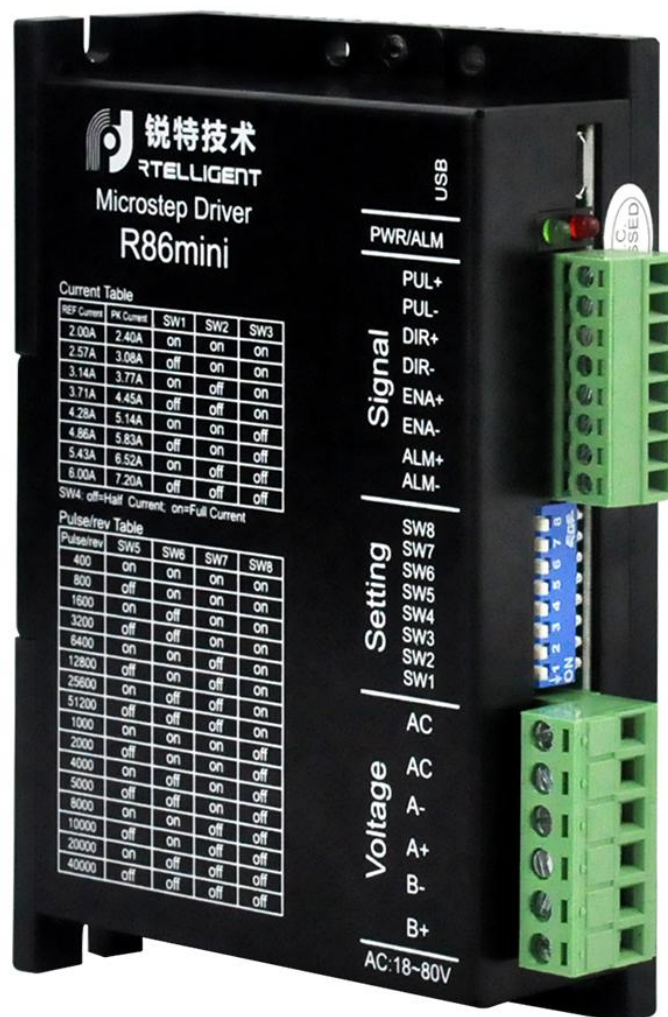


# Digital Stepper Driver R86mini

## User Manual



Shenzhen RteLLIGENT Mechanical Electrical Technology Co.,Ltd

## Contents

|                                                              |    |
|--------------------------------------------------------------|----|
| 1. Product overview.....                                     | 1  |
| 1.1 Characteristic.....                                      | 1  |
| 2. Application environment and installation.....             | 2  |
| 2.1 Environmental requirement.....                           | 2  |
| 2.2 Driver installation dimensions.....                      | 2  |
| 3. Driver port and connection.....                           | 3  |
| 3.1 Power and motor port function description.....           | 3  |
| 3.2 Control signal connection.....                           | 3  |
| 3.3 USB port.....                                            | 4  |
| 3.4 Pulse control wiring diagram.....                        | 5  |
| 4. The setting of DIP switches and operating parameters..... | 6  |
| 4.1 The setting of current.....                              | 6  |
| 4.2 Standby current.....                                     | 6  |
| 4.3 The setting of pulse per revolution.....                 | 6  |
| 4.4 Pulse command filtering.....                             | 7  |
| 5. Driver working status LED indication.....                 | 8  |
| 6. Phase loss alarm.....                                     | 8  |
| 7. Internal motion control function.....                     | 8  |
| 7.1 Communication control mode.....                          | 9  |
| 7.2 IO Control: start and stop + direction.....              | 9  |
| 7.3 IO Control: forward + reverse.....                       | 10 |
| 8. Common faults and troubleshooting.....                    | 10 |
| Appendix A. Guarantee Clause.....                            | 12 |

# 1. Product overview

R86Mini is a digital two-phase stepper motor driver that supports AC18V~AC80V input. It integrates intelligent motion controller functions and built-in S-shaped acceleration and deceleration commands. Through the USB port, it is convenient to configure the driver and expand the application of the driver.

## 1.1 Characteristic

- Working Voltage :18~80VAC or 24~100VDC
- Communication: USB to COM
- Maximum Phase Current output: 7.2A/Phase (Sinusoidal Peak)
- PUL+DIR, CW+CCW pulse mode optional
- Phase loss alarm function
- Half-current function
- Digital IO port:

3 photoelectric isolation digital signal input, high level can directly receive 24V DC level;  
1 photoelectric isolated digital signal output, maximum withstand voltage 30V, maximum input or pull-out current 50mA.

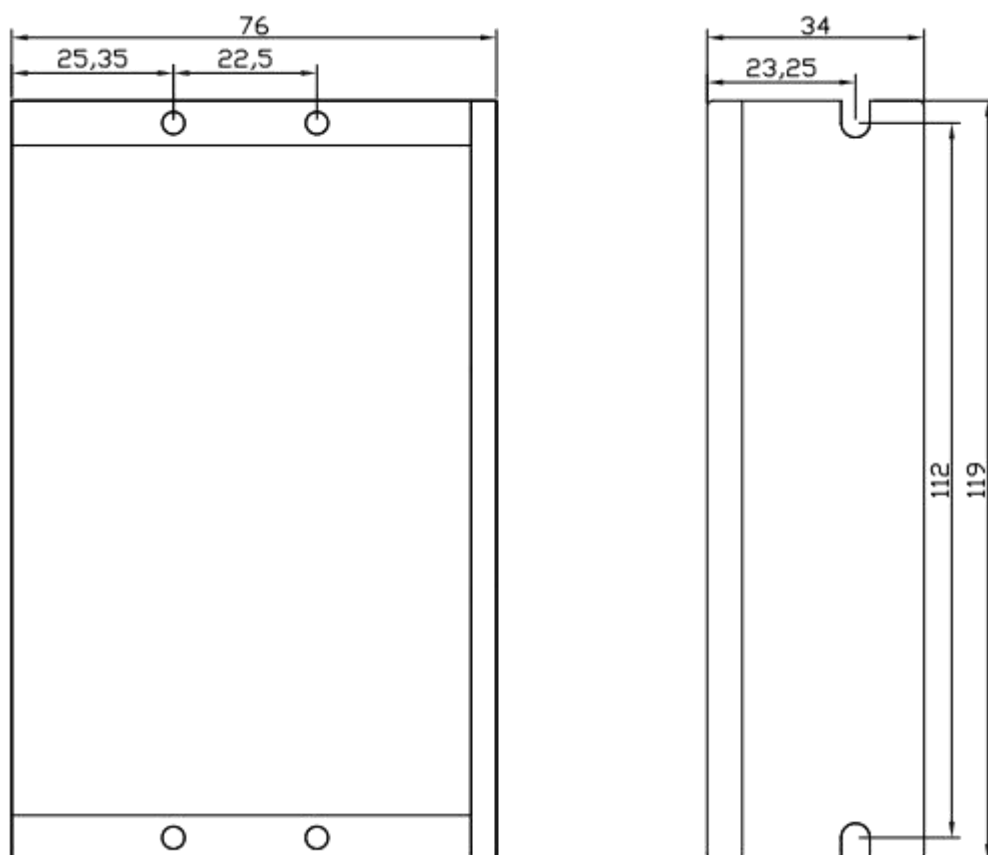
- 8 gears can be customized by users
- 16 gears can be subdivided by user-defined subdivision, supporting arbitrary resolution in the range of 200-65535
- IO control mode, support 16 speed customization
- Programmable input port and output port

## 2. Application environment and installation

### 2.1 Environmental requirement

|                                         |                                             |
|-----------------------------------------|---------------------------------------------|
| Item                                    | Rtelligent R86MINI                          |
| Installation environment                | Avoid dust, oil and corrosive environment   |
| Vibration                               | 0.5G (4.9m/s <sup>2</sup> ) Max             |
| Operating temperature/humidity          | 0℃ ~ 45℃ / 90% RH or less (no condensation) |
| Storage and transportation temperature: | -10℃ ~ 70℃                                  |
| Cooling                                 | Natural cooling / away from the heat source |
| Waterproof grade                        | IP54                                        |

### 2.2 Driver installation dimensions



## 3. Driver port and connection

### 3.1 Power and motor port function description

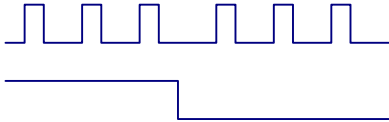
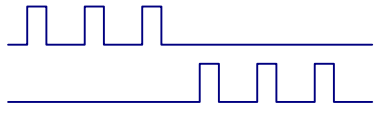
| Function     | Grade | Definition                                | Remarks                 |
|--------------|-------|-------------------------------------------|-------------------------|
| Power supply | AC    | Power supply interface                    | AC 18~80V<br>DC 24~100V |
|              | AC    |                                           |                         |
| Motor        | B-    | Two-phase stepper motor winding interface |                         |
|              | B+    |                                           |                         |
|              | A-    |                                           |                         |
|              | A+    |                                           |                         |

### 3.2 Control signal connection

| Function        | Identification | Description                                                                                  |
|-----------------|----------------|----------------------------------------------------------------------------------------------|
| Pulse / IN1     | PUL+           | The control signal is 5~24V compatible. No additional current limiting resistor is required. |
|                 | PUL-           |                                                                                              |
| Direction / IN2 | DIR+           |                                                                                              |
|                 | DIR-           |                                                                                              |
| Enable / IN3    | ENA+           |                                                                                              |
|                 | ENA-           |                                                                                              |
| Alarm / OUT1    | ALM+           | Optocoupler isolation, open collector output                                                 |
|                 | ALM-           |                                                                                              |

#### 3.2.1 PUL、DIR(IN1, IN2)ports:

By default, when operating in external pulse command mode, the R60-AL can receive two pulse command signals: PUL+DIR, CW+CCW.

|                                  |                                                                                      |
|----------------------------------|--------------------------------------------------------------------------------------|
| Pulse & Direction<br>(PUL + DIR) |  |
| Double pulse<br>(CW + CCW)       |  |

The command form of the external pulse is set by the debugging software:

|  | RegisterAddr | Function             | Parameter             |
|--|--------------|----------------------|-----------------------|
|  | 0-16         | Keep                 | -                     |
|  | 17           | Command work mode    | 0-Internal pulse      |
|  | 18           | Keep                 | -                     |
|  | 19           | Pulse mode           | 0-PUL+DIR<br>1-CW+CCW |
|  | 20           | Internal applicat... | 0-PUL+DIR<br>1-CW+CCW |
|  | 21           | Motor type           | 0-Two phase           |
|  | 22           | Keep                 | -                     |

### 3.2.2 ENA (IN3) port:

The default ENA port is the driver offline (enable) function:

When the internal optocoupler is off, the driver outputs current to the motor;

When the internal optocoupler is on, the driver will cut off the current of each phase of the motor to make the motor free, and the step pulse will not be responded.

When the motor is in an error state, it is automatically turned off. The level logic of the enable signal can be set to the opposite.

At the same time, this port can be reused as other functions like IN1 and IN2.

### 3.2.3 ALM (OUT1) port:

The driver includes an optically isolated output port ALM. By default, the ALM port is an alarm output port. When the driver is in an error state and normal operation, the ALM port outputs different optocoupler levels.

It can also be reused for other functions, as shown below:

IO settings

☒ Frequent on    ☐ Frequent off

|                    |                                               |                    |                                               |                       |                                               |                      |                                               |
|--------------------|-----------------------------------------------|--------------------|-----------------------------------------------|-----------------------|-----------------------------------------------|----------------------|-----------------------------------------------|
| IN1: 0-Pulse input | Polarity: <input checked="" type="checkbox"/> | IN4: 0-Pulse input | Polarity: <input checked="" type="checkbox"/> | OUT1: 1-Fault alarm   | Polarity: <input checked="" type="checkbox"/> | OUT4: 0-Pulse output | Polarity: <input checked="" type="checkbox"/> |
| IN2: 0-Pulse input | Polarity: <input checked="" type="checkbox"/> | IN5: 0-Pulse input | Polarity: <input checked="" type="checkbox"/> | OUT2: 0-Normal output | Polarity: <input checked="" type="checkbox"/> |                      |                                               |
| IN3: 0-Pulse input | Polarity: <input checked="" type="checkbox"/> | IN6: 0-Pulse input | Polarity: <input checked="" type="checkbox"/> | OUT3: 1-Fault alarm   | Polarity: <input checked="" type="checkbox"/> |                      |                                               |

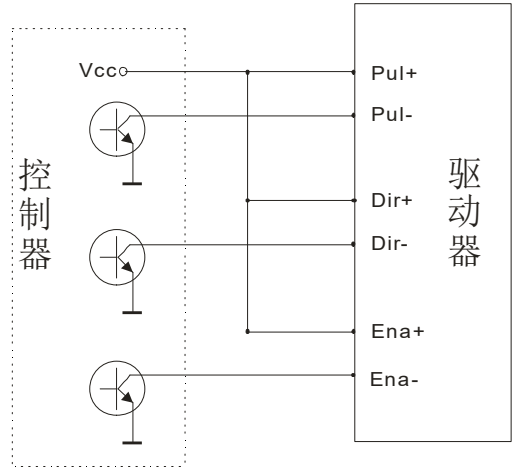
OUT1: 1-Fault alarm  
 0-Normal output  
 2-Brake output  
 3-Positioning complete  
 4-Speed reached  
 5-Homing completed  
 6-Driver ready  
 7-Motor stop  
 8-Positive limit output  
 9-Negative limit output

## 3.3 USB port

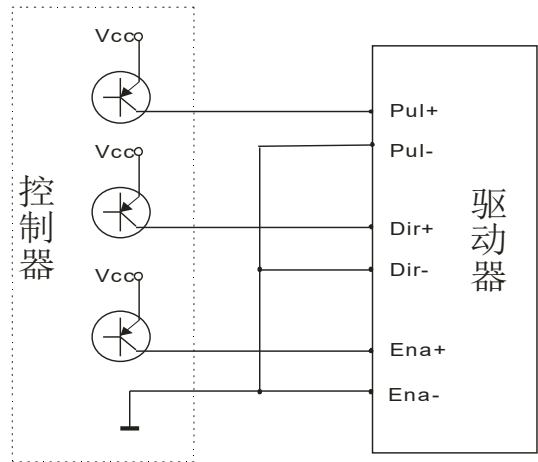
The USB is a micro usb connection port, and a USB driver needs to be installed.

### 3.4 Pulse control wiring diagram

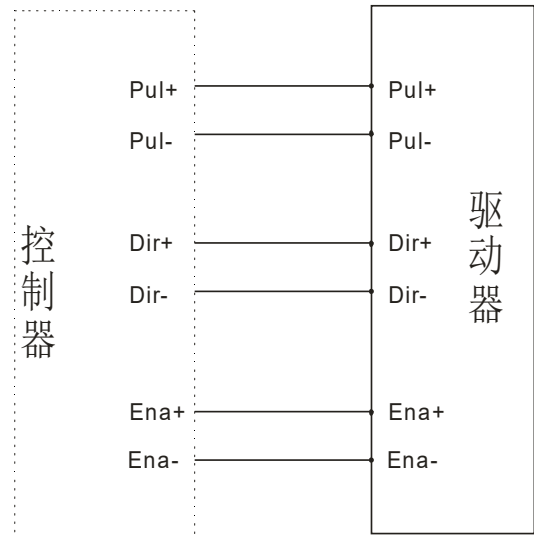
Common Anode



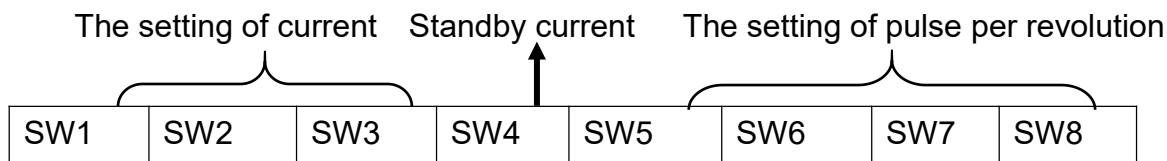
Common Cathode



Difference



## 4. The setting of DIP switches and operating parameters



### 4.1 The setting of current

| Peak Current | Average Current | SW1 | SW2 | SW3 | Remarks                           |
|--------------|-----------------|-----|-----|-----|-----------------------------------|
| 2.40A        | 2.00A           | on  | on  | on  | Other Current can be custom-made. |
| 3.08A        | 2.57A           | off | on  | on  |                                   |
| 3.77A        | 3.14A           | on  | off | on  |                                   |
| 4.45A        | 3.71A           | off | off | on  |                                   |
| 5.14A        | 4.28A           | on  | on  | off |                                   |
| 5.83A        | 4.86A           | off | on  | off |                                   |
| 6.52A        | 5.43A           | on  | off | off |                                   |
| 7.20A        | 6.00A           | off | off | off |                                   |

### 4.2 Standby current

SW4 is used to set the percentage of current when the driver is in standby.

SW4 = ON, the current is kept at the set current as long as the driver is enabled.

SW4 = OFF, the driver stops receiving pulses for a certain period of time, enters the standby state, and the current drops to a certain percentage of the set current.

The default setting is: After stopping the receiving pulse for 1 second, the motor winding current will be 50%.

### 4.3 The setting of pulse per revolution

| Steps/revolution | SW5 | SW6 | SW7 | SW8 | Remarks                                |
|------------------|-----|-----|-----|-----|----------------------------------------|
| 400              | on  | on  | on  | on  | Other subdivisions can be custom-made. |
| 800              | off | on  | on  | on  |                                        |
| 1600             | on  | off | on  | on  |                                        |
| 3200             | off | off | on  | on  |                                        |
| 6400             | on  | on  | off | on  |                                        |

|       |     |     |     |     |
|-------|-----|-----|-----|-----|
| 12800 | off | on  | off | on  |
| 25600 | on  | off | off | on  |
| 51200 | off | off | off | on  |
| 1000  | on  | on  | on  | off |
| 2000  | off | on  | on  | off |
| 4000  | on  | off | on  | off |
| 5000  | off | off | on  | off |
| 8000  | on  | on  | off | off |
| 10000 | off | on  | off | off |
| 20000 | on  | off | off | off |
| 40000 | off | off | off | off |

DIP SW5, SW6, SW7, and SW8 are used to set the pulse per revolution required by the motor.

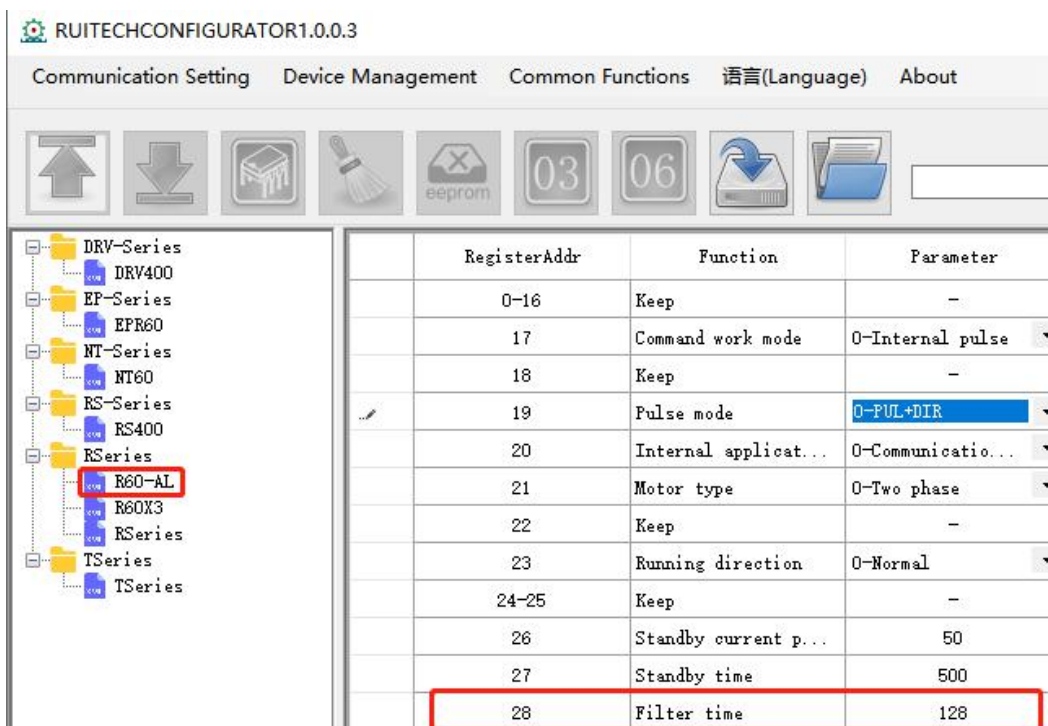
Due to the digital control, the subdivision can be set to any number between 200 and 65535.

## 4.4 Pulse command filtering

The driver has built-in pulse command smoothing function, which can make the motor start more smoothly.

Command filtering can smooth the motor movement, but also introduces lag. Users need to choose whether to enable the function according to the actual situation.

The filter time can be set by the debugging software:



## 5. Driver working status LED indication

| LED Status                                                                        |                                              | Driver Status                               |
|-----------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------|
|  | Green indicator is on for long time          | Driver not enabled                          |
|  | Green indicator is flickering                | Driver working normally                     |
|  | One green indicator and one red indicator    | Driver overcurrent                          |
|  | One green indicator and two red indicators   | Driver input power overvoltage              |
|  | One green indicator and three red indicators | The internal voltage of the driver is wrong |
|  | One green indicator and seven red indicators | Motor phase loss                            |

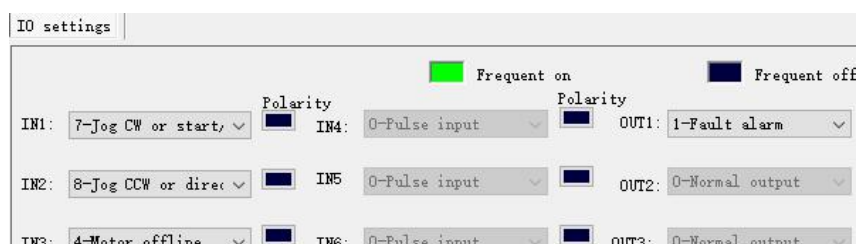
## 6. Phase loss alarm

The driver has a motor phase loss alarm function, which can detect the phase loss state of the motor during stationary and movement. During the operation of the stepper motor, due to mechanical reasons, the winding wire of the motor may be loosened and disconnected. At this time, the driver will output an alarm signal to prevent the device from making an erroneous action.

Since this function relies on the current detection of the motor windings, this function has a false alarm when the motor current is too small (less than 300 mA). At this point, the user can turn off this function. In the parameter management and setting interface of the debugging software, set parameter No. 188(phase loss detection enable) to 0.

## 7. Internal motion control function

When operating in the internal pulse command mode, the PUL and DIR ports are used as IO input signals. The function of the IO needs to be set by the debugging software. As shown below:



## 7.1 Communication control mode

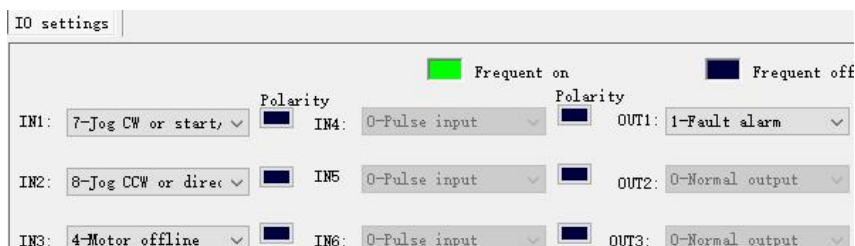
In this mode, the user can make the motor run the specified pulse stroke or jog operation by communicating the given operation command. Used by the user to test the motor using the debugging software.

## 7.2 IO Control: start and stop + direction

With this mode, two IN terminals are used to control the operation of the motor. One of the IN terminals is used to control the start/stop of the motor, and one IN terminal is used to control the running direction of the motor.

### 7.2.1 Software settings

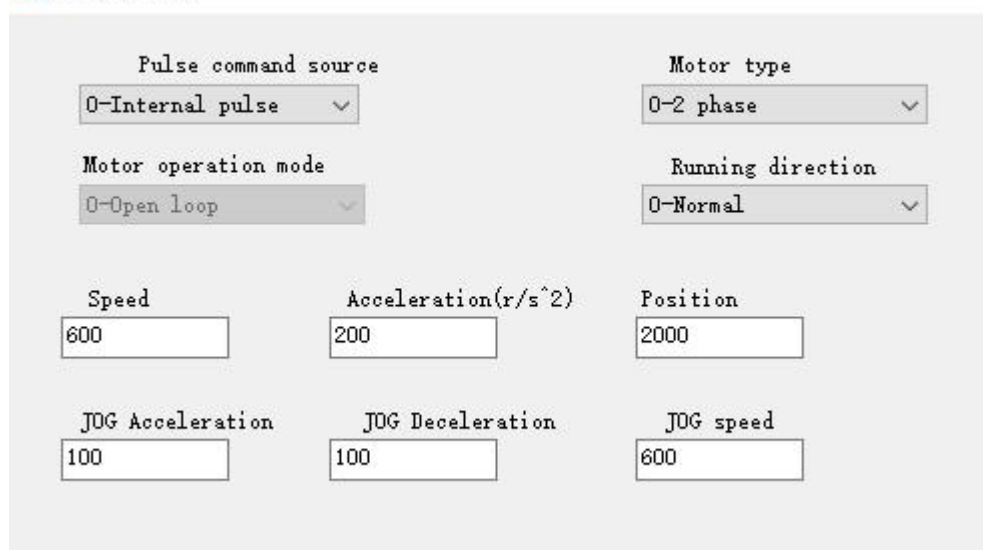
- (1) Command mode: 0 - internal pulse mode
- (2) Internal application mode: 2 - IO speed control: start and stop + direction
- (3) IO settings:



| Terminal | Function               | Polarity |
|----------|------------------------|----------|
| IN1      | 7-Jog CW or start      | Blue     |
| IN2      | 8-Jog CCW or direction | Blue     |
| IN3      | 4-Motor offline        | Blue     |
| IN4      | 0-Pulse input          | Blue     |
| IN5      | 0-Pulse input          | Blue     |
| IN6      | 0-Pulse input          | Blue     |
| OUT1     | 1-Fault alarm          | Blue     |
| OUT2     | 0-Normal output        | Blue     |
| OUT3     | 0-Normal output        | Blue     |

- (4) This mode is for the speed defined by the speed table, selected by SW5, 6, 7, 8.
- (5) Set the motion parameters, you can modify the acceleration, deceleration

 MotionTest



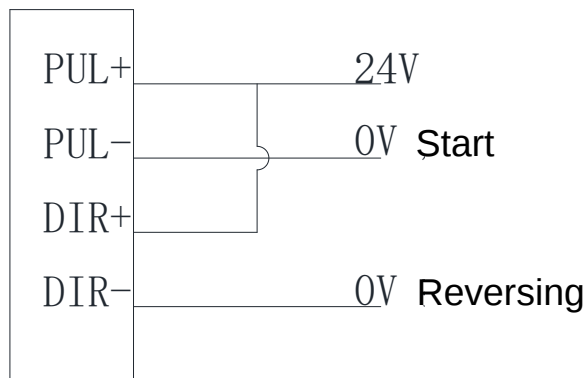
| Pulse command source |  | Motor type |
|----------------------|--|------------|
| 0-Internal pulse     |  | 0-2 phase  |

| Motor operation mode |  | Running direction |
|----------------------|--|-------------------|
| 0-Open loop          |  | 0-Normal          |

| Speed | Acceleration(r/s^2) | Position |
|-------|---------------------|----------|
| 600   | 200                 | 2000     |

| JOG Acceleration | JOG Deceleration | JOG speed |
|------------------|------------------|-----------|
| 100              | 100              | 600       |

## 7.2.2 Wiring diagram

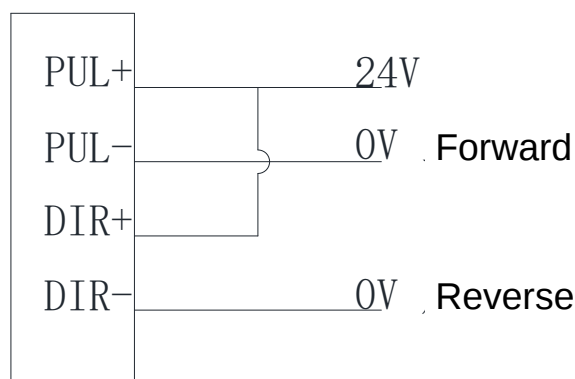


## 7.3 IO Control: forward + reverse

### 7.3.1 Software settings

Same as 7.2.1, only need to change (2) to: 3 - IO speed control: forward + reverse.

### 7.3.2 Wiring diagram



## 8. Common faults and troubleshooting

| Phenomenon                 | Possible situations                                   | Solutions                                                   |
|----------------------------|-------------------------------------------------------|-------------------------------------------------------------|
| <b>Motor does not work</b> | Power indicator is off                                | Check the power supply circuit for normal power supply      |
|                            | The motor rotor is locked but the motor does not work | Pulse signal is weak; increase the signal current to 7-16mA |
|                            | The speed is too slow                                 | Select the right micro-stepping                             |
|                            | Driver is protected                                   | Solve the alarm and re-power                                |
|                            | Enable signal problem                                 | Pull up or disconnect the enable signal                     |
|                            | Command pulse is incorrect                            | Check whether the upper computer has pulse output           |

|                                       |                                                       |                                                                                                    |
|---------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <b>The steering of motor is wrong</b> | The rotary direction of motor is reverse              | Adjust the DIP SW5                                                                                 |
|                                       | The motor cable is disconnected                       | Check the connection                                                                               |
|                                       | The motor has only one direction                      | Pulse mode error or DIR port damaged                                                               |
| <b>Alarm indicator is on</b>          | The motor connection is wrong                         | Check the motor connection                                                                         |
|                                       | The motor connection and encoder connection are wrong | Check the sequence of encoder connection                                                           |
|                                       | The voltage is too high or too low                    | Check the power supply                                                                             |
| <b>The position or speed is wrong</b> | The signal is disturbed                               | Eliminate interference for reliable grounding                                                      |
|                                       | The command input is incorrect                        | Check the upper computer instructions to ensure the output is correct                              |
|                                       | The setting of Pulse per revolution is wrong          | Check the DIP switch status and correctly connect the switches                                     |
|                                       | Encoder signal is abnormal                            | Replace the motor and contact the manufacturer                                                     |
| <b>The Driver terminal burned up</b>  | Short circuit between terminals                       | Check power polarity or external short circuit                                                     |
|                                       | Internal resistance between terminals is too large    | Check whether there is any solder ball due to excessive addition of solder on the wire connections |
| <b>The motor is out of tolerance</b>  | Acceleration and deceleration time is too short       | Reduce command acceleration or increase Driver filtering parameters                                |
|                                       | Motor torque is too low                               | Select the motor with high torque                                                                  |
|                                       | The load is too heavy                                 | Check the load weight and quality and adjust the mechanical structure                              |
|                                       | The current of power supply is too low                | Replace the appropriate power supply                                                               |

---

## Appendix A. Guarantee Clause

### A.1 Warranty period: 12 months

We provide quality assurance for one year from the date of delivery and free maintenance service for our products during the warranty period.

### A.2 Exclude the following:

Improper connection, such as the polarity of the power supply is reversed and insert/pull the motor connection when the power supply is connected.

Beyond electrical and environmental requirements.

Change the internal device without permission.

### A.3 Maintenance process

For maintenance of products, please follow the procedures shown below:

- (1) Contact our customer service staff to get the rework permission.
- (2) The written document of the driver failure phenomenon is attached to the goods, as well as the contact information and mailing methods of the sender.

Mailing address:

Post code:

---