V1.4

# LM40B Intelligent Peristaltic Pump
## Instruction Manual

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# Chapter1 Product Introduction

## 1.1 Overview

The LM40B peristaltic pump peristaltic pump uses a cost-effective processor to control the stepper motor, and uses multiple independent LEDs to display the status (including positive/negative rotation, foot pedal mode F1/F2, motor movement/motor stop, external control trigger, etc.).

## 1.2 Product Features

The product can be adjusted the speed by keyboard panel or rotary encoder. The LED displays the positive/negative rotation, foot switch status, whether the motor is running, whether the external control interface is effective, etc. The display is intuitive, the operation is easy & convenient, and the content is simple.  Motor subdivision is adaptive, and speed control accuracy is up to ±0.1rpm. The product support rich application scenarios, keyboard control mode, RS485 communication control mode, external control mode (Multiple signal conversion modules are optional) and passive contact output for motor working status.

# Chapter 2 Port and Structure Description

## 2.1 Product Technical Parameters

| Name | Specification |
|---|---|
| Range of speed | 0.1rpm ~ 300/400.0rpm（The maximum speed varies slightly depending on different pump heads or tubes） |
| Speed accuracy | ±0.1rpm |
| Flow rate | 0.03~117 ml/min |
| Foot pedal input interface | Foot pedal switch control start and stop (keyboard control mode only) |
| External control speed signal input interface | Support multiple switching control inputs (external control mode only) |
| External control steering signal input interface | Support steering switching control inputs (external control mode or foot pedal control mode only) |
| External control start signal input interface | Support start/stop switch control input(external control mode only) |
| Communication control | RS485 （communication control mode only) |
| Power supply mode | DC24V±10% |
| Power consumption | 20W |
| Working environment | Temperature 0 ~ 40C° Relative humidity < 80% |
| Dimension | 180.1(length)×107.4(width)×101.5(height) (mm) |
| Weight | 0.90Kg |
| Protection level | IP31 |

## 2.2 Diagram of Overall structure

The product is composed of body, pump head, pump tube, etc.



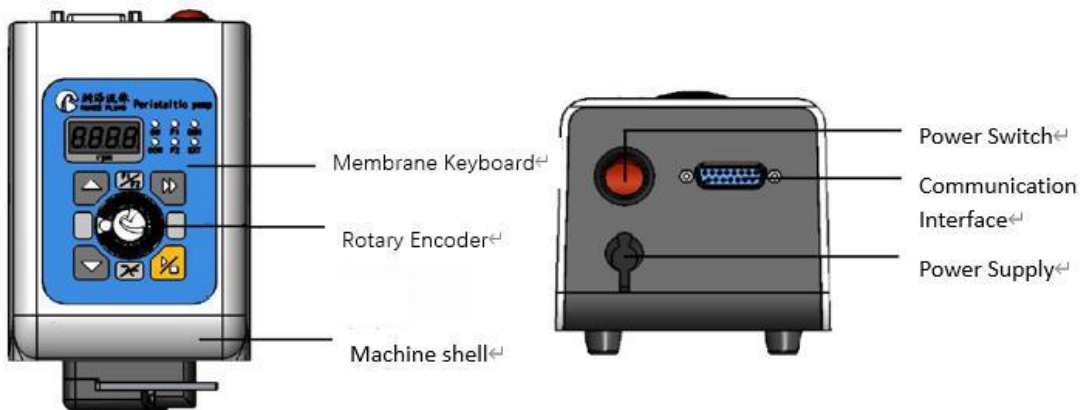*Figure 2-1* Diagram of LM40B Intelligent Filling Peristaltic Pump

## 2.3 Definition of Communication Interface

| No. | Attribute | Meaning |
|---|---|---|
| 1 | +24V | DC24V power output (only used with external interface) |
| 2 | EXT-EN | External control enable signal (external control function takes effect when grounded) |
| 3 | EXT-DIR | External control steering signal (take effect when external control is effective or foot pedal is effective) |
| 4 | COM | Passive contact common end |
| 5 | COM-GND | ADC-IN GND |
| 6 | FT-EN | Foot switch enable signal interface (foot pedal control takes effect when grounded) |
| 7 | CK | Passive contact output-normally open state |
| 8 | FT-SW | Foot switch input signal interface (used with F1/F2 keys) |
| 9 | GND | Ground wire |
| 10 | EXT-ST | External control trigger signal input interface (take effect when external control is effective) |
| 11 | A | RS485- port A |
| 12 | B | RS485- port B |
| 13 | SWD-DIO | SWD-DIO interface |
| 14 | SWD-CLK | SWD-CLK interface |
| 15 | ADC-IN | External control speed input interface (3.3V interface)-used with dedicated conversion module. |

***Table 2-1*** *DB15 External Terminal Attribute Definition*

## 2.4 Pump Head/Tube Selection

| Pump head | Flexible tube | Max. flow rate | Max. speed |
|---|---|---|---|
| RZ1030 | WT 0.8mm ID 2.54mm | 117ml/min | 400rpm |

***Table 2-2*** *Model of Pump Head/Tube and Corresponding Max. Flow Reference*

**Note:** (1) When selecting pump head and pump tube, refer to chapter 6 flow curve.

(2) The flexible tubes with same specification vary in the ductility, resilience and hardness due to different materials. Maximum flow rate is for reference only.

# Chapter 3 Keyboard Control Mode

## 3.1 Man-Machine Interface

### 3.1.1 LED Indicator Light Meaning

| Name | LED status definition |
|---|---|
| CW | The indicator light is on, indicating that the current rotation of the peristaltic pump motor is clockwise by default. (Note 1) |
| CCW | The indicator light is on, indicating that the current rotation of the peristaltic pump motor is counterclockwise by default. (Note 1) |
| F1 | The indicator light is always on, indicating that the current foot switch trigger mode is continuous mode by default. (Note 2) |
| F2 | The indicator light is always on, indicating that the current foot switch trigger mode is inching mode by default. (Note 2) |
| RUN | The indicator light is always on, indicating that the motor is in running.<br>The indicator light flashes slowly (1 second on and 1 second off), indicating that the motor is stopped and the software is running.<br>The indicator light flashes quickly (0.1 second on and 0.1 second off), indicating that the motor is running at full speed and the software is running. |
| EXT | The indicator light is on, indicating the motor is in external control mode currently, and the control of the motor operation is determined by the external control mode status. |

**Note 1:** The direction of backflash rotation is opposite to that of CW/CCW.

**Note 2:** One of the CW/CCW indicator lights will be on only when the matching foot switch is connected correctly.

### 3.1.2 Key Function

| Name | Key function | Key result |
|---|---|---|
| ▲ | Speed increase | When the motor is stopped, change the default speed; when the motor is rotating, increase the dynamic speed; After pressing it for 1 second, keep it pressed to achieve a rapid increase in speed. (Note 1)<br>Reuse for increasing setting of suction angle. |
| ▼ | Speed decrease | When the motor stops, change the default speed; when the motor is rotating, decrease the dynamic speed; after pressing it for 1 second, keep it pressed to achieve a rapid decrease in speed. (Note 1)<br>When reused, it is the decrease setting of suction angle. |
| ✕ | CW/CCW switching | When the motor stops, change the default direction of rotation; when the motor rotates, change the direction of rotation immediately. Corresponding CW/CCW indicator lights switch. |

| | | |
|---|---|---|
| ▶▶ | Full-speed key | When it stops or runs continuously, switch to full-speed status; when in full-speed, return to the status before full-speed. (Note 2) |
| ▶/■ | ON/OFF key | Control the start and stop of the motor manually. |
| F1/F2 | Foot pedal switch mode indication | When the matched foot pedal switch is effectively connected, press the F1/F2 key to switch the working mode, corresponding F1/F2 indicator lights switch (F1 means continuous operation, F2 means jog operation); if the foot pedal switch is not connected, it cannot switch. |
| △ | Multifunction key | When the motor stops, press the blank key to switch to the suction angle editing interface, press the up and down keys to change the value of the suction angle, and press the blank key again to save the current value; when the motor runs normally, press the blank key to save the current dynamic speed; when the motor is running at full speed, this key is invalid. (Note 1) |
| ◀)) / ◀x | Mute key | Pressing this key can mute the sound or enable the buzzer. |

**Note 1:** When at full speed, this key is invalid.

**Note 2:** When at full speed, the RUN indicator light flashes quickly.

### 3.1.3 Rotary Encoder Function

| Name | Key function | Key result |
|---|---|---|
| Ⓡ | Multifunction key | Reuse as a start/stop key. |
| ○ | Rotary encoder rotation | used to change the speed/the suction angle. |

## 3.2 Working Mode Description

### 3.2.1 Keyboard Control Mode

The keyboard can control the start and stop of the peristaltic pump, control the increase and decrease of the speed, and realize full speed with one-key.

Foot switch control mode: Continuous mode (F1) and Inching mode (F2).

Continuous mode: Step on pedal switch and release to start peristaltic pump, then step again and release to stop peristaltic pump.

Inching mode: When the foot switch keeps is stepped and held, the peristaltic pump keeps rotating; when it is released, the peristaltic pump stops.

### 3.2.2 Communication Control Mode

Through the RS485 communication interface, control the start and stop of the peristaltic pump. Run step by step or in circles.

### 3.2.3 External Control Mode

With the external control module connected, the EXT indicator light is on. Steering can be controlled by the external steering signal; Start and stop can be controlled by the trigger signal and the speed can be controlled by changing the input analog signal.

**(1) Current code:** The current code is used to set the maximum current of the motor.

**The table of current code definition is as follows:**

| Current code | Motor max. output current (A) | Motor effective output current (A) | Current code | Motor max. output current (A) | Motor effective output current (A) |
|---|---|---|---|---|---|
| 4 | 1.01 | 0.72 | 18 | 3.86 | 2.73 |
| 5 | 1.21 (note 1) | 0.86 | 19 | 4.06 | 2.87 |
| 6 | 1.42 | 1.00 | 20 | 4.27 | 3.02 |
| 7 | 1.63 | 1.15 | 21 | 4.47 | 3.16 |
| 8 | **1.83** | **1.29** | 22 | 4.67 | 3.30 |
| 9 | **2.03** | **1.44** | 23 | 4.88 | 3.45 |
| 10 | **2.24** | **1.58** | 24 | 5.08 | 3.59 |
| 11 | 2.44 | 1.73 | 25 | 5.28 | 3.73 |
| 12 | 2.64 | 1.87 | 26 | 5.49 | 3.88 |
| 13 | 2.85 | 2.02 | 27 | 5.69 | 4.02 |
| 14 | 3.05 | 2.16 | 28 | 5.89 | 4.17 |
| 15 | 3.25 | 2.30 | 29 | 6.10 | 4.31 |
| 16 | 3.46 | 2.45 | 30 | 6.30 | 4.47 |
| 17 | 3.66 | 2.59 | 31 | 6.50 | 4.60 |

***Table 3-1*** *Comparison Table of Current Code and Motor Current*

**Note 1:** Hardware default current code value of LM40B

# Chapter 4 Communication Control Mode

## 4.1 Long Command/Reply Format

**Byte send:**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|----|
| FH (frame header) | Address code | Function code | Function parameter | | | | EOF (end of frame) | CUCUM (cumulative sum) | |
| STX | ADDR | FUNC | 1-8 bit | 9-16 bit | 17-24 bit | 25-32 bit | ETX | Low byte | High byte |

The 1$^{st}$ byte STX : Frame header （0xCC）

The 2$^{nd}$ byte ADDR : Slave address（0x01 ~ 0xF7）

Multicast address （0x80~0xFE） Broadcast address（0xFF）

The 3$^{rd}$ byte FUNC : Function code

The 4$^{th}$-7$^{th}$ byte : Parameters corresponding to the function code

The 8$^{th}$ byte ETX : End of frame（0xDD）

The 9$^{th}$-10$^{th}$ byte : Cumulative sum check code from byte 1 to 8

**Byte return:**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|----|
| FH (frame header) | Address code | Status code | Status parameter | | | | EOF (end of frame) | CUCUM (cumulative sum) | |
| STX | ADDR | STATE | 1-8 bit | 9-16 bit | 17-24 bit | 25-32 bit | ETX | Low byte | High byte |

The 1$^{st}$ byte STX : Frame header （0xCC）

The 2$^{nd}$ byte ADDR : Slave address（0x00 ~ 0xF7）

Multicast address （0x80~0xFE） Broadcast address（0xFF）

The 3$^{rd}$ byte STATE : Status code

The 4$^{th}$-7$^{th}$ byte : Parameters corresponding to the status code

The 8$^{th}$ byte ETX : End of frame（0xDD）

The 9$^{th}$-10$^{th}$ byte : Cumulative sum check code from byte 1 to 8

## 4.2 Short Command/Reply Format

**Byte send:**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| FH (frame header) | Address code | Function code | Function parameter | | EOF (end of frame) | CUCUM (cumulative sum) | |
| STX | ADDR | FUNC | 1-8 bit | 9-16 bit | ETX | Low byte | High byte |

The 1st byte STX　　:　　Frame header　（0xCC）

The 2nd byte ADDR　:　　Slave address（0x00～0xF7）

　　　　　　　　　　　　Multicast address　（0x80~0xFE）Broadcast address（0xFF）

The 3rd byte FUNC　:　　Function code

The 4th-5th byte　　:　　Parameters corresponding to the function code

The 6th byte ETX　　:　　End of frame（0xDD）

The 7th-8th byte　　:　　Cumulative sum check code from byte 1 to 6

**Byte return:**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| FH(frame header) | Address code | Status code | Status parameter | | EOF (end of frame) | CUCUM (cumulative sum) | |
| STX | ADDR | STATE | 1-8 bit | 9-16 bit | ETX | Low byte | High byte |

The 1st byte STX　　:　　Frame header　（0xCC）

The 2nd byte ADDR　:　　Slave address（0x00～0xF7）

　　　　　　　　　　　　Multicast address　（0x80~0xFE）Broadcast address（0xFF）

The 3rd byte STATE　:　　Status code

The 4th-5th byte　　:　　Parameters corresponding to the status code

The 6th byte ETX　　:　　End of frame（0xDD）

The 7th-8th byte　　:　　Cumulative sum check code from byte 1 to 6

## 4.3 Factory Setting Command/ Reply Format

**Byte send:**

| 1 | 2 | 3 | 4-7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|
| FH frame header) | Address code | Function code | Code | Function parameter | | | | EOF (end of frame) | CUCUM (cumulative sum) | |
| STX | ADDR | FUNC | | 1-8 bit | 9-16 bit | 17-24 bit | 25-32 bit | ETX | Low byte | High byte |

The 1st byte STX　　:　　Frame header　（0xCC）

The 2nd byte ADDR　:　　Slave address（0x00～0xF7）

　　　　　　　　　　　　Multicast address　（0x80~0xFE）Broadcast address（0xFF）

The 3rd byte FUNC　:　　Function code

The 4th-7th byte　　　:　　Code, fixed as 0xAABBEEFF, little-endian mode

The 8th-11th byte　　　:　　Parameters corresponding to the function code

The 12th byte ETX　　:　　End of frame（0xDD）

The 13th-14th byte　　:　　Cumulative sum check code from byte 1 to 12

**Byte return:**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| FH (frame header) | Address code | Status code | Status parameter | | EOF (end of frame) | CUCUM (cumulative sum) | |
| STX | ADDR | STATE | 1-8 bit | 9-16 bit | ETX | Low byte | High byte |

The 1st byte STX　　　:　　Frame header（0xCC）

The 2nd byte ADDR　:　　Slave address（0x00～0xF7）

　　　　　　　　　　　　Multicast address （0x80~0xFE）Broadcast address（0xFF）

The 3rd byte STATE　:　　Status code

The 4th-5th byte　　　:　　Parameters corresponding to the status code

The 6th byte ETX　　　:　　End of frame（0xDD）
The 7th-8th byte　　　:　　Cumulative sum check code from byte 1 to 6

## 4.4 Command List

| No. | Function code | Function | Parameter | Remark |
|---|---|---|---|---|
| 1 | 0x00 | Set address command | Parameter range is 0x01~0xF7 | Factory dedicated command |
| 2 | 0x02 | Set RS485 baud rate | Parameter range is 0x00-0x04<br>0x00 corresponding baud rate is 9600bps<br>0x01 corresponding baud rate is 19200bps<br>0x02 corresponding baud rate is 38400bps<br>0x03 corresponding baud rate is 57600bps<br>0x04 corresponding baud rate is 115200bps | Factory dedicated command |
| 3 | 0x04 | Set (software) current command | Parameter range is **0-31**, representing **0.2-6.5A** | Factory dedicated command |
| 4 | 0x05 | Set current setting source | 0- determined by hardware，1- determined by software | Factory dedicated command |
| 5 | 0x06 | Set one-key full speed | Parameter range is **0x03E8** （0.1~400rpm）．Maximum speed (100.0 to actual maximum speed) ten times storage，fixed parameter **0x0FA0**（**400.0rpm**） | Factory dedicated command |

| 6 | 0x07 | Set maximum speed | Parameter range is 0x03E8-0x0FA0, （100.0~400.0rpm）, 10 times storage, fixed parameter 0x0FA0（400.0rpm） | Factory dedicated command |
|---|---|---|---|---|
| 7 | 0x08 | Set suction angle | Parameter range is 0x00-0x0E10（0~360°）0 times storage, fixed parameter 0x00 | Factory dedicated command |
| 8 | 0x09 | Set Multicast address | Parameter range （0x80~0xFE) | Factory dedicated command |
| 9 | 0x20 | Query address command | Parameter range is 0x01-0xF7, not match address | Compatible with long command/ short command |
| 10 | 0x22 | Query RS485 baud rate | Parameter range is 0x00-0x04<br>0x00 corresponding baud rate is 9600bps<br>0x01 corresponding baud rate is 19200bps<br>0x02 corresponding baud rate is 38400bps<br>0x03 corresponding baud rate is 57600bps<br>0x04 corresponding baud rate is 115200bps | Compatible with long command/ short command |
| 11 | 0x23 | Query (hardware) current command | Parameter range is 0x05/0x0F/0x13/0x17/0x1B/0x1F, representing 1.21A/3.25A/4.06A/4.88A/5.69A/6.50A | Compatible with long command/ short command |
| 12 | 0x24 | Query (software) current command | Parameter range is 0-31, representing 0.2-6.5A | Compatible with long command/ short command |
| 13 | 0x25 | Query current source | 0-determined by hardware dialing code selection (default), 1-determined by software setup command | Compatible with long command/ short command |
| 14 | 0x26 | Set one-key full speed | Parameter range is 0x03E8-0x0FA0 （100.0~400.0rpm）, 10 times storage, fixed parameter is 0x0FA0（400.0rpm） | Compatible with long command/ short command |
| 15 | 0x27 | Query maximum speed | Parameter range is 0x03E8-0x0FA0 （100.0~400.0rpm）, 10 times storage, fixed parameter is 0x0FA0（400.0rpm） | Compatible with long command/ short command |
| 16 | 0x28 | Query suction angle | Parameter range is 0x00-0x0E10（0~360°）0 times storage, fixed parameter 0x00 | Compatible with long command/ short command |
| 17 | 0x29 | Query Multicast address | Parameter range （0x80~0xFE) | Compatible with long command/ short command |
| 18 | 0x40 | Run a few steps clockwise | 00000001H-FFFFFFFFH (long command)<br>0001H-FFFFH (short command) | Compatible with long command/ short command |
| 19 | 0x41 | Run a few steps counterclockwise | 0x00000001-0xFFFFFFFF (long command)<br>0001H-FFFFH (short command) | Compatible with long command/ |

| | | | | short command |
|---|---|---|---|---|
| 20 | 0x42 | Run a few circles clockwise | 0x00000001-0xFFFFFFFF (long command) 0x0001-0xFFFF (short command) | Compatible with long command/ short command |
| 21 | 0x43 | Run a few circles counterclockwise | 0x00000001-0xFFFFFFFF (long command) 0x0001-0xFFFF (short command) | Compatible with long command/ short command |
| 22 | 0x47 | rotate clockwise continuously | Parameters can be random. | Compatible with long command/ short command |
| 23 | 0x48 | rotate counterclockwise continuously | Parameters can be random. | Compatible with long command/ short command |
| 24 | 0x49 | Stop forcibly | Parameters can be random. | Compatible with long command/ short command |
| 25 | 0x4A | Query motor status | Parameters can be random. Reply the current dynamic speed. | Compatible with long command/ short command |
| 26 | 0x4B | Set dynamic speed | 0x0001~0x0FA0 (0.1~400rpm), 10 times storage, fixed parameter is (1~4000) | Compatible with long command/ short command |
| 27 | 0x4C | Query dynamic speed | Parameters can be random. Reply the current dynamic speed. | Compatible with long command/ short command |
| 28 | 0x4D | Query motor remaining steps | Parameters can be random. Use short command to query and reply low 16 bits of steps left. | Compatible with long command/ short command |
| 29 | 0x4E | Query motor remaining circles | Parameters can be random. Use short command to query and reply low 16 bits of circles left. | Compatible with long command/ short command |

**Note:**

1. The parameter ranges of the above long commands/short commands are different. The long commands support 32-bit parameters, and the short commands support 16-bit parameters.

2. Factory commands are generally not required to be used, and relatively suitable parameters have been defaulted by the factory. It is only used under special circumstances.

# Chapter 5 External Control Mode

## 5.1 External Control Mode

(1) When external control module is plugged in, the EXT external control indicator lights on and the machine switches to external control mode automatically.

(2) Under external control mode, keyboard control is not supported; When the external control mode is removed, the machine will switch to the keyboard control mode automatically.

(3) Under external control mode, steering control, triggering start and stop and speed adjustment are supported.

**EXT-DIR，** no matter when the motor stops or runs, the direction of rotation can be switched. If EXT-DIR signal is floating or high, it means positive rotation, and if EXT-DIR is low (GND short-circuit), it means negative rotation.

**EXT-ST，** (The wire jumper determines whether to turn on the start/stop switch). Suspended or high Ext-ST signal means stop, and low Ext-ST (short circuit with GND) means start
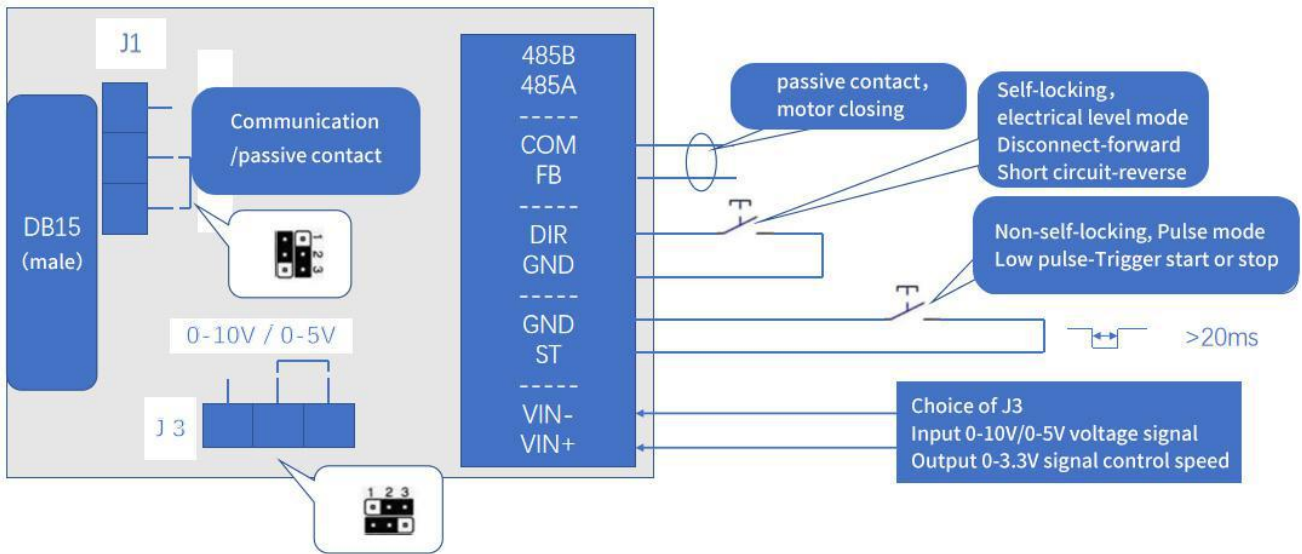
**ADC-IN，** it determines the rotation speed. Actually applied external input signal, which might be 0-5V, 0-10V, 4-20mA or 0-10KHz, etc., finally convert to 0-3.3V by the external control module, and the voltage has a linear relationship with the speed.

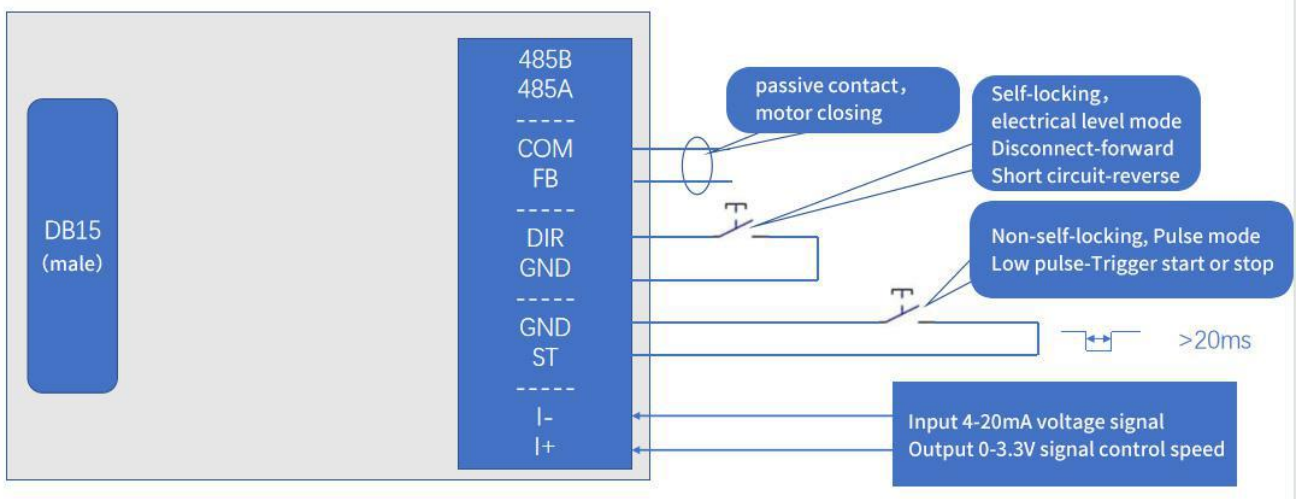## 5.2 External Control Speed Module

| Type of external control speed signal | Remark |
|---|---|
| 0-3.3V external control speed | The voltage signal of 0~3.3V is directly applied to the ADC-IN port. |
| 0-5V external control speed | Require 0~5V/10V to 0~3.3V dedicated conversion module. |
| 0-10V external control speed | Require 0~10V to 0~3.3V dedicated conversion module. |
| 4-20mA external control speed | Require 4~20mA to 0~3.3V dedicated conversion module. |
| 0-10KHz external control speed | Require 0~10KHz to 0~3.3V dedicated conversion module. |

**Note:** External control speed will correspond to the range from 0 to maximum speed. Due to the error of AD collection, the actual minimum speed will be greater than 0.1rpm, and the actual maximum speed will be less than the theoretical set maximum speed

### 5.2.1 0-5V /10V external control speed module Schematic diagram



### 5.2.2 4-20mA external control speed module Schematic diagram



## 5.3 Maximum Speed Setting

The maximum speed is set through RS485 when the motor stops, see the 0x07 command in chapter 4.2.

When the instrument leaves the factory, the appropriate maximum speed will be preset according to the pump head/pump tube. The user does not need to set.

## 5.4 Foot Pedal Control Mode

**(1)** Plug in the dedicated pedal module. One of the pedal mode indicators (F1/F2 ) lights on, and the machine switch to pedal control mode automatically.

**(2)** In the foot pedal control mode, keyboard control is supported, but it is the pedal switch that determines the final running status of the motor. That is, in F1 mode, the pedal can start and stop the motor, or the keyboard can start and stop the motor; in F2 mode, the status of the pedal switch plays a decisive role, and pressing the key at this time will interfere with the execution effect of the foot pedal.

**(3)** In the foot pedal control mode, the suction angle is effective when the motor stops.

**(4)** In the foot pedal control mode, the veer key is valid, and EXT-DIR is also valid.

**EXT-DIR，** No matter when the motor stops or runs, the direction of rotation can be switched. If EXT-DIR signal is floating or high, it means positive rotation, and if EXT-DIR is low (GND short-circuit), it means negative rotation.

**FT-EN** If the signal is suspended or high, the pedal is disabled, and if the signal is low (GND short-circuit), it is enabled.

**FT-SW** If the signal is suspended or high, the motor stops under foot pedal mode, and if the signal is low (short circuit with GND), the motor runs.

**(5)** When the foot pedal switch is removed, the machine will switch to the keyboard control mode automatically. F1/F2 indicator lights off.

# Chapter 6 Technical Parameters of Peristaltic Pump Tube

## 6.1 Peristaltic Pump Head-Tube Reference Flow Curve

| Model | LM40B |
|---|---|
| WT（metric system：mm） | 0.8 |
| ID（metric system：mm） | 2.54 |

***Table 6-1*** *Parameter List of Common Model of Flexible Tube*

## 6.2 Peristaltic Pump Head-Tube Reference Flow Curve
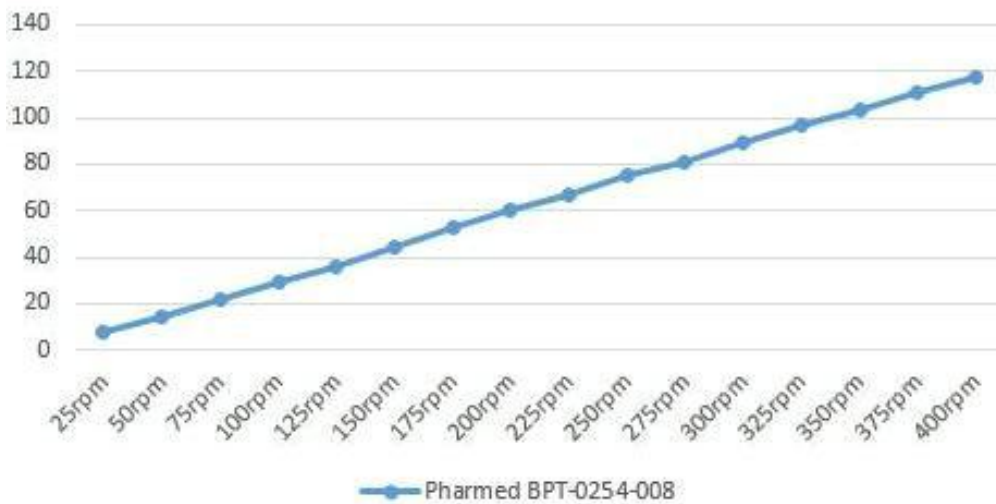
### 6.2.1 RZ1030（LM40B）Flow-Speed Curve



***Table 6-7*** *RZ1030 Flow-Speed Curve*

Note 1: The above "flow-speed" of different pump heads and different flexible tubes is the actual test curve without any modification and is for reference only;

Note 2: The above tested liquid is water under normal temperature, and the test temperature is about 25C°;

Note 3: There are many factors that affect the actual test value, including the following aspects: the material and elasticity of the tube, the tightness of the tube installation, the viscosity and other characteristics of the tested liquid;

Note 4: The diameter and wall thickness of the tube affect the maximum speed of the actual stable operation of pump head;

Note 5： If there is a higher requirement for the filling precision, please choose other types of products like syringe pump.

# Chapter 7 Equipment Maintenance

## 7.1 Common Equipment Maintenance Process

(1) **Regularly maintenance of the tube:** when not in use for a long time, please drain the liquid in the peristaltic pump tube in time, open the peristaltic pump protection lock, and loosen the peristaltic pump tube.

(2) **Regularly check the pipe connector:** regularly check whether the connectors are loose or damaged. If there is an abnormality, it must be replaced in time.

## 7.2 Common Problems and Solutions

| Problem | Problem description | Solution |
|---|---|---|
| The fan does not turn. | Too much dust on the fan causes stoppage | Remove the dust with soft brush after power down |
| | The fan is broken or the fan power supply is not in good contact. | Return it to factory for repair. |
| The motor does not rotate. | The screen displays the speed and the running light is always on, but it does not actually rotate | Check whether the pump body connector is tight or not. |
| | | Check whether the "Current code" in "Setting" is too small and set the current code consistent with the product. |
| | | Motor connection wire is loose and return it to factory for repair. |
| | | Motor power supply wire is loose and return it to factory for repair. |
| Motor is stalled. | The original valve head/tube can run at a certain speed, but the new valve head/tube cannot run. | The new valve head/tube needs to run for one or two minutes at a lower speed. |
| | Exceed the maximum speed of the valve head/tube. | Refer to the aforementioned running curve and select the suitable speed corresponding to the valve head/tube. |
| Flow is inaccurate. | The tube has been used for a long time and the resilience is reduced. | Replace the tube. |
| | Inappropriate accuracy requirements. | Flow rate/rotation speed/tube diameter is inversely proportional to accuracy. Under the working condition, try to use the tube with a smaller diameter. |

# Chapter 8 Version Description

| Version | Description | Release time |
|---------|-------------|--------------|
| V1.0 | Original version | 2020.12.20 |
| V1.1 | Add LM40A drawings and the command display format is changed from 00H to 0x00. | 2021.04.22 |
| V1.2 | Add description of setting and control of the suction angle. Add description of external control mode/foot pedal control mode. Modify the actual corresponding table of current code and current. | 2021.05.28 |
| V1.3 | Describe the current and communication parameters | 2021.08.21 |
| V1.4 | Change external dimensions. Add multicast address, broadcast address command change parameter range in Address20 Add external control module wiring schematic Add suction angle command | 2021.10.13 |

# Chapter 9 Technical Service

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