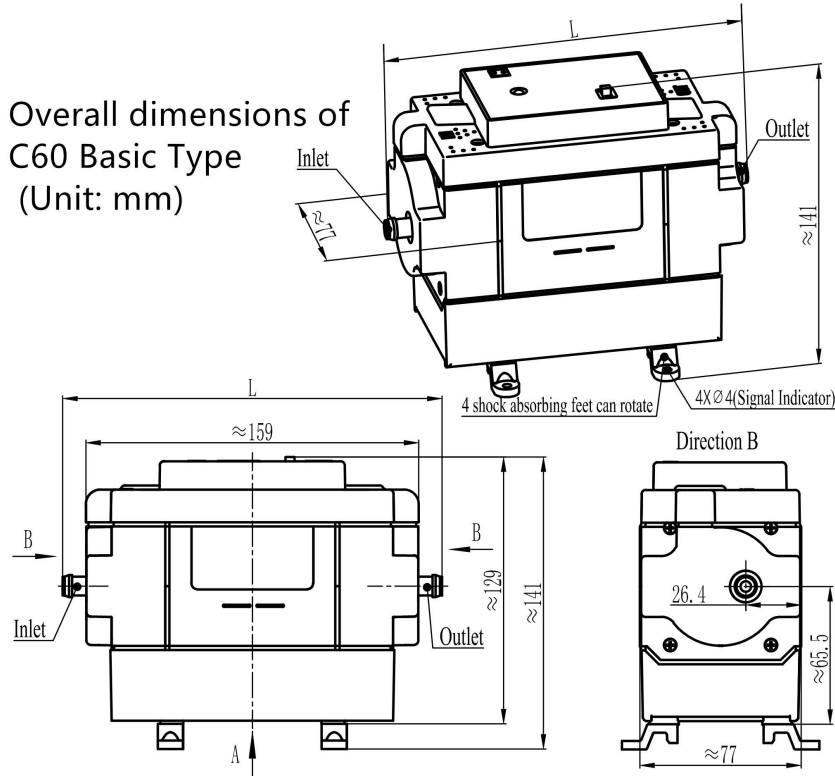
10. If this series of pumps do not use the matching power supply, it may cause interference to the operation of the pump. Leading the ground wire at the power connector to reliably ground will help improve the reliability of operation!

11. Please operate strictly in accordance with the instructions of this user guide.

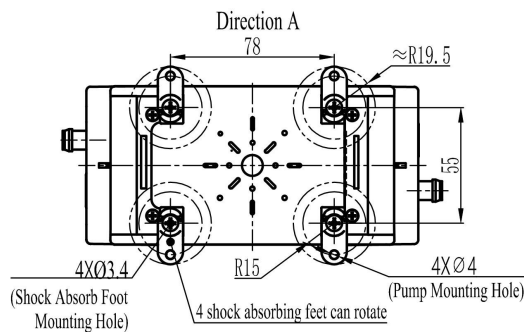
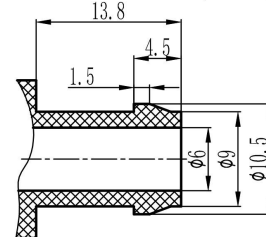
7

Dimensions

Overall dimensions of C60 Basic Type (Unit: mm)



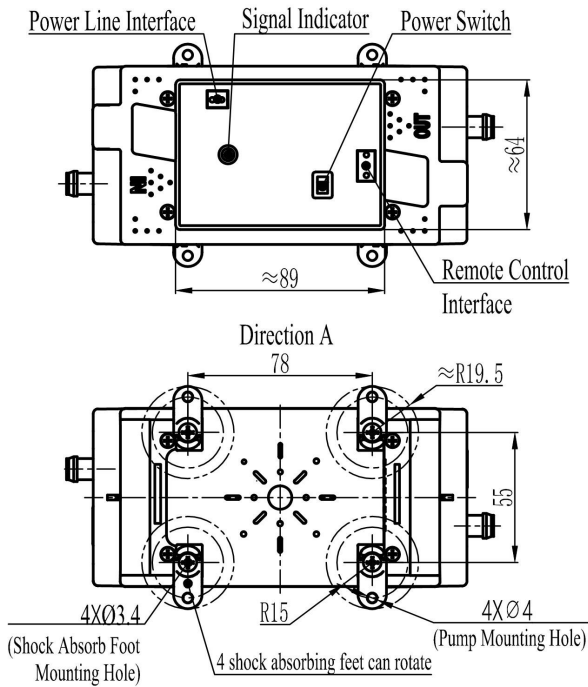
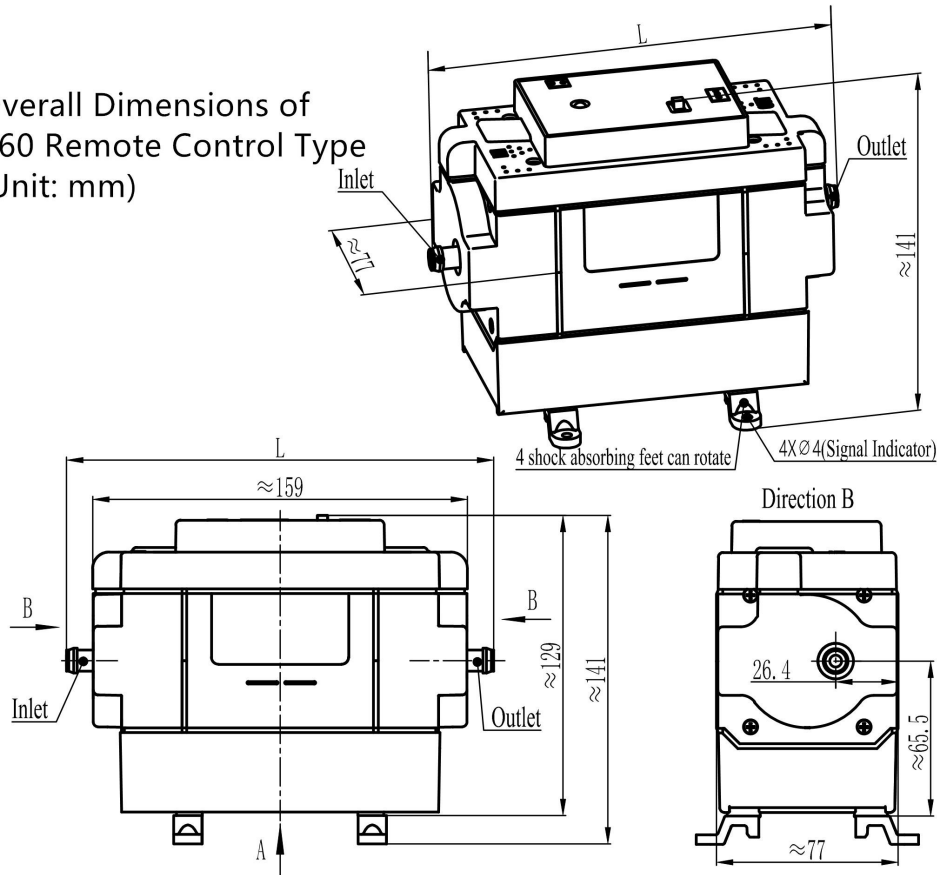
Hose Connector Inlet/Outlet (Standard)



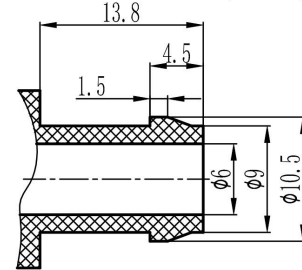
Type of Connectors	L value
Hose Connector (Standard)	181
Internal Thread Interface (Plastic/Stainless Steel)	159
PC6 Quick-change Connector	159+X (≈183 ^①)
PC8 Quick-change Connector	159+X (≈190 ^②)
Stainless Steel Hose Connector	159+X (≈196 ^③)
Plastic Hose Connector	159+X (≈196 ^④)

Size of ①②③④ is related to the pneumatic connectors and its installation dimensions, for reference only, the error may be a few millimeters.

Overall Dimensions of C60 Remote Control Type (Unit: mm)



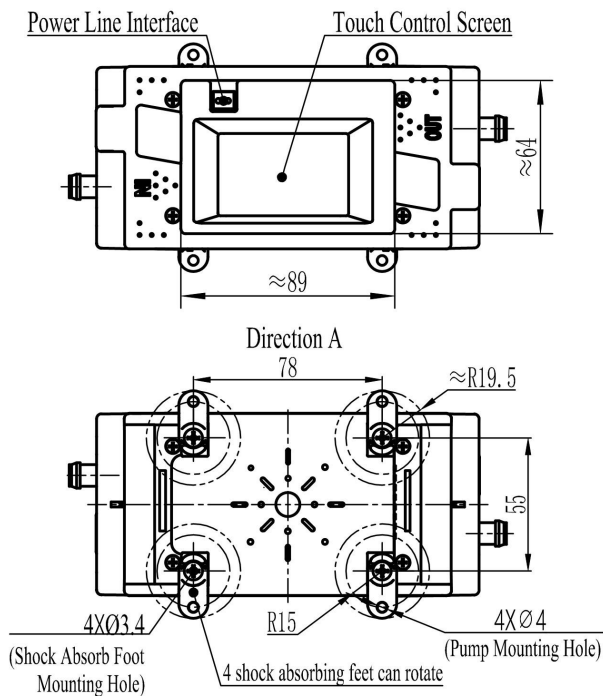
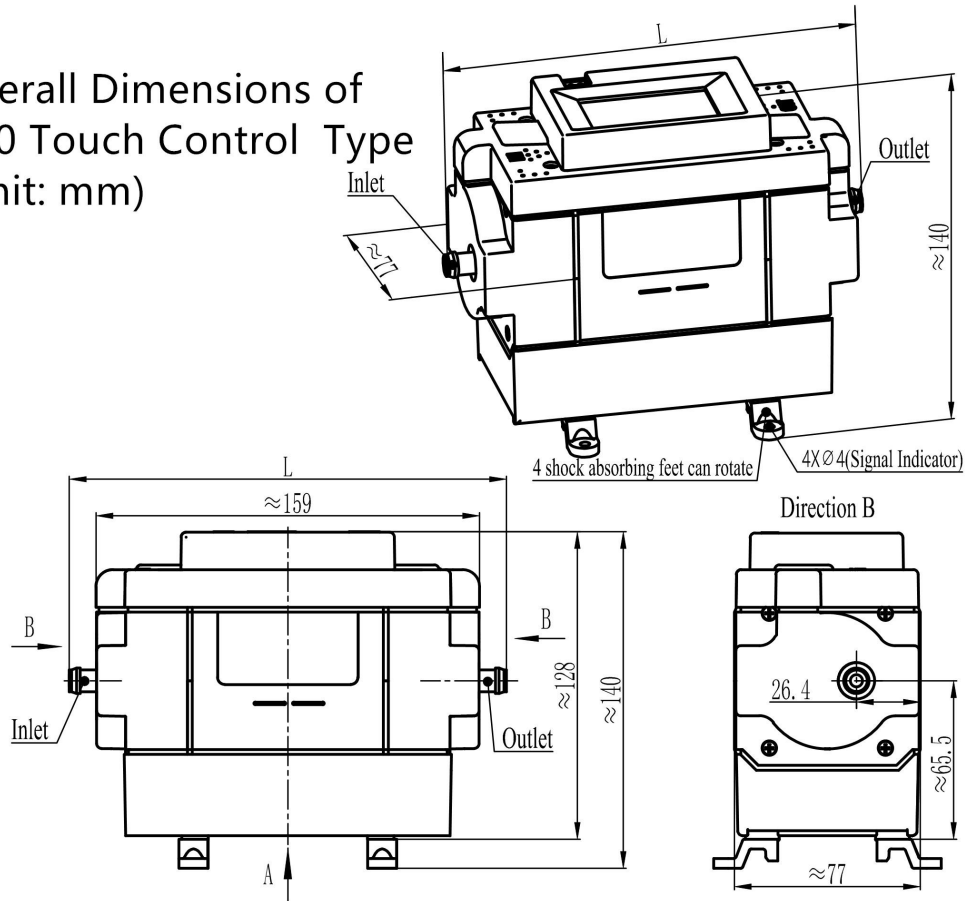
Hose Connector Inlet/Outlet (Standard)



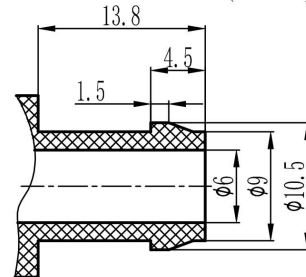
Type of Connectors	L value
Hose Connector (Standard)	181
Internal Thread Interface (Plastic/Stainless Steel)	159
PC6 Quick-change Connector	159+X (≈183 ^①)
PC8 Quick-change Connector	159+X (≈190 ^②)
Stainless Steel Hose Connector	159+X (≈196 ^③)
Plastic Hose Connector	159+X (≈196 ^④)

Size of ①②③④ is related to the pneumatic connectors and its installation dimensions, for reference only, the error may be a few millimeters.

Overall Dimensions of C60 Touch Control Type (Unit: mm)



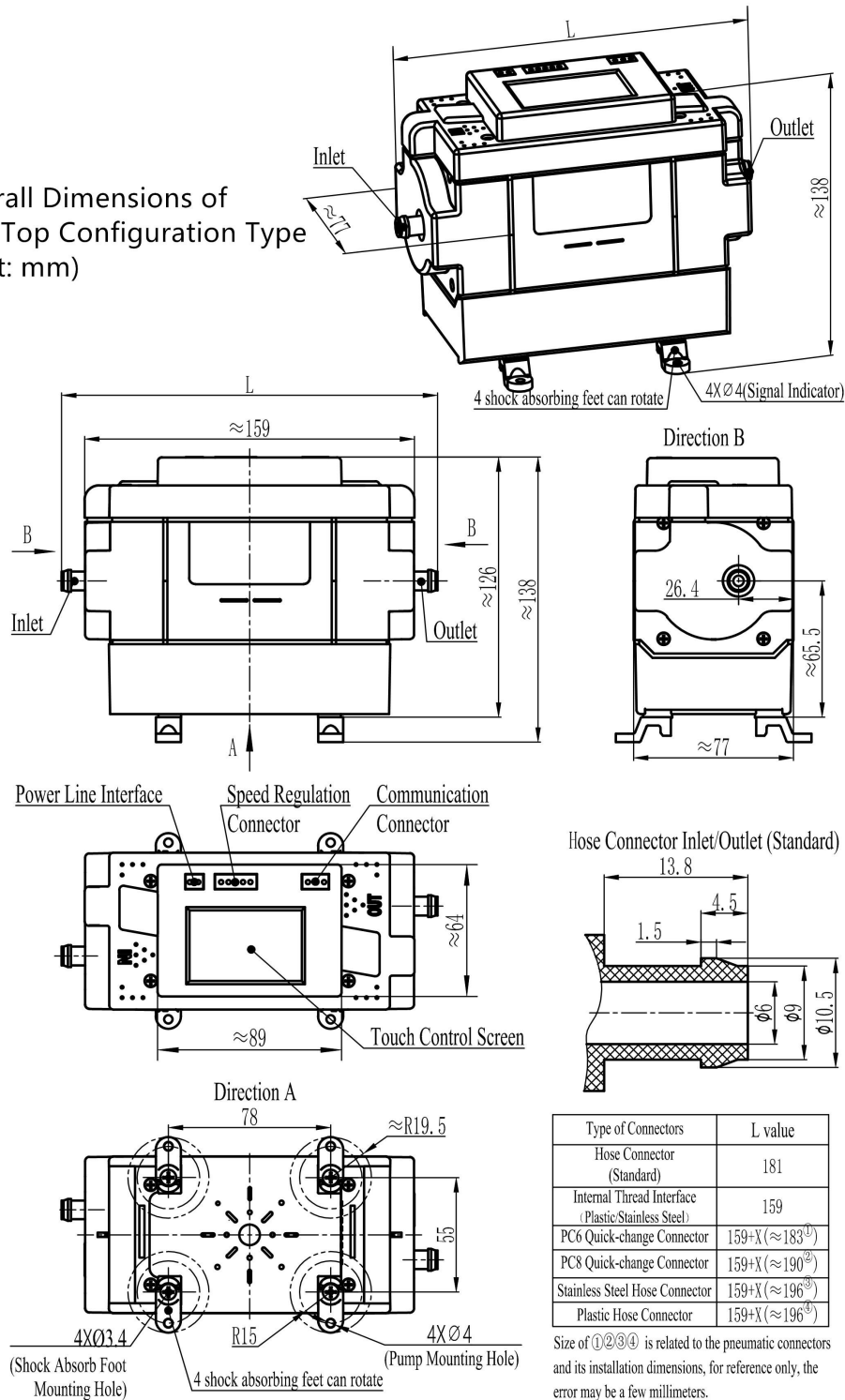
Hose Connector Inlet/Outlet (Standard)



Type of Connectors	L value
Hose Connector (Standard)	181
Internal Thread Interface (Plastic/Stainless Steel)	159
PC6 Quick-change Connector	159+X (≈183 ^①)
PC8 Quick-change Connector	159+X (≈190 ^②)
Stainless Steel Hose Connector	159+X (≈196 ^③)
Plastic Hose Connector	159+X (≈196 ^④)

Size of ①②③④ is related to the pneumatic connectors and its installation dimensions, for reference only, the error may be a few millimeters.

Overall Dimensions of C60 Top Configuration Type (Unit: mm)



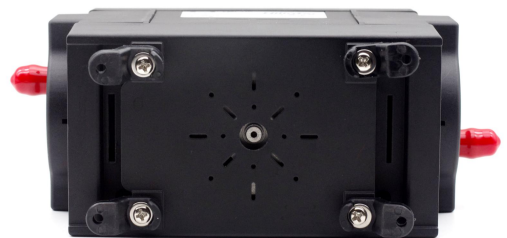
Installation instructions:

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 dis-assembly, otherwise the installation will be loose and unreliable.

8

Appearance

C60-Top Configuration Type



C60-Touch Control Type



C60-Remote Control Type



C60-Basic Type

