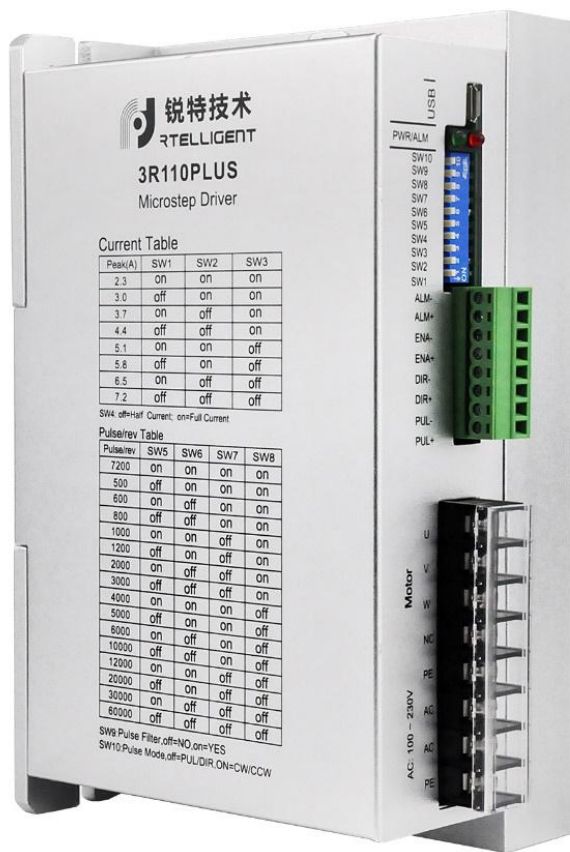


# Digital Stepper Driver 3R110PLUS

## User Manual



Shenzhen Rtelligent Mechanical Electrical Technology Co.,Ltd

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# 1. Product overview

R110-PLUS is a high-voltage digital two-phase stepper motor driver with integrated 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

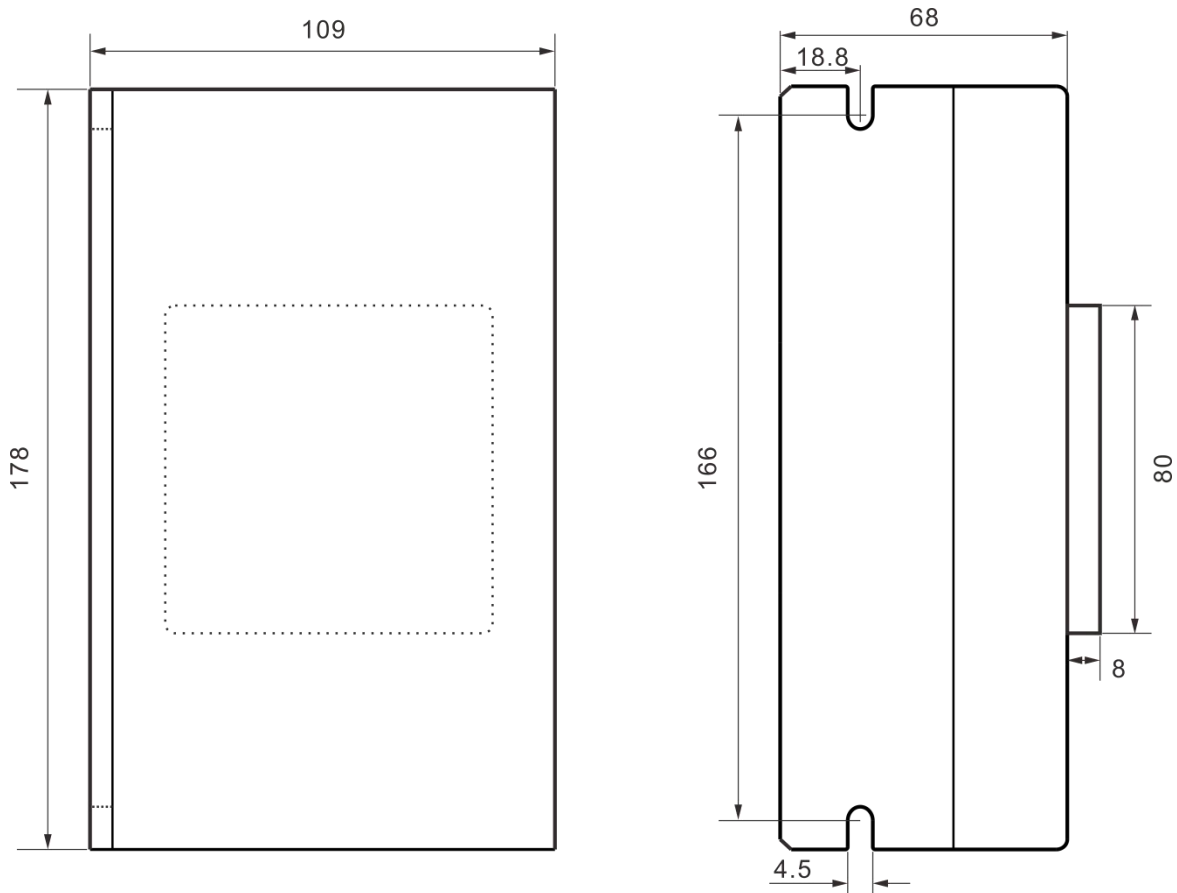
- Working voltage: 110~220VAC
- Communication: USB to COM
- Maximum phase current output: 7.2A/Phase (Sinusoidal Peak)
- PUL+DIR/CW+CCW pulse mode optional
- Phase loss alarm function
- Half-flow function
- Digital IO port:
- 3 photoelectric isolation digital signal input, high level can directly receive 24V DC level;
- 1 photoelectric isolation 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 3R110-PLUS
Installation environment	Avoid dust, oil and corrosive environment
Vibration	0.5G (4.9m/s <sup>2</sup> ) Max
Operating temperature/humidity	0 °C ~ 45 °C / 90% RH or less (no condensation)
Storage and transportation temperature:	-10°C ~ 70°C
Cooling	Natural cooling / away from the heat source
Waterproof grade	IP54

## 2.2 Driver installation dimensions



## 3. Driver port and connection

### 3.1 Power supply and motor port function description

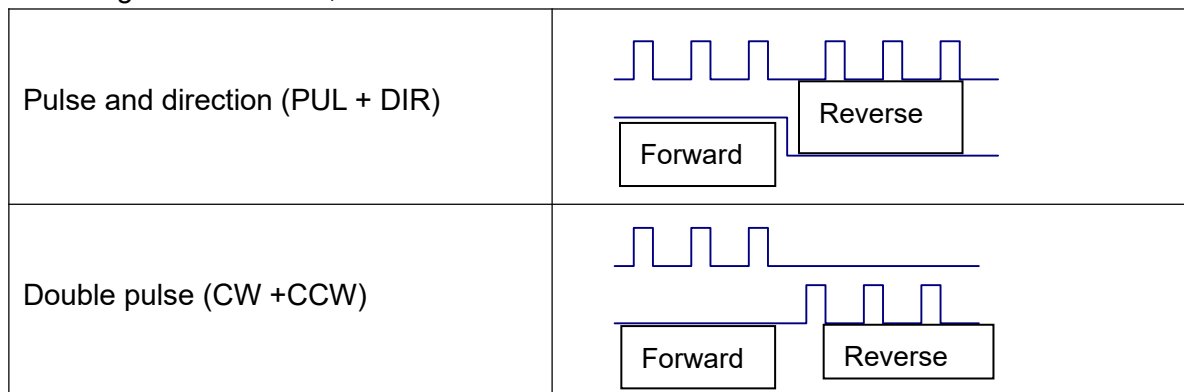
Function	Grade	Definition	Remarks
Power supply	PE	Single-phase 220VAC power input	
	AC		
	AC		
Motor	PE	Motor PE earth wire	Reversing any two wires of U, V, W, which can make the motor run in the opposite direction
	NC	Dangling	
	W		
	V	Three phase stepper motor	
	U		

### 3.2 Control signal connection

Function	Grade	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 port(IN1, IN2)

By default, when operating in external pulse command mode, 3R110-PLUS can receive two pulse command signals: PUL+DIR, CW+CCW.



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

Set by DIP switch 10

SW10 = OFF, PUL+DIR

SW10 = ON, CW+CCW

### 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.

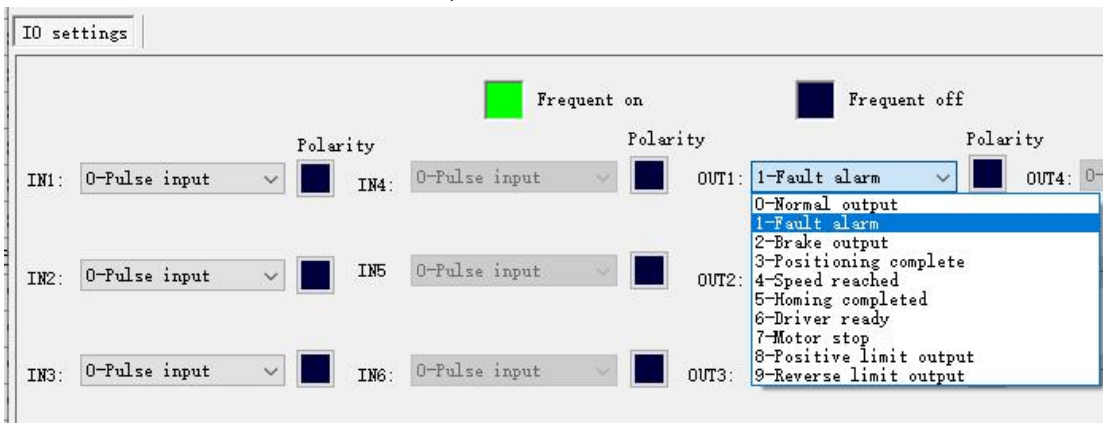
When the motor is in an error state, it is automatically turned off. The level logic of the enable signal can be set to the opposite.

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:



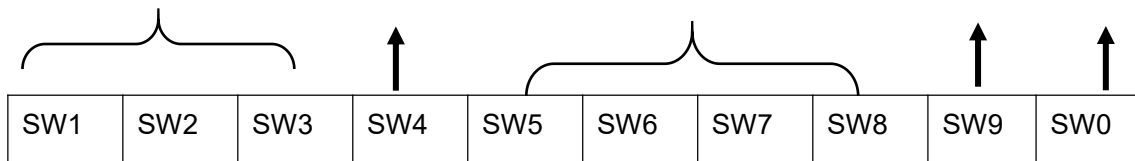
### 3.3 USB port

The USB is a micro usb connector and requires a USB bridge.



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

The setting of current   Standby current   The setting of pulse per revolution   Filtering   Pulse mode



### 4.1 The setting of current

Sine peak A	SW1	SW2	SW3	Remarks
2.3	on	on	on	User can set 8 levels of current through debugging software
3.0	off	on	on	
3.7	on	off	on	
4.4	off	off	on	
5.1	on	on	off	
5.8	off	on	off	
6.5	on	off	off	
7.2	off	off	off	

### 4.2 Standby current

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

SW4 = ON, as long as the driver is in the enabled state, the current remains at the set current

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

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

### 4.3 The setting of pulse per revolution

Set the pulse per revolution required by the motor. Due to digital control, the number of subdivisions can be set to any number between 200 and 65535.

Steps/revolution	SW5	SW6	SW7	SW8	Remarks
7200	on	on	on	on	Users can set up 16 level subdivision through debugging software.
400	off	on	on	on	
800	on	off	on	on	
1600	off	off	on	on	

3200	on	on	off	on
6400	off	on	off	on
12800	on	off	off	on
25600	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
25000	off	off	off	off

### 4.4 Pulse command filtering

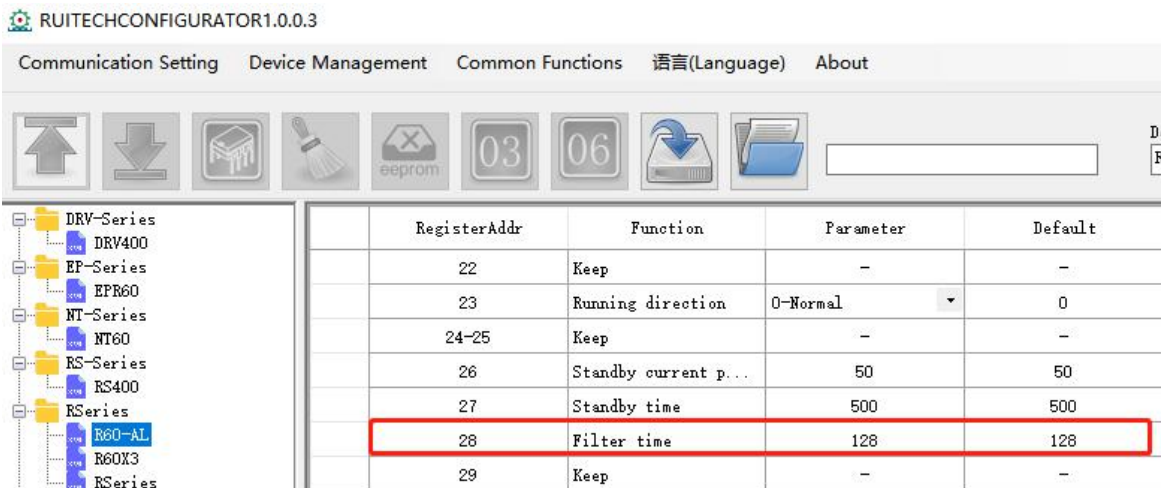
The driver has a built-in pulse command smoothing function, which can make the motor start more stable.

SW9 = ON, enable pulse command filtering

SW9 = OFF, disable pulse command filtering

The default command filter time is  $512 \times 61 \mu s = 31 \text{ms}$

Command filtering can smooth the motor movement, but also introduces lag. The user needs to choose whether to enable this function according to the actual situation. The filter time can be set by the debugging software:










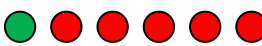
## 4.5 The setting of pulse mode

SW10 is used to set the form of the driver receiving pulse.

SW10 = OFF, pulse + direction mode

SW10 = ON, CW+CCW double pulse mode

## 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 lose phase

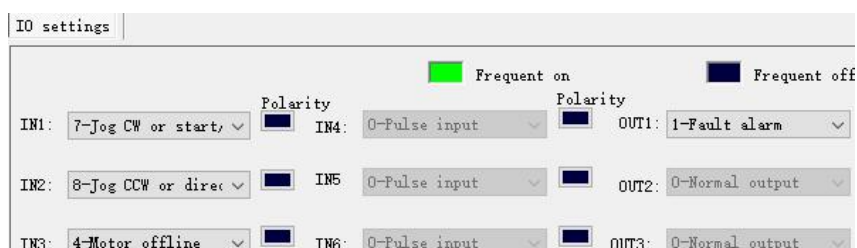
## 6. Phase loss alarm

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 working in the internal pulse command mode, the PUL and DIR ports are used as IO input signals. The IO function needs to be set through 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.

In internal pulse mode, the motor is controlled by register 18

### 0: Waiting state.

The driver receives any control command and will resume the waiting state after the driver processes it. So reading this register always returns 0.

### 1: Fixed length forward rotation.

In the relative position mode, the motor runs in the forward direction according to the 70 ~ 74 register parameters.

In the absolute position mode, the operation state is determined according to the current position and the absolute position set by 70~74.

### 2: Fixed length reverse rotation.

In the relative position mode, the motor runs in the reverse direction based on the 70~74 register parameters.

In the absolute position mode, the operation state is determined according to the current position and the absolute position set from 70 ~ 74.

### 3: Speed mode, continuous forward rotation.

According to 75 and 76 registers, the motor runs at forward acceleration.

### 4: Speed mode, continuous reverse.

According to 75 and 76 registers, the motor runs at reverse acceleration.

### 5: Emergency stop

According to the 77 register, the motor decelerates and stops.

### 6: Slow down and stop.

In position mode, the motor decelerates and stops according to the 71 register

In speed mode, the motor decelerates and stops according to the 76 register

Others: no effect.

### 7.1.1 Point control mode

The communication controls the function of the motor to run the specified pulse stroke. The specific modes and parameters to be set are as follows (register addresses are not specified or specified as decimal numbers):

(1) Set the value of register address 20 (preset application selection in internal pulse mode) to 0(Communication control, respond to the command of register address 18)

(2) Set the function of the digital input and output port according to the application requirements and the actual wiring terminals;

(3) Set the motion parameters:

Address	Unit	Parameter Description
70	R/S <sup>2</sup>	Acceleration of point motion
72	RPM	Speed of point motion
73	Command pulse	The number of command pulses for point motion is lower than the 16-bit register
74	Command pulse	The number of command pulses for point motion is high 16-bit register
78	R/S <sup>2</sup>	Emergency stop deceleration
84	-	Set position operation mode: 0: incremental 1: Absolute

(4) Communication given operation command: start the point movement by writing the values “1” (fixed length forward rotation) and “2” (fixed length reverse rotation) to register 18. (For details on this register, please see "Driver Control Mode" Set register 18 in [17~23]);

(5) During operation, if need to stop, please write value “6” (deceleration to stop, deceleration is the setting value of register 71) and value “5” (emergency stop, deceleration is the setting value of register 78) to register 18 .

**Note:**

When the motor is in operation, it only responds to the stop command (deceleration stop or emergency stop). If it is necessary to change the running direction of the motor by command, please send the stop command to wait for the motor to stop, and then send the start signal of the other direction.

The acceleration (register 70), deceleration (register 71), and speed (register 72) are changed during motor operation, but the driver will not respond to these set values immediately. It will not run at the set values until the motor is stopped and restarted.

It is important to note that the emergency stop deceleration (Register 78) is responded to during the current sport emergency stop, without waiting for the next stop of the emergency stop.

### 7.1.2 Jog control mode

3R110Plus has the function of controlling the jog operation of the motor through communication. The specific modes and parameters to be set are as follows (register addresses are not specified or specified as decimal numbers):

(1) Set the value of register address 20 (preset application selection in internal pulse mode) to 0 (Communication control, respond to the command of register address 18)

(2) Set the function of the digital input and output port according to the application requirements and the actual wiring terminals;

(3) Set the motion parameters:

Address	Unit	Parameter Description
75	R/S^2	Acceleration of jog motion
76	R/S^2	Deceleration of jog motion
77	RPM	Speed of jog motion
78	R/S^2	Emergency stop deceleration

(4) Communication given operation command: Start jog movement by writing values 3 (continuous forward rotation) and 4 (continuous reverse rotation) to register 18.(For details on this register, please see "Drive Control Mode" Set register 18 in [17~23]");

(5) During operation, if need to stop, please write value “6 “(deceleration to stop, deceleration is the setting value of register 76) and value “5” (emergency stop, deceleration is the setting value of register 78) to register 18 .

**Note:**

When the motor is in operation, it only responds to the stop command (deceleration stop or emergency stop). If it is necessary to change the running direction of the motor by command, please send the stop command to wait for the motor to stop, and then send the start signal of the other direction.

The acceleration (register 75) and deceleration (register 76) are changed during motor operation, but the driver will not respond to these set values immediately. It will not run at the set values until the motor is stopped and restarted.

It is important to note that the emergency stop deceleration (Register 78) is responded to during the current sport emergency stop, without waiting for the next stop of the emergency stop.

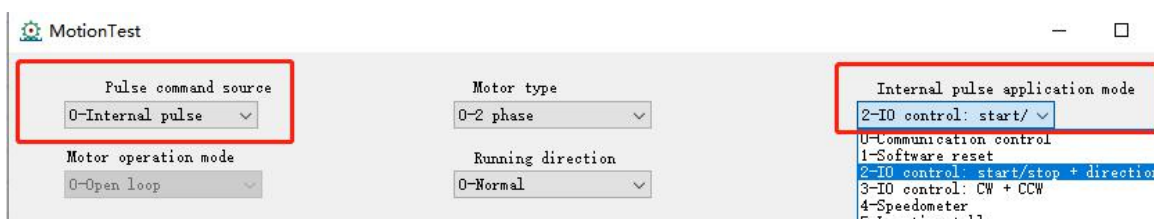
The speed (register 77) can be changed during the operation of the motor, and the driver will respond immediately, that is, the motor will run at the set speed value immediately, without stopping and restarting to respond.

## 7.2 IO Control: Start and Stop + Direction

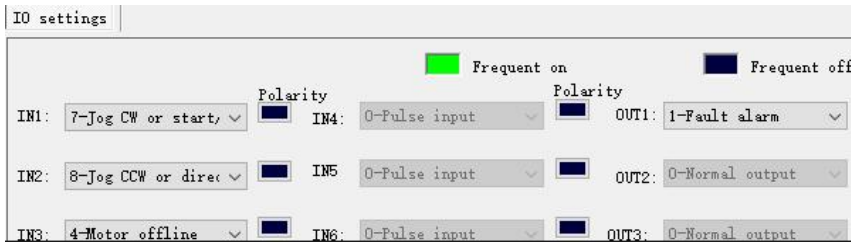
With this mode, two IN terminals are used to control the operation of the motor. One IN terminals is used to control the start/stop of the motor, and the other IN terminal is used to control the running direction of the motor. The specific settings are as follows:

(1)Command mode: 0 - internal pulse mode

(2)Internal application mode: 2 - IO speed control: start and stop + direction



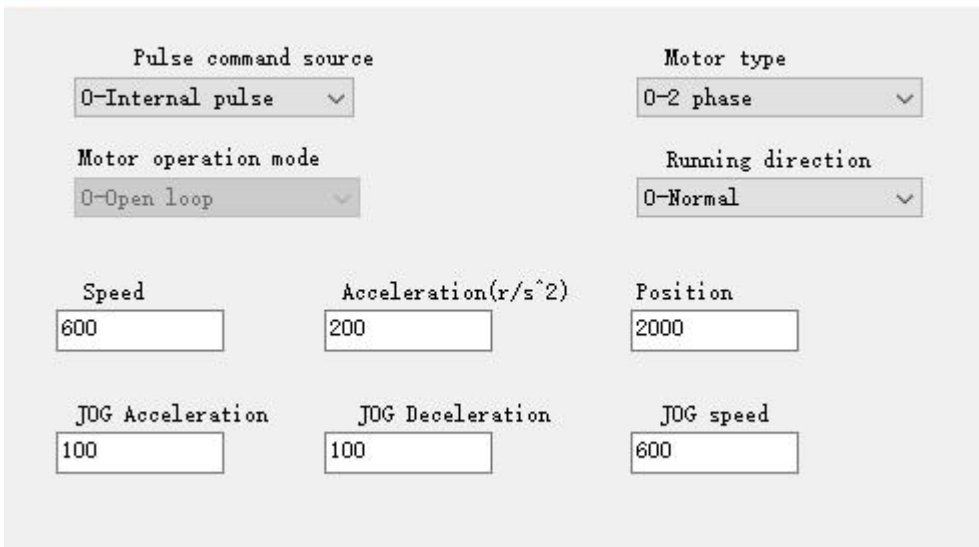
(3)IO settings:



(4)This mode is for the speed defined by the speed table, selected by SW5, 6, 7, 8.

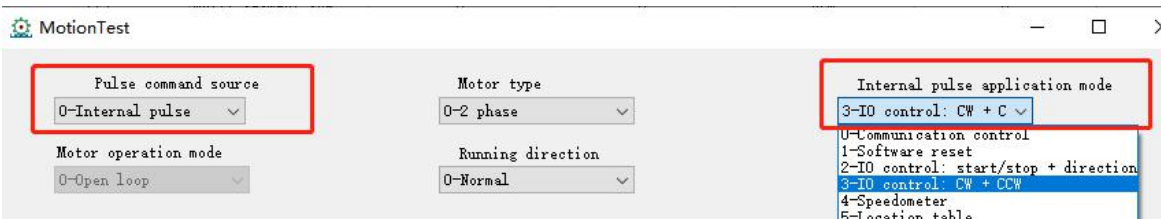
(5)Set the motion parameters, you can modify the acceleration, deceleration

### MotionTest



## 7.3 IO Control: Forward + Reverse

Same as 7.2, only need to change (2) to: 3 - IO speed control: forward + reverse.



## 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 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

## 9. Guarantee clause

### 9.1 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.

### 9.2 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.

### 9.3 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:

Tel.: