Kinco® Stepper Driver CM Series

User Manual V1.1

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To be the partner of your success

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1. Safety Precautions

● Before open the driver's housing, must wait for more than 1 minute after power off. Make sure the indicator is off or the voltage is less than 36VDC, otherwise it will be risk of electric shock.

● Never connect wires while the driver and the motor are working, otherwise, the electric shock may occur.

● Don't open the drive housing when the power is on.

● Do not attempt to service the equipment yourself. Servicing by a qualified professional is required.

● Please take the time to follow the instructions carefully. It will help you set up and operate your system properly and enjoy all of its advanced features. Must be securely grounded with the cross section of the ground cable not less than 1.25 mm² for drive.

● Do not insert any object into the driver.

● Any fault occurs to the driver, please return it to repair center. Opening the driver without authorization or misoperation may cause damage the drive and the warranty will be void.

● As for Disposal of your old driver, can be recycled and reused. Or disposed it following standard of industrial waste.

⚠ **Statement:**

● When this driver is applied in mechanical instruments where personal safety is directly involved, be sure to install proper fault-proof devices to avoid the possibility of personal injury.

● Electronic devices are not permanently reliable! Please make sure personal and equipment safety in case of a failure. The users must be liable for any loss resulting from equipment fault or misoperation of the driver.

2. Product Overview

2.1 Product Acceptance

Table 2-1 Packing list

Packing list	
Item	**Qty.**
Driver	1 pcs
Service guide	1 pcs
User Manual	1 pcs
Length 8mm diameter φ1.0mm insulated terminals	6 pcs
Length 15mm diameter φ1.5mm insulated terminals	6 pcs

2.2 Product Model Description

2 CM 5 60 ☐

2	2-Phase Motor Driver
3	3-Phase Motor Driver
None	2&3Phase Motor Driver

| A | IO Version |

| 60 | Output phase current |

CM	Compact Micro-step
M	Micro-step
H	Full-half step

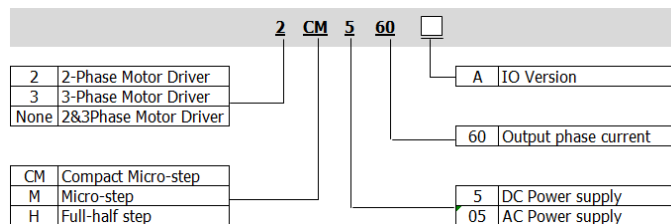| 5 | DC Power supply |
| 05 | AC Power supply |

Fig.2-1 Product Model Description

2.3 Product Functions

● **Motor auto adaptation:** When motor parameters detection function is enabled, the driver will automatically detect the electrical parameters of the motor which connected with the driver every time after drive power on, and automatically adjust the drive parameters according to the detected motor status to deliver the optimum driving performance. If users don't want to detect motor parameters every time, please disable it according to Table 3-7.

● **Phase memory:** The driver will keep the phase of the motor in the case of power failure with the motor. It prevents the error caused by motor jitter upon power-on on some application occasions. The kept phase will be lost if the motor is replaced or the motor still rotates after the driver stops.

● **Auto-half current:** After the motor stops rotation and locks tight, the driver will reduce the phase current of the motor by a half in 1.5 seconds in order to cut down the heat generated by the motor, theoretically, by 25%.

● **Trail running:** If the driver has been set up as this status, it will automatically drive the motor at 80RPM. the output current are the peak value (0.8A for 2CM525:2A for 2CM545,3A for 2CM560,3A for 2CM560,3A for 2CM860, 4A for 2CM880,4A for 3CM880)and the subdivision setting becomes invalid. This function is used to check whether the driver status is normal.

● **PLS+DIR and CW/CCW compatible input:** The control signal input port of the driver supports "PLS + DIR" control and "CW/CCW" control.

● **Over-voltage alarm:** The driver will generate a high-voltage alarm if the bus voltage exceeds 85VDC. Turn off the power supply in time and reboot the driver to clear the alarm. If the over-voltage alarm occurs frequently, it is recommended that the input voltage be tuned down.

● **Over-current alarm:** The driver will show you over-current protection in the case of short-circuit or wrong wiring of the motor, in order to prevent the damage of your driver, please turn off the power supply in time when you find over-current alarm, or check the motor wiring if the reason is caused by motor, just need reboot the driver to clear the alarm.

● **Under-voltage alarm:** The driver will generate a low-voltage alarm if the DC bus voltage goes below 15 VDC. To clear the alarm, reboot the driver.

● **Overheat alarm:** The overheat alarm will apper if the internal temperature reaches 85°C.When the temperature decrease to 70°C,the alarm will be clear after rebooting it.

2.4 Scopes of Application

The drivers are applicable to various medium and small automation equipment, including engraving machines, and numerical control machine tools and so on. They are ideal choices for users in search of low vibration, low noise, high accuracy, and high speed.

3. Product Specifications and Installation

3.1 Product Specifications

Table 3-1 Electrical specifications

Specification	2CM525	2CM545	2CM560	2CM860	2CM880	3CM880
Input voltage	24-50VDC			24-70VDC		
Output current(peak, Unit: A)	0.3～2.5	1～4.5	1.8～6	1.8～6	2.4～8	2.4～8
Micro step(Unit: Pulse/rev)	200	200	200	200	200	400
	400	400	400	400	400	500
	...	...	...	...	...	...
	25600	25600	25600	25600	25600	25600
Control mode	PLS+DIR; CW/CCW					
Input signal PLS/DIR/FRE	Voltage: 5～24VDC.Current: 8mA@5VDC.12mA@24VDC Effective input signal: >3VD, Invalid input signal: <1.5VDC Max. Frequency for PLS,DIR: 400kHz.Min.pulse width: 1us					
Output signal ERR	Max.current:100mA. Max. voltage: 30VDC, Max. voltage drop: 0.8VDC@100mA					
Protection	Over-voltage(>85VDC), under-voltage (<15VDC), over-current, overheat (>85℃ Temperature of thermistor)					

Table 3-2 Operating Environment and Specifications

Cooling method		Nature air cooling
Environment	Operation environment	Avoid the environment with great amount of metallic
	Operation humidity	<85%, RH (non-condensing or water drops)
	Operation temperature	0℃～+40℃
	Storage temperature	-20℃～+70℃
Net Weight	2CM525 & 2CM545 2CM560 & 2CM860	250g
	2CM880 & 3CM880	253g
Gross Weight	2CM525 & 2CM545 2CM560 & 2CM860	330g
	2CM880 & 3CM880	333g
Dimensions	2CM525 & 2CM545 2CM560 & 2CM860	118*75.5*25.4mm
	2CM880 & 3CM880	118*75.5*34mm
Protection Class		IP20

3.2 Description of Terminals

The terminals of the driver are divided into three types: control signal port, motor power cable port, and power supply port. The control signal port supports differential signal, NPN and PNP. It inbuilt optocoupler isolation for anti-interference in environments. The definitions of the driver ports are detailed below:

Table 3-3 Definition of Control Signal Port

Signal	Function Description
PLS+（CW+）	In the PLS+DIR control signal mode, the signal is the pulse control signal and the rising edge is effective.In the CW/CCW control signal mode, the signal is the forward rotation control signal and the rising edge is effective.
PLS-（CW-）	
DIR+ (CCW+)	In the PLS+DIR control signal mode, the signal is direction control signal, and the driver sets the rotation direction of the motor by detecting the level of this signal. The signal value of the effective moment in the rising edge of pulse signal. In the CW/CCW control signal mode, the signal is the reverse rotation control signal and the rising edge is effective.
DIR- (CCW-)	
FRE+	This signal is offline signal. If the signal is at a high level, the driver turns off the power supply for the motor, and the motor rotor turns into Free status (Offline).
FRE-	
ERR+ ERR-	Alarm output signal. This signal port is passive optocoupler output port for open collector. When the driver has an exception alarm or power failure alarm, this signal port will not output signal(level determined by the external circuit).Reverse wiring is forbidden, or it will destroy the internal circuit.

Table 3-4 Definition of Motor Power Port

2 phase	3 phase	Function Descriptions
A+	U	For 2 phase motor, if swapping the wires of A+/A- or B+/B-,it can change the motor direction. For 3 phase motor, if swapping wires of U,V,W,it can change the motor direction.
A-	V	
B+	W	
B-	NC	
GND		Power supply for driver.
Vdc+		

3.3 Wiring Diagram

● The input circuits of all control signals of the driver have been reliably isolated by optocoupler elements, which minimize the interference from external electrical noises.

● If driver work in the strong interference field, advice to use the twisted-pair wiring to reduce the interference signal source.
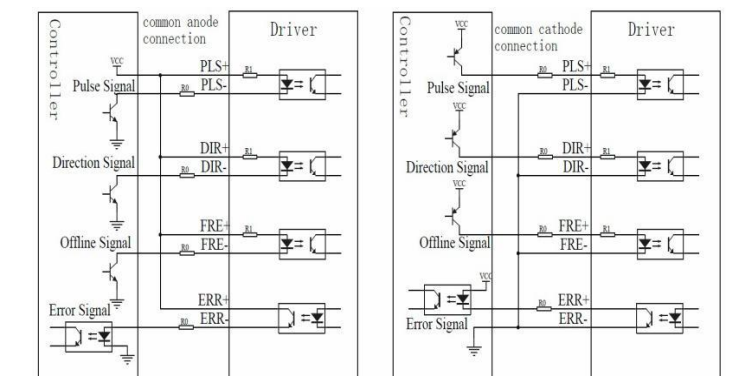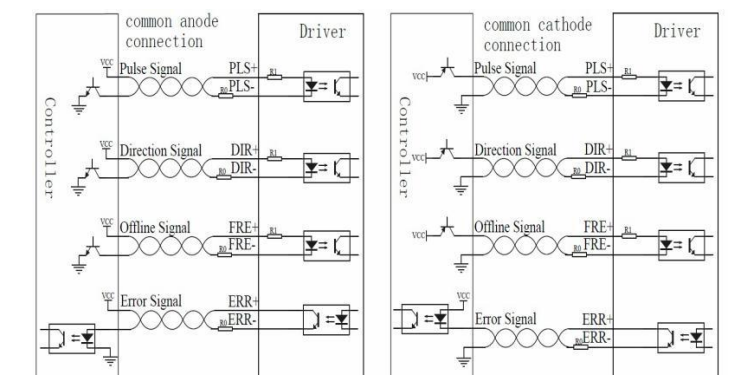

Fig.3-1 General Way Control Signal Wiring Diagram

Fig.3-2 wisted-pair Way Control Signal Wiring Diagram

⚠ **Precautions on Control Signal:**

- In order to avoid disturbance when you connect the driver, please follow the isolated rules both for strong and weak voltage, the distance from the power cable to the motor cables is 10cm at least.
- It is recommended that the twisted pairs be adopted for control signal cables for the driver, and the shielding layer be grounded reliably (to the true ground of the driver and equipment).
- Due to endurance of heavy current, conductors with cross-section no less than $1mm^2$ are recommended for the motor cabling, or even thicker ones as appropriate. Put an insulated terminal on the Motor cabling, it can reduce the contact resistance between motor and driver.
- It is strictly forbidden to connect wires while the power is on; otherwise, it may cause equipment damage and personal injury. Please note that the power cable of the motor still carries heavy current even if the motor is in the locked status.

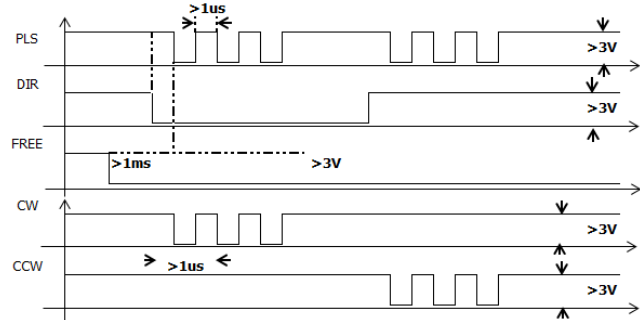## 3.4 Control Signal Sequence Diagram

Fig.3-3 Control signal sequence diagram

⚠ Precautions on Control Signal
- Direction signal is forbidden to change during the time of pulse signal rise.
- FREE signal shall be set up as 1ms earlier than a pulse signal.
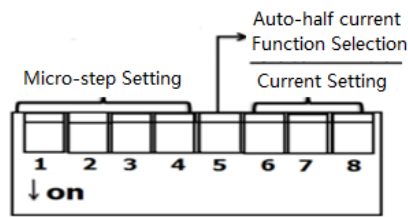
3.5 DIP Switch Settings

Fig.3-4 DIP Switch Settings

Table 3-5 Micro-step settings（Unit: Pulse/rev）

2CM525 &2CM545 2CM560 &2CM860 2CM880	3CM880	SW1	SW2	SW3	SW4
200	400	ON	ON	ON	ON
400	500	OFF	ON	ON	ON
800	600	ON	OFF	ON	ON
1600	800	OFF	OFF	ON	ON
3200	1000	ON	ON	OFF	ON
6400	1200	OFF	ON	OFF	ON
12800	2000	ON	OFF	OFF	ON
25600	3000	OFF	OFF	OFF	ON
1000	4000	ON	ON	ON	OFF
2000	5000	OFF	ON	ON	OFF
4000	6000	ON	OFF	ON	OFF
5000	10000	OFF	OFF	ON	OFF
8000	12800	ON	ON	OFF	OFF
10000	20000	OFF	ON	OFF	OFF
20000	25600	ON	OFF	OFF	OFF
NA	NA	OFF	OFF	OFF	OFF

range.

Table 3-6 Current Setting (Unit: A)

2CM525		2CM545		2CM560 2CM860		2CM880 3CM880		SW6	SW7	SW8
Peak	RMS	Peak	RMS	Peak	RMS	Peak	RMS			
0.3	0.2	1.0	0.7	1.8	1.3	2.4	1.7	OFF	OFF	OFF
0.6	0.4	1.5	1.1	2.4	1.7	3.2	2.3	ON	OFF	OFF
0.8	0.6	2.0	1.4	3.0	2.1	4.0	2.8	OFF	ON	OFF
1.2	0.8	2.5	1.8	3.6	2.5	4.8	3.4	ON	ON	OFF
1.4	1.0	3.0	2.1	4.2	3.0	5.6	4.0	OFF	OFF	ON
1.6	1.1	3.5	2.5	4.8	3.4	6.4	4.5	ON	OFF	ON
2.0	1.4	4.0	2.8	5.4	3.8	7.2	5.1	OFF	ON	ON
2.5	1.8	4.5	3.2	6.0	4.2	8.0	5.7	ON	ON	ON

Table 3-7 DIP Switch Setting

Function	DIP Switch Setting	Descriptions
PLS+DIR	SW6,SW7=ON Others are OFF	
CW/CCW	SW7,SW8=ON Others are OFF	
Micro-step smooth(Dynamic) filter disable	SW5,SW6=ON Others are OFF	Set up the DIP switch after driver power off. After finishing settings, power on the driver, the indicator of driver will be "RUN" led is blinking slowly. "ERR" led is always on.
Micro-step smooth filter enable	SW5,SW7=ON Others are OFF	
Micro-step dynamic filter enable	SW5,SW8=ON Others are OFF	
Motor auto Adaption disable	SW6,SW7,SW8=ON Others are OFF	
Motor auto adaption enable	SW5,SW6,SW7=ON Others are OFF	
Test running	SW6,SW8=ON Others are OFF	Motor runs at speed 80RPM.
Auto-half current	SW5=ON,Or SW5=OFF	Set it as ON to enable auto-half current function. Then when the motor stops for 1.5s,it will decrease the current to half of setting current. Set it OFF to disable auto-half current function.

⚠ **Precautions on DIP switch:**
- **It is set as PLS+DIR mode by default.**
- Micro-step smooth filter will show you the advantage to run the motor smoothly. Dynamic filter is improved based on smooth filter, it can make motor run more smoothly at low speed (such as 10rpm). Micro-step smooth (or dynamic) filter will reduce motor's response speed. If the requirement of the field application about motor response speed is too high as CNC machine, suggested to stop use micro-step filter to short the time of reaching position. **Micro-step smooth filter is enable by default.**
- **Motor auto adaption function is enable by default.** It will test motor parameters every time when driver power on. If users don't want to test motor parameters every time, they can set SW6, SW7, SW8 as ON and others as OFF when power off, then it will test motor parameters when power on at the first time and store the parameter in memory. After that, it will not test motor parameters again when driver power on.

3.6 Mechanical Dimension and Installation Precautions

⚠ **Installation Precautions**
- Recommended that the driver is mounted as side and kept by upright position, in order to maintain the environment as well.
- For better heat dissipation, two drivers shall be installed at a clearance of at least 30mm.
- With an ingress protection class of IP20, the driver shall be installed in an industry-compliant indoor environment and electrical cabinet or it may cause damage to the driver or personal injury.
- Enhanced heat dissipation is required if the driver generates overheat alarms frequently. A fan can be installed in a position close to the driver for forced cooling and heat dissipation, in order to ensure the driver works in an allowable temperature
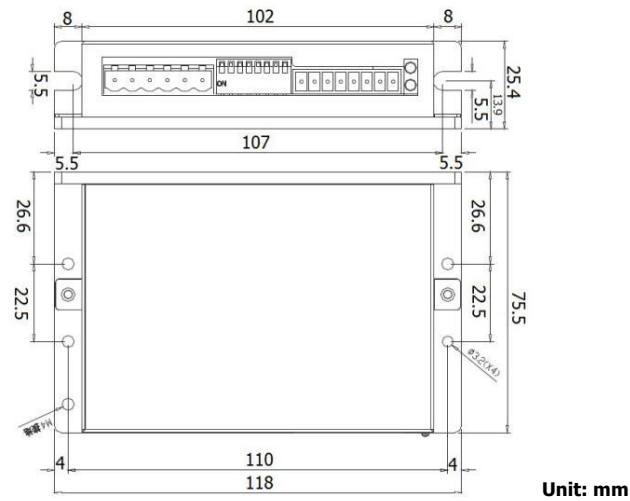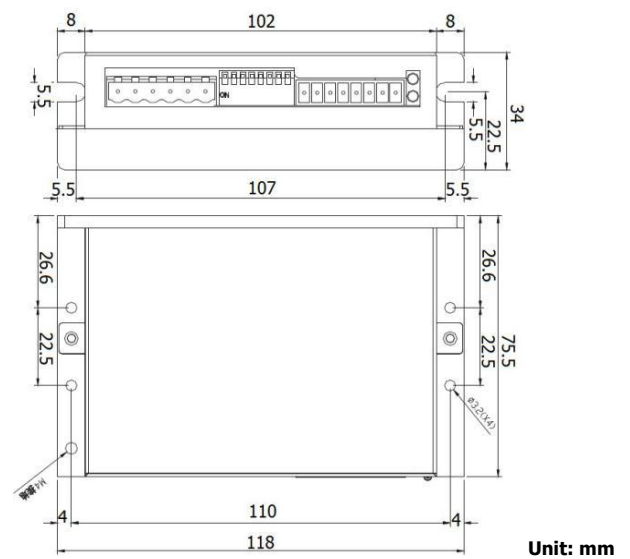

Fig.3-5 Dimensions of 2CM525_2CM545_2CM560_2CM860

Fig.3-6 Dimensions of 2CM880_3CM880

4. FAQ

4.1 Descriptions of Driver Indicators

Indicator		Alarm	Reason	Solution
RUN	ERR			
Off	Off	Power failure	There is no power inside driver	Check power supply
Off	Blink quickly	Over current	1.Motor phase wires short circuit. 2. Driver internal problem .	1.Check motor wiring. 2.Change driver.
Blink quickly	Blink quickly	Over voltage	1.Voltage of power supply is too high. 2.Stop motor in high speed.	1.Check power supply. 2.Add braking resistance.
Off	Blink slowly	Overheat	Internal temperature of driver is over 85 °C.	It needs to add assist heat-dissipation when environment temperature is over 40 °C.
Off	On	Under voltage	1.Voltage of power supply is too low. 2.Fast start.	1.Check power supply. 2.Decrease acceleration.
Blink slowly	On	DIP switch	DIP switch SW1～SW4 are set as OFF	Make sure DIP switch in proper position.
Blink quickly	On	Motor error	Motor is wrong connection or disconnect.	Check the motor wiring.
Blink quickly /slowly	On	EEPROM Error	Driver failure in reading data from EEPROM	Restart driver.If the problem can not be solved,then change driver.
On	Off	Normal		
Blink slowly	Off	Test running		

⚠ **Note:**
- Blinking slowly means blinking at 2S/time, and blinking quickly means blinking at 0.2S/time.
- To clear any alarm of the driver, it is necessary reboot the driver.
- Except for the normal running, test running mode, the driver ERR signal will output an effective signal.
- If any indication not covered in the above table occurs, please contact Kinco service person.

4.2 FAQ on the Driver and Stepper Motor

1. What is the max surface temperature for a stepper motor?
The high temperature will demagnetize the magnetic materials of a stepper motor and as the result, cause lower torque or out of step of the motor. Therefore, the max surface temperature of a stepper motor depends on the demagnetization point of different magnetic materials. For the motor as isolated class of B degree, the MAX demagnetization point of magnetic is 130℃, so it's normal if the surface temperature of motor remains at 80℃ - 90℃.

2.How to calculate output power of a stepper motor?
The output power varies with the rotation speed and measured by torque. The calculation formula is: $P=P=\omega*M$; $\omega=2\pi*n/60$, ω indicates the angular speed, M indicates the output torque.

3.How to calculate input power of power supply of the driver?
The input power is consist of its loss and output power, as $P=P1+P2$，P1 is about several Watt. P2 is $P3/A$,P2 is the output power of driver, and P3 is the output power of stepper motor. A is conversion rate (Approximately 77%). the input power is $P=P1+M*2\pi*n/(60*77\%)$, n is rotary speed (rpm), M is the output torque of motor (N.M).

4.What is the subdivision function of the driver intended for?
The subdivision function of a driver is a kind of electronic damping technology. Highlight it as 1) enhances the control accuracy due to the subdivision of step angles.2)Subdivision is the best method to suppress the low-frequency oscillation of the motor. 3) Can enhance the motor torque to some extent.

5.How to wiring for 4-wires and 8-wires motor?
For 4-wires and 8-wires stepper motor connecting, please refer following pictures. As for 8-wires, there are 2 kind of class to connect it, and the performance is different. (1)Parallel wiring will decrease the inductance of winding, suitable for high speed running. But it's requires bigger current to reach the target torque. (2)Series wiring will increase the inductance of winding, it's suitable for low speed running, requires the smaller current to reach target torque as following fig4-3 and fig4-4.
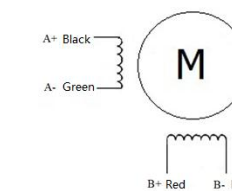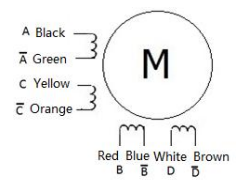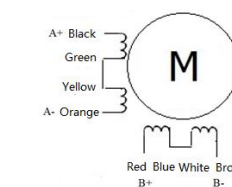

Fig.4-1 4-wires motor
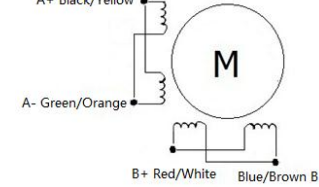

Fig.4-2 8-wires motor

Fig.4-3 Series wiring of 8-wires motor

Fig.4-4 Parallel wiring of 8-wires motor