JKD7208S

User's Guide Of
Digital Two-Phase Stepper Driver

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Contents

JKD7208S Digital Two-Phase Stepper Driver

1. Products'introduce

1. General introduce

JKD7208S is a new digital stepper motor driver by JKONGMOTOR. It adopts the latest 32-bit DSP digital processing technology. The drive control algorithm adopts advanced variable current technology and advanced frequency conversion technology. The driver has small heating, small motor vibration and stable operation. Users can set any subdivision within 200 ~ 51200 and any current value in the rated current to meet the application needs in most occasions. Thanks to the built-in micro-subdivision technology, the subdivision effect can be achieved even under the condition of low subdivision. The operation is smooth and the noise is ultra-small under low, medium and high speed. The driver integrates the parameter auto-adjust function, which can automatically generate optimal operating parameters for different motors to maximize the performance of the motor.

2. Characteristic

● New 32-bit DSP technology
● Ultra-low vibration noise
● Built-in high subdivision
● Automatic parameter adjustment function when power on
● Variable current control reduces the heating of the motor
● The current automatically halve at rest

● Can drive two phase stepping motors of 4, 6, 8 lines
● Optical isolation differential signal input
● The pulse response frequency can reach to 500KHz（Factory default 200KHz）
● The current setting is convenient and can choose between 0.1 to 7.2A
● Subdivision setting range is between 200 to 51200
● Has the protection function of overpressure, underpressure and overcurrent

3. Application

Suitable for all kinds of small and medium sized automation equipment and instruments, such as: engraving machine, marking machine, cutting machine, laser lighting, plotter, cnc machine, automatic assembly equipment, etc. It use very well in the equipment that user expects small noise, and high peed.

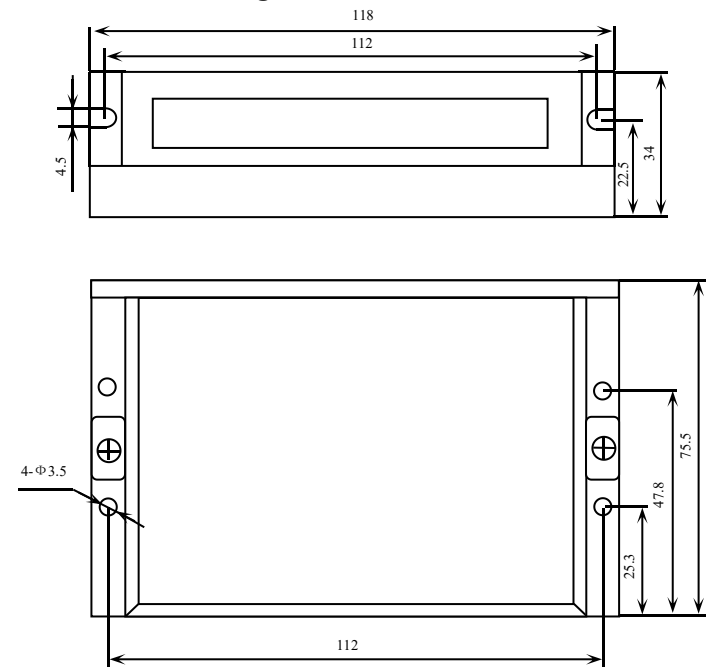## 2. Electrical, mechanical and environmental indicators

1. Electrical indicators

Instruction	JKD7208S			
	Minimum	Typical	Maximum	Unit
The output current	0.1	-	7.2	A
Input voltage	24	48	75	VDC
Control signal input current	6	10	16	mA
Control signal interface	4.5	5	28	Vdc

level				
Input signal minimum pulse width	1.5	-	-	us
Stepper pulse frequency	0	-	200	KHz
Insulation resistance	100			MΩ

2. Using environment and parameters

Cooling method		Natural cooling or forced air cooling
Using environment	occasion	Can not be placed next to other heating equipment, should avoid dust, oil mist, corrosive gas, too big humidity and strong vibration place, prohibit to have combustible gas and conductive dust
	temperature	-5℃ ～ +50℃
	humidity	40 ～ 90%RH
	vibration	5.9m/s2MAX
Storage temperature		-20℃～80℃
Using altitude		Below 1000 metres
Weight		About 280 g

3. Mechanical installation diagram

Drawing 1   Installation dimension diagram (Unit:mm)

※**It is recommended to use side installation, better heat dissipation effect, please consider the size of the terminal and wiring when design the installation dimensions.**

4. Enhanced heat dissipation

1）Driver's reliable working temperature control in 66 ℃, the motor's working temperature control in 85 ℃

2）We suggest automatic half stream mode,when the motor is stopped and the current is reduced by half to reduce the heating of the motor and actuator

3）When installing the driver, use vertical side installation to make the cooling tooth form a stronger air convection. The fan shall be installed near the actuator in the time necessary to heat the heat and ensure that the driver works in the range of reliable working temperature.

3. Drive Interface and Wiring Introduction

### 1. Interface description

1）Control signal interface circuit

Name	Function
PUL+ PUL-	Pulse signal: pulse rising edge is effective; In PUL high level,voltage is 4.5 ~ 28Vdc, and the low level, voltage is 0 ~ 0.5v. In order to reliably respond to the pulse signal, the pulse width should be greater than 1.5μs
DIR+ DIR-	Direction signal: high/low level signal, to ensure reliable commutation of motor, directional signal should be established before the pulse signal at least 2μs. The initial direction of the motor is connect to motor wiring, change winding (e.g., A +, A - exchange) can change the direction of the motor running, In DIR high level,the voltage is 4.5 ~ 28 VDC,in low level,voltage is 0 ~ 0.5 V.
ENA+ ENA-	Enable signal: this input signal is used to enable or prohibit. ENA+ connect 4.5 ~ 28Vdc, ENA- connect low level (or internal optical coupling), the actuator will cut off the electrical current to keep the motor in a free state and the stepper pulse is not responsive. When this function is not required, the enable signal can be suspended.

2）High voltage interface

Name	Function
GND	DC power grounding
+Vdc	DC power positive, dc 24~75 VDC, recommended for 48Vdc.
A+、A-	Motor A phase coil interface
B+、B-	Motor B phase coil interface

3）232 Communication interface

It is possible to connect a PC or STU debugger with a dedicated serial cable, and forbid charged plug. Through STU or the PC software ProTuner, the subdivision and current value, effective edge and single double pulse all can be set, and can also be used for the elimination and adjustment of the resonance point.
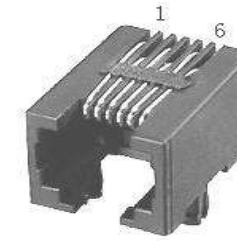
Drawing 2　RS232 Interface pins are defined

Terminals No.	Signal	Name	Instruction
1	NC		
2	+5V	5V positive of power supply	Only by external STU
3	TxD	RS232 sender	
4	GND	5V power grounding	0V
5	RxD	RS232 receiver	
6	NC		

Note: JKD7208S and PC, text display or STU servo debugger connection cable must be special cable,please confirmwith us before use.

4）Status indication

Green LED is the power indicator, when the driver connect to the power supply, the LED is light; When the driver cuts off the power, the LED is off. The red LED is the fault indicator, and when there is a failure, the indicator will blink in a cycle of three seconds. Red LED is off when the fault is removed by the user. Red LED flashing times in 3 seconds representing different fault information. Showing in the following table:

| No.	Flashing times	Red LED flashes	Fault Description
1	1		Overcurrent or short circuit fault
2	2		Overvoltage fault
3	3		No definition
4	4		Motor opening or contact malfunctioning

2. Control signal interface circuit

JKD7208S drives using a differential interface circuit applicable for difference signal, single-ended common cathode and single-ended anode interface, such as built-in high-speed photoelectric coupler, allows receive long-term driver, open collector and PNP output circuit signal. In bad environment, we recommend a long - line driver circuit with strong anti-interference ability.

Now take the collector open and PNP output as an example, the interface circuit diagram is as follows:

Co-anode connection Co-cathode connection

Drawing 3 Input interface circuit
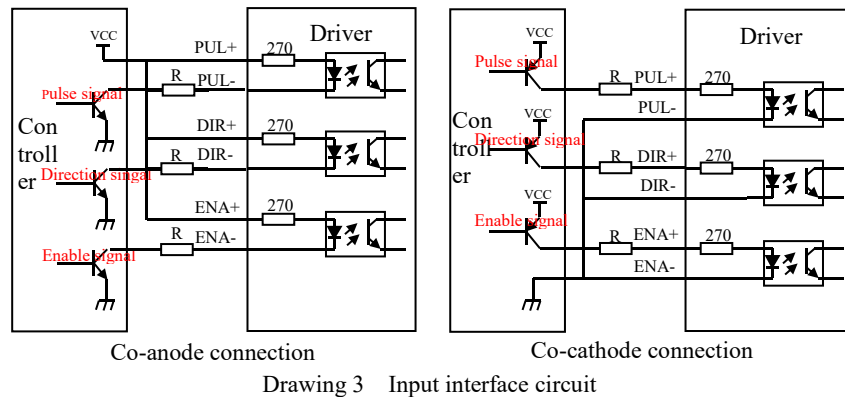
Remark：VCC value is 4.5～28Vdc，R short connection or no connection.

3. Control signal timing diagram

To avoid some missteps and errors, PUL, DIR, and ENA should meet certain requirements:

Drawing 4 Control signal timing diagram
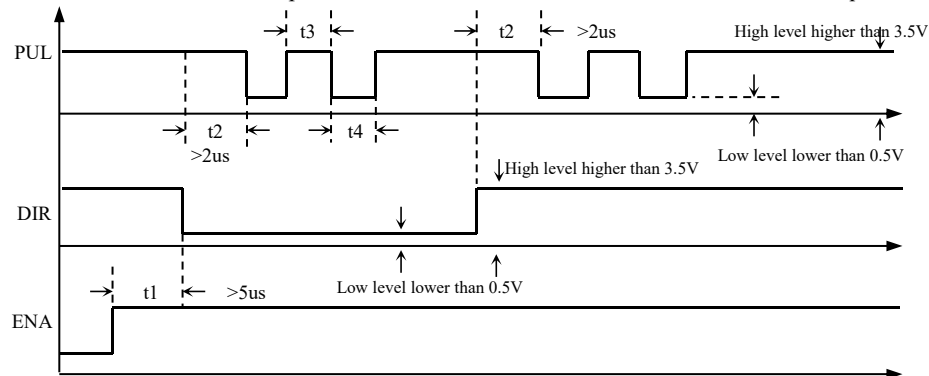
Remark：

1）t1：ENA（enable signal）DIR should be ahead of at least 5μs, identified as high. Under normal circumstances,we suggest ENA＋ and ENA- can be vacant.

2）t2：DIR at least 2μs early than PUL falling edge to determine its status is high or low

3）t3：The pulse width is not less than 2μs

4）t4：Low-level width is no less than 2μs.

4. Control signal mode setting

Pulse Trigger Edge and Single / Double Pulse Selection: Trigger on rising or falling edge of pulse by PC software ProTuner software or STU debugger. It is also possible to set single pulse mode or double pulse mode. In dual pulse mode, the signal on the direction control terminal must be held high or floating.

5. Wiring requirements

1) In order to prevent the driver from being disturbed, it is recommended that useshielded cable for the control signal and the shielding layer should be connect to the ground. Unless otherwise specified, the shielding wire of the control signal is connected to the ground. One end of the shielded cable is grounded. One shielded cable end of the drive is vacant. The same machine only allows grounding at the same point, if it is not a true ground wire, the interference may be serious, then the shield is not connected.

2) The pulse and direction signal lines and the motor lines are not allowed to be tied together side by side, it is better to separate at least 10cm or more. Otherwise, the motor noise may easily disturb the pulse direction signal to cause the motor to be inaccurate and the system unstable.

3) If a power supply for multiple drives, parallel connection should be taken at the power supply, not allow one first to another chain-like connection.

4) It is strictly forbidden to pull the plug of the driver with strong power P2 terminal. When the charged motor stops, a large current will flow through the windings. Plugging and inserting the P2 terminal will result in a huge inductive electromotive force that will burn the driver.

5) It is forbidden to connect the lead wire with tin to the access terminal. Otherwise, the terminal may be damaged due to overheated by the larger contact resistance.

6) The wiring terminals can not be exposed outside the terminals, in case of accidental short circuit and damage the driver

4. Current, subdivision dial switch settings and parameter self-tuning

JKD7208S driver adopts the eight dialing switch to set the subdivision precision, the dynamic current, the static half current and the self-tuning of the motor parameters and internal adjustment parameters. Detailed description as follows:

Dynamic current setting   Subdivision accuracy setting

SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
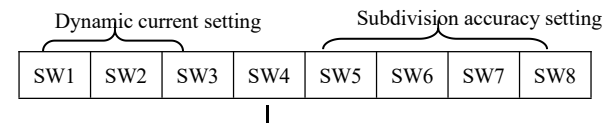
Half - flow/full flow mode setting/parameter self-tuning

1．Current setting

1）Working (dynamic) current setting

Output peak current	Output average current	SW1	SW2	SW3	Current self-setting
Default[2.0A]		on	on	on	When SW1, SW2, SW3 are set to off off off, the required current can be set by PC software,max 7.2 A, resolution 0.1 A. Default current is 2 A without setting
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	

2）Static current setting

Static current can set by SW4 DIP switch settings, off means the static current is set to half of dynamic current, on means static current and dynamic current is the same. SW4 should be set to off for general use, can reduce the heating of the motor and the driver. About 400ms after the pulse train stopped it will automatically reduced to half current (60% of the actual value), the heat will reduced to 30% theoretically .

2. Subdivision setting

Step/Rev.	SW5	SW6	SW7	SW8	Subdivide description
400	on	on	on	on	Subdivision Description: The driver subdivision adopts the internal default subdivision. Users set the subdivision number through the PC software ProTuner or STU debugger, the minimum value is 1, the resolution Is 1, the maximum is 51200.
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	

3. Parameter self-tuning function

If switch the SW4 back and forth within 1 second, the driver can auto-complete the motor parameters and internal parameters adjustment; when the conditions like motor, supply voltage changes, please conduct a self-tuning, otherwise, the motor may not run normal. Note that the pulse can not be input at this time and the direction signal should not change.

Method 1:SW4 from on to off, and then off back to on in 1 second;

Method 2: SW4 from off to on, and then by the dial back to off within 1 second.

Note: This model has power-on auto tuning function.

5. Power supply options

JKD7208S can working normally in the specified range of voltage, and use non-regulated DC power supply is best, also can use transformer reduction + bridge rectifier + capacitor filter. However,should notice that voltage ripple peak value after rectifier should not exceed its maximum specified voltage. It is recommended that users use DC voltage lower than the maximum voltage to supply power and avoid the fluctuation of power grid beyond the working range of driver voltage.

If using a regulated switching power supply, be aware that the output current range of the switching power supply needs to be maximized.

Please note:

1) When wiring, pay attention to the positive and negative poles of the power supply.

2) Best use non-regulated power supply;

3) When using non-regulated power supply, the power supply current output capacity should be greater than 60% of the driver set current;

4) When use regulated switching power supply, the output current of the power supply should be greater than or equal to the working current of the driver;

5) To reduce costs, two or three drives can share a power supply, but should ensure that the power supply is large enough.

6. Motor matching

JKD7208S can be used to drive 4,6,8-wire two-phase, four-phase hybrid stepper motor, step angle of 1.8 degrees and 0.9 degrees are both applicable. When selecting a motor, it is mainly determined by the torque of the motor and the rated current. The size of the torque is mainly determined by the motor size. The motor torque is large for large size; and the current is mainly related to the inductance, small inductance motor has high speed performance, but the is current larger.

1. Motor selection

1）Determine the load torque, transmission ratio operating speed range

$T_{电机}=C（J\varepsilon+T_{负载}）$

J：Moment of inertia of the load　　　ε：The maximum angular acceleration of the load

C：Safety factor, recommended value 1.2-1.4

$T_{负载}$：The maximum load torque, including the payload, friction, transmission efficiency and other resistance torque

2）The motor output torque is determined by what factors

For a given stepper motor and coil connection, the output torque has the following characteristics：

● The output torque will increase by actual current increase, but the motor copper loss more (P

= I2R), and the motor heat more;

●The higher the supply voltage of driver, the greater high speed torque of motor;

●The torque-frequency characteristics of the stepper motor shows that the torque in high-speed is smaller than low-speed.
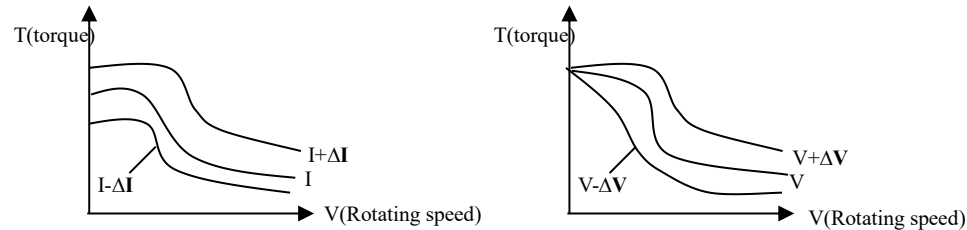
Drawing 5　Frequency characteristics drawing

2.Motor wiring

For 6, 8-wire stepper motor, different coil connection of the motor,the performance is quite different, shown as below:
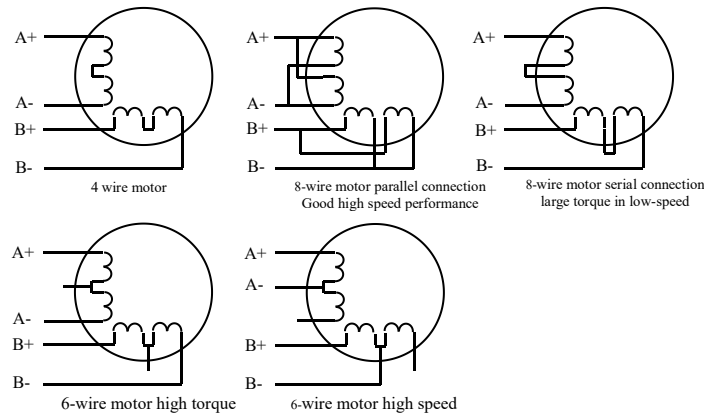
Drawing 6　Motor wiring drawing

3.Input voltage and output current selection

1）Power supply voltage setting

In general,Supply higher voltage, the motor torque will bigger at high speed,and can better avoid lost stepat high speed. But on the other hand, too much voltage can cause overvoltage protection, more motor heat and even damage the driver. When working at high voltage, the motor will vibrate bigger at low speed.

2）Output current setting

For the same motor, the greater the current setting, the greater the motor output torque will be, but the motor and drive will heat more. The heat not only detemined by the current setting, but also relate to the type of exercise and stay time The following setting method refer to the current of the stepper motor, but the best value in practical application should be adjusted on this basis. In principle, if the temperature is very low (<40 ℃), the current should be increase for increase the motor output power (torque and high speed response).

● Four-wire motor: the output current is set equal to or slightly less than the motor rated current value;

● Six-wire motor high torque mode: the output current is set to 50% of the motor unipolar connection rated current;

● Six-wire motor high-speed mode: the output current is set to 100% of the motor unipolar connection rated current;

● Eight-wire motor series connection method: the output current can be set to 70% of motor unipolar connection rated current;

● Eight-wire motor parallel connection method: the output current can be set to 140% of motor unipolar connection rated current.

△Note: After setting the current, please run the motor for 15 to 30 minutes. If the temperature is too high (> 70 ℃), reduce the current. Therefore, the general situation is to set the current value in the situation that the motor working long-term appears warm but not too hot.

7. Typical connection example

JKD7208S with 86HS45 series and parallel connection method (if the motor is different from the desired direction of rotation, only need exchange A +, A-), JKD7208S driver can drive four-, six- or eight-wire two-phase / four-phase motor. The following figure is detail of the 4-wire, 6-wire, 8-wire stepper motor connection:
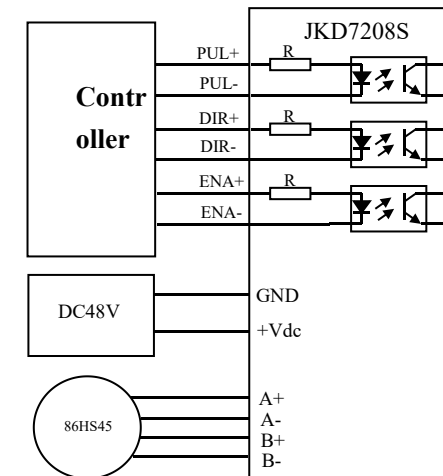

Drawing 7　JKD7208S match with

Remark：

1）Different motor has different color of motor lines,please refer to motor data,For example,57 and 86 motor line color is different.

2） Phase is relative, but the different phase windings can not be connected to the same phase terminal of the driver (A +, A- is one phase, B +, B- is another phase), 86HS45 motor lead definition, string, and the connection method show as follows:

(a) Lead definition   (b)Series connection   (C)Parallel connection
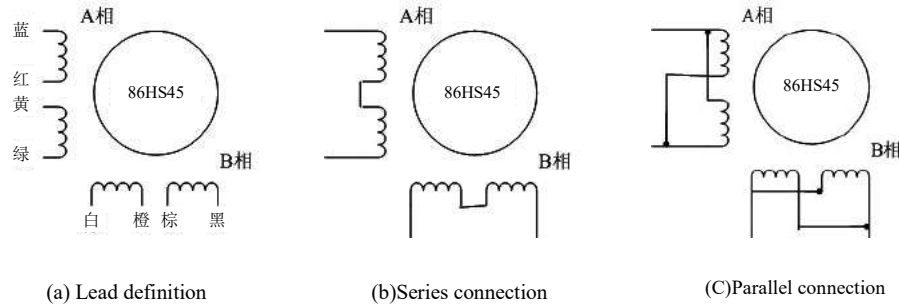
Drawing 8   86 motor serial and parallel

3) JKD7208S drives can only drive two-phase hybrid stepper motor, can not drive three-phase and five-phase stepper motor.

4) How to determine the stepper motor series or parallel connection method is correct or not: without connect to the driver, use hand directly to rotate the motor shaft, if you can easily and evenly rotate the wiring means it's correct, if you encounter greater resistance and Uneven and accompanied by a certain sound meanswrong wiring.

8. Protective function

1) Short circuit protection

When a short circuit occurs or the internal of driver over-current, the red light of driver flashes 1, and repeated flashing within 3 seconds. At this time must clearing of fault, re-power and reset.

2) Over-voltage protection

When the input voltage is higher than 92V of JKD7208S, the driver flashes red light 2 times, and repeated flashing within 3 seconds. At this time must clearing of fault, re-power and reset.

3) Motor open circuit protection

When the motor in open circuit or not connected, the driver red light flashes 4 times, and flashes repeatedly within 3 seconds. At this time must clearing of fault, re-power and reset.

> △ **Remark** ：Since the drive does not have the power supply reverse polarity protection function, so before power again make sure the positive and negative power supply wiring is correct. Reverse polarity will lead to burn the fuse in the driver!

9. Common problems

1. common problems and solutions in application

Phenomenon	Possible problems	Solutions
Motor not running	Power light is off	Check the power supply circuit, normal power supply
	Motor shaft has torque	The pulse signal is weak and increase the current to 7-16mA
	Too small subdivision	Choose right subdivision
	If the current setting too small	Choose right current
	Driver is protected	Re-power
	The enable signal is low	This signal is pulled high or not connect
	No responsive to control signal	No powered
Motor direction error	Wrong wiring of motor	Exchange any two lines of the same phase of the motor (eg A +, A-exchange connection positions)
	Motor circut is open	Check and connection right
Alarm indicator light	Wrong wiring of motor	Check the wiring
	Voltage is too high or too low	Check the power supply
	Motor or driverdamaged	Change the motor or driver
Wrong position	The signal is disturbed	Eliminate interference
	No connect grounding	Grounding right
	Motor circut is open	Check and connection right
	Wrong subdivision	Set right subdivision
	Small current	Increase the current
The motor can't run when acceleration	Acceleration time is too short	Acceleration more time
	Too samll motor torque	Select a large torque motor
	Low voltage or current is too small	Increase the voltage or current

2. Driver FAQ

1）What is a stepper motor and stepper driver?

Stepper motor is a special motor for precise control of speed and position. It rotates at a fixed angle (called "step angle") step by step, so called stepper motor. It is characterized by no cumulative error. It receives every pulse sent from the controller and drives the motor at a fixed angle by the driver. Therefore, it is widely used in various open-loop control.

The stepper driver is a kind of power amplifier that can make the stepper motor operation. It can convert the pulse signal from the controller into the power signal of the stepper motor. The

speed of the motor is proportional to the pulse frequency, so that control pulse frequency can be precisely adjusted speed, and control the pulse can precise positioning.

2）What is the subdivision of the driver? What is the relationship between the speed and the pulse frequency?

Stepper motor due to its own unique structure, the factory are marked with "motor inherent step angle" (such as 0.9°/1.8°, means half-step work every step of the turn angle is 0.9°, the whole step is 1.8°). However, in many precise control and occasions, the whole step angle is too large, which affects the control accuracy and the vibration is too large. Therefore, it requires many steps to complete an inherent motor step angle, which is called subdivision drive and the electronics which can realize this function are called subdivided drivers.

$$V = \frac{P*\theta e}{360*m}$$

V：Motor speed（r/s）   P：Pulse frequency（Hz）
θe：Motor inherent step angle   m：Subdivision (whole step is 1, half step is 2)

3) What are the advantages of subdivision driver?

● Increasing step uniformity by reducing the step angle,so that can improve the control accuracy.

● Can greatly reduce the motor vibration, low-frequency oscillation is the inherent characteristics of the stepper motor, using of subdivision is the best way to eliminate it.

● can effectively reduce the torque ripple, increase the output torque.

These advantages are generally recognized by the user, and bring them benifits, so we recommend use subdivision driver.

4) Why does my motor only operate in one direction?

● The direction signal may be too weak, or the wiring polarity is wrong, or the signal voltage is too high, burnout direction current limiting resistor.

● Pulse mode mismatch, signal is pulse / direction, driver must be set to this mode; drive must be in the same mode if the signal is CW / CCW (double pulse mode), or the motor will run in only one direction.

JKONGMOTOR warranty terms

Except situation from warranty

■ Improper wiring, such as power supply polarity reversal, plug or unplug the motor leads when power on.

■ Exceeding electrical and environmental requirements

■ Change the internal device without authorization.

■ Poor cooling environment

Maintenance process

Need to repair the product, follow the procedure below:

(1) Contact our customer service to get the repair permission.

(2) Attached the written description of the failure of the driver or pictures and your connection dtail with the problem products.