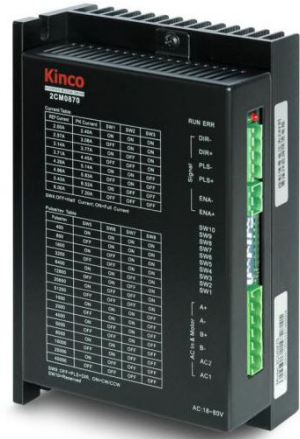# Kinco®Stepper Driver 2CM0870
User manual V1.0

Kinco Electric(Shenzhen) Ltd.
To be the partner of your success

Kinco 步科

1. Safety Precautions
- Observe safety precautions strictly.
- Use a multi-meter to verify that the voltage on the driver terminals is safe; otherwise, the electric shock may occur.
- Never connect wires while the driver and the motor are working; otherwise, the electric shock may occur.
- Do not remove the housing of the driver when the power is on or the driver is working; otherwise the electric shock may occur.
- To avoid personal injury and property loss, only qualified and service-trained personnel can operate the driver.
- Do not insert any object into the driver, which may cause damage to the equipment.
- If any fault occurs to the drive, please return the driver to the maintenance and repair center. Opening the driver without authorization or improper operation may cause damage to the driver. Removing the enclosure of the driver without authorization will void the warranty.
- The waste driver shall be disposed of as industrial waste to avoid environmental pollution.

⚠Statement：
- When this driver is applied in some mechanical instruments where personal safety is directly involved (e.g. nuclear power control, medical device, truck, train, airplane, amusement and safety devices), be sure to install proper fault-proof devices to avoid the possibility of personal injury.
- Electronic devices are not permanently reliable! Adequate safety measures must be taken to ensure 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
2-1 Packing list

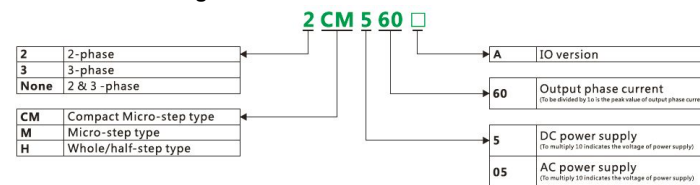| Packing list	
Article	Qty.
2CM0870 dirver	1pcs
After-sales Service Registration Form	1pcs
2PIN，4PIN，6PIN connector	1pcs for each
2kΩ metal film DIP resistor	3pcs

2.2Product naming rule

2 CM 5 60 □

2	2-phase
3	3-phase
None	2 & 3 -phase

CM	Compact Micro-step type
M	Micro-step type
H	Whole/half-step type

A	IO version
60	Output phase current (To be divided by 1o is the peak value of output phase current)
5	DC power supply (To multiply 10 indicates the voltage of power supply)
05	AC power supply (To multiply 10 indicates the voltage of power supply)

Fig 2-1 Naming rule

2.3Product Functions
AC voltage input: Built-in rectifier and bulk capacitor.

Motor auto adaption: The driver can automatically detect the electrical parameters (e.g., inductance and resistance) of the motor connected with the driver, trace the status of motor in real time, and automatically adjust the driver parameters according to the detected motor status to deliver the optimum driving performance. If no need to detect motor parameter for every time power on, please refer to sheet 3-7 to set DIP to disable this function.

Phase memory: The driver will keep the phase of the motor in the case of power failure with the motor. Therefore, 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.

Automatic half current function: Phase current will reduce to half of the set value after motor stop in 1.5s. This function helps to reduce heat dissipation of motor to 25%.

Test running: If the driver is set to this status, it will automatically drive the motor at a speed of 80RPM. At this time, the output current are the set value 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 signal and "CW/CCW" control signal input.

Over-voltage alarm: The driver will generate a over-voltage alarm if the internal bus voltage exceeds 160VDC. Turn off the power supply in time and reboot the driver to clear the alarm.

Over-current alarm: The driver will generate a over-current alarm in the case of short circuit or wrong wiring, so as to prevent driver from damage. In this case, turn of power supply in time and check the wiring of the motor. Reboot the driver to clear the alarm.

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

Overheat alarm: The driver will generate a overheat alarm if the internal temperature reaches 80°C.

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

3.Product Parameters and Installation
3.1 Product Parameters

Sheet 3-1 Specification

Parameter	2CM0870
Input voltage	18-80VAC
Output current (Peak, Unit:A)	2.4A-7.2A
Subdivision (Unit:Pulse/rev)	400
	800

	51200
Control mode	Pulse control: PLS+DIR, CW/CCW
Input signal PLS/DIR/ENA	Input voltage:5VDC, input current:5mA@5VDC Valid input signal: >4VDC, Invalid: ＜1.5VDC Max input freq of PLS,DIR signal: 400kHz Min pulse width: 1us
Protection	Over-voltage, over-current, under-voltage, over heat protection.
Over-voltage protection	>112VAC
Under-voltage protection	<15VAC
Overheat protection	>85℃(Temperature of thermistor)

Sheet 3-2 Operation Environment

Cooling method		forced cooling
Environment	Operation environment	Avoid the environment with great amount of metallic powder, oil mist, or erosive gases.
	Operation humidity	<85%, RH (non-condensing or water drops)
	Operation temperature	0℃～+40℃
	Storage temperature	-20℃～+70℃
Net weight	2CM0870	696g
Gross weight	2CM0870	807g
Dimensions	2CM0870	151*97.5*57.5mm
Ingress protection		IP20

3.2 Description of wiring terminals
Wiring terminals of the driver are divided into three types: control signal port, motor power cable port, and power input port.
The control terminal could accept 5V signal, single-end common-cathode or common-anode signal. Built-in opto-coupler could isolate external interference.

**Sheet 3-3 Definition of control signal interface**

Signal	Function description
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.
DIR+(CCW+)	In the CW/CCW control signal mode, the signal is the reverse rotation control signal and the rising edge is effective.
PLS-（CW-）	Pulse signal. In the PLS+DIR control signal mode, the signal is the pulse control signal and the rising edge is effective.
PLS+（CW+）	In the CW/CCW control signal mode, the signal is the forward rotation control signal and the rising edge is effective.
ENA-	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).
ENA+	

Sheet 3-4 Definition of strong power interface

2-phase	3-phase	Function description
A+	/	Phase A and phase B of motor. Users could change motor run direction by exchanging A+ and A-, or exchanging B+ and B-.
A-	/	
B+	/	
B-	/	
AC2		Power supply, AC:18-80
AC1		

3.3 Wiring Diagram
- The input circuits of all control signals of the driver have been reliably isolated through opto-coupler elements, which minimize the interference from external electrical noises.
- The twisted pairs are recommended as signal lines for enhancing interference immunity in environments with strong electromagnetic interference.
- When external 24V control signal is applied, a 2K ohm resistor should be connected in series.
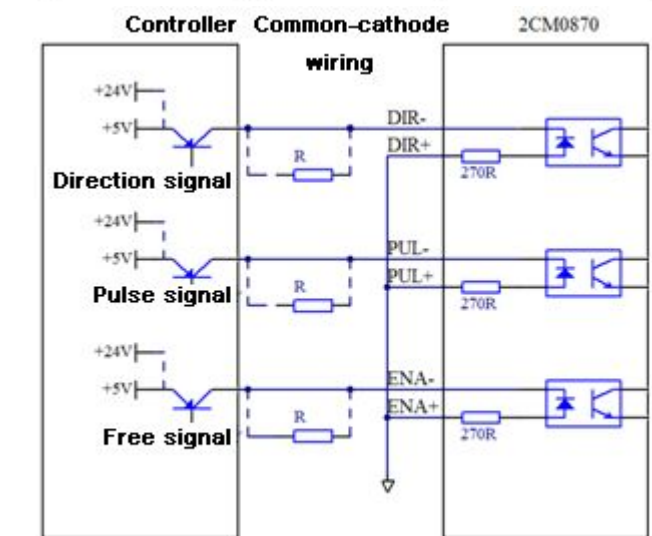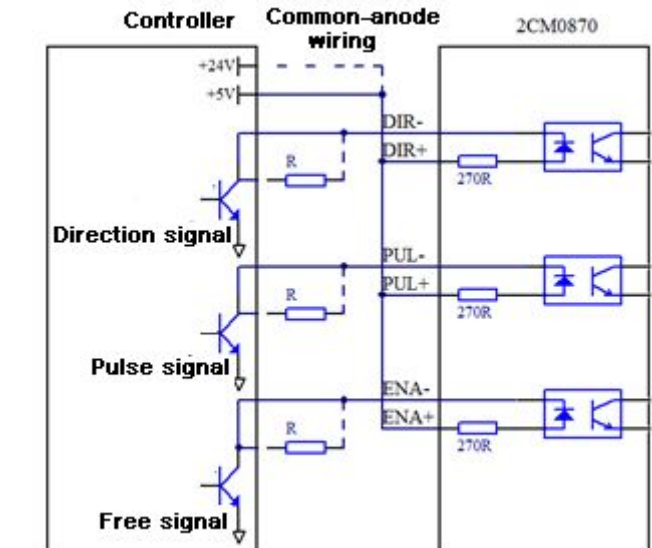

Sheet 3-1 Control signal wiring diagram
Control signal=5V: Short R, Control signal=24V, R=2K (accessories)

⚠**Precautions for wiring:**
- To avoid interference on the driver, the power cables (phase wires and power cables of the driver) shall be isolated from the signal cables (for a distance of at least 10cm) when connecting wires for the driver.
- 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. The insulation terminal of motor power cable could reduce contact resistance.
- 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 line of the motor still carries heavy current even if the motor is in the locked status.

3.4 Time sequence diagram of control signal
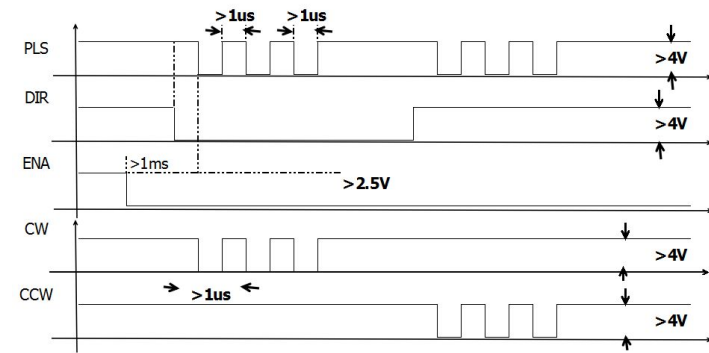
Sheet 3-4 Time sequence diagram of control signal

⚠ **Precautions on Control Signal**

- The direction signal is forbidden changing at pulse rising edge.
- The low level of control control signal should be lower than 0.5V.
- Free signal should be set 1ms earlier than pulse signal.

3.5 DIP setting

Sheet 3-5 subdivision setting（Unit: Pulse/rev）

PULSE/REV	SW5	SW6	SW7	SW8
400	ON	ON	ON	ON
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

Sheet 3-6 Current setting (Unit: A)

REF Current	PK Current	SW1	SW2	SW3
2.00A	2.40A	ON	ON	ON
2.57A	3.08A	OFF	ON	ON
3.14A	3.77A	ON	OFF	ON
3.71A	4.45A	OFF	OFF	ON
4.28A	5.14A	ON	ON	OFF
4.86A	5.83A	OFF	ON	OFF
5.43A	6.52A	ON	OFF	OFF
6.00A	7.2A	OFF	OFF	OFF

Sheet 3-7　DIP switch setting

Function	DIP switch setting	Description
Micro-step smooth&dynamic filter disable	SW5,SW6, SW10=ON, Others=OFF	Set DIP switches according to functions required when power off. Power on driver, RUN LED blinks in green, ERR LED is red. Then it means settings take effect. Then power off the driver, reset subdivision and current for normal use.
Micro-step smooth filter enable	SW5,SW7, SW10=ON, Others=OFF	
Micro-step dynamic filter enable	SW5,SW8, SW10=ON, Others=OFF	
Test motor parameter upon power on disable	SW6,SW7,SW8 ,SW10=ON, Others=OFF	
Test motor parameter upon power on enable	SW5,SW6,SW7 ,SW10=ON, Others=OFF	
Test running	SW6,SW8, SW10=ON, Others=OFF	Motor running @ 80RPM
Automatic half current	SW4=ON, Or SW4=OFF	Set SW4=OFF to enable automatic half current. Phase current will reduce to half of the set value after motor stops for 1.5s. SW4=ON indicates to disable this function.
CW/CCW	SW9=ON,	Set SW9=ON, subdivision and current for normal use
PLS+DIR	SW9=OFF,	Set SW9=OFF, subdivision and current for normal use

⚠ **Precautions for DIP switch setting:**

- **The driver is set to PUL+DIR control mode by default when leave factory.**
- Micro-step smooth filter could improve vibration during motor running, to make sure motor run more smoothly. While micro-step dynamic improves based on micro-step smooth filter to make sure low speed performance more stable (For example:10rpm). Micro-step smooth & dynamic filter will slow down motor response. The micro-step filter is recommended to be disabled for application requiring high response speed. **Micro-step filer is enabled by default when drivers leave factory.**
- **Test motor parameter upon power on is enabled by default when drivers leave factory.** Driver automatically detects motor parameters upon power on. If users do not need this function, could power off the driver, set SW6/SW7/SW8/SW10=ON, others=OFF. Then driver only detects and save motor parameters when motor is connected for the first time. Then when users power on driver again, driver will recall the previous saved motor parameters instead of detecting motor parameters again.
- **Please set SW10=OFF for normal work.**

3.5 Mechanical dimensions and installation precautions

⚠ **Installation precautions:**

- It is recommended that the driver be mounted on a side and kept in an upright position, so as to maintain a well ventilated installation environment.
- 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 switching cabinet; failure to do so may cause damage to the driver or personal injury.
- Enhanced heat dissipation is required if the driver generates overheat alarms frequently. A fan may be installed in a position close to the driver for forced cooling and heat dissipation, so as to ensure the driver works in an allowable temperature range
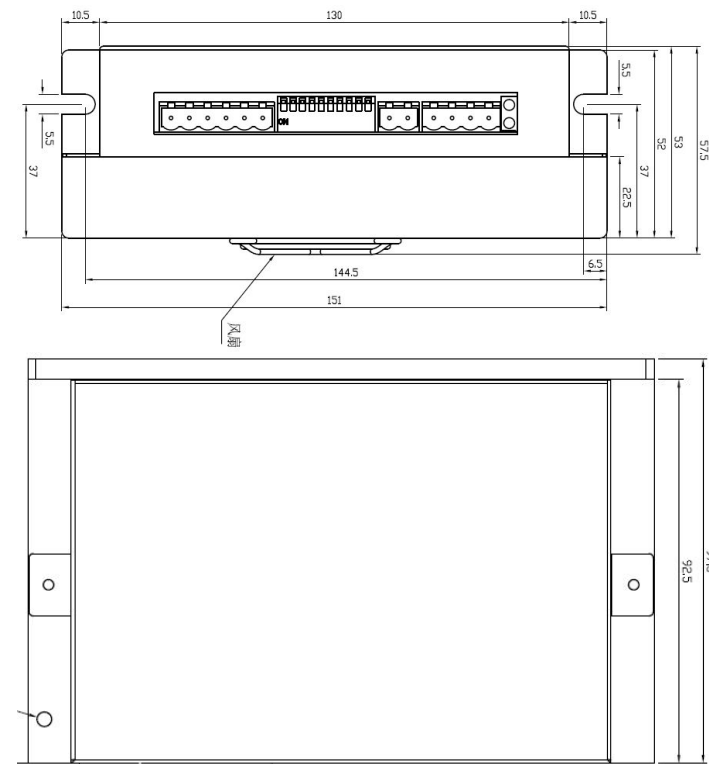
Unit: mm

Fig.3-5 installation dimensions of 2CM0870

4.FAQ

4.1 Driver indicators

Indicator		Definition	Reason	Solutions
RUN	ERR			
OFF	OFF	Internal power failure	There is no power internally.	Check power supplyconnection
OFF	Blink quickly	Over-current alarm	1. Motor phase to phase short circuit 2. Driver internal error	1.Check motor connection 2. Change driver
Blink quickly	Blink quickly	Over-voltage alarm	1. Voltage of power supply is too high 2. Stop motor at high speed	1.Check power supply 2.Add braking resistor
OFF	Blink slowly	Over heat alarm	Internal temperature of driver is higher than 85℃.	Ambient temperature is higher than 40℃.Need to add auxiliary cooling device.
OFF	ON	Under voltage alarm	1. Voltage of driver is too low 2.Quickly start	1. Check power of the power supply 2. Reduce acceleration
Blink quickly	ON	Motor error	Motor cable is not connected or connection is wrong.	Check motor cable and connection
Blink quickly/slowly	ON	EEPROM error	Read EEPROM error	Reboot driver. Change driver if the error occurs again.
ON	OFF	Normal		
Blink slowly	OFF	Test running		

⚠ **Note:**

- Blinking slowly means blinking at a frequency of 0.5Hz, and blinking quickly means at a frequency of 5Hz.
- To clear any alarm of the driver, it is necessary to disconnect the power supply and then reboot the driver.
- In the case of any alarm, it is necessary to disconnect the power supply in time, and never touch the driver and motor when the power supply of the driver is on.
- If any indication not covered in the above table occurs, please contact our customer service personnel.

4.2 What is the maximum allowable surface temperature for a stepper motor?

1. What is the maximum allowable surface temperature for a stepper motor?

The excessively high temperature will demagnetize the magnetic materials of a stepper motor and as a result, cause lower torque or out of step of the motor. Therefore, the maximum allowable surface temperature of a stepper motor depends on the demagnetization point of different magnetic materials. In general, the demagnetization point for magnetic materials is above 130℃ for motor with insulation class B, so it is normal if the surface temperature of a stepper motor remains at 80℃ - 90℃.

2. How to calculate output power of a stepper motor?

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

3. How to calculate input power of stepper driver?

Input power of stepper driver compose of consumption and output power:$P=P1+P2$. P1 indicates power consumption, is usually several wats. P2 could be calculated by stepper motor power output: $P2=P3/A$. A indicates the efficiency. Power factor also should be taken into consideration for the AC power supply. Usually take power factor as 0.6. So the input power $P=(P1+M*2\prod*n/（60*77\%）)/0.6$. n is rotate speed(rpm),M is motor torque output(N.M).

4. What is the subdivision function of the driver intended for?

The subdivision function of a stepper motor driver is a kind of electronic damping technology. It has three distinctive functions: A. It enhances the control accuracy due to the subdivision of step angles. B. Subdivision is the best method to suppress the low-frequency oscillation of the motor.
C. It can enhance the motor torque to some extent.

5.How to connect 4-wire and 8-wire motors?

There are two methods to connect 8-wire motors. The differences are as follows: a. parallel connection could reduce inductance, which is adaptable for high speed application. Motor requires larger current of driver to abtain required torque. b. series connection could increase inductance, which is adaptable for lower speed application. Motor requires lower current output of driver to abtain required torque.
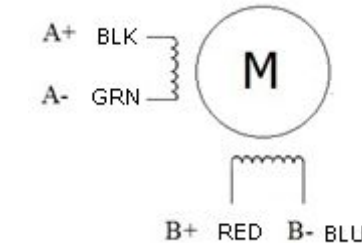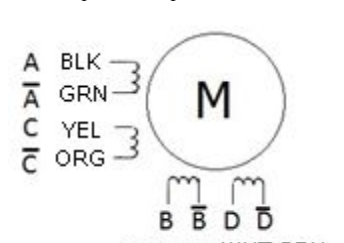

Fig. 4-1 40wire motor

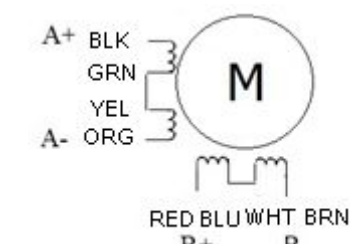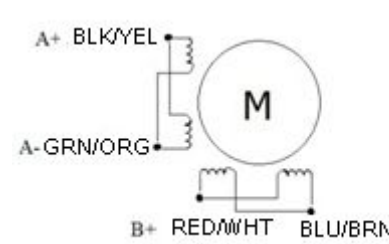**Fig. 4-2 8-wire motor**

Fig. 4-3 Series connection of 8-wire motor

Fig. 4-4 Parallel connection of 8-wire motor