

N Series Stepper Motor Driver **2M880N**

User Manual

Version: V1.0



Kinco Electric (Shenzhen) Ltd.

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Release Notes on N Series Multi-functional Micro-step Stepper Motor Driver User Manual

Products involved: 2M880N stepper motor drivers.

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Revision History		
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V1.0	2009-8-3	

Chapter 1 Safety Precautions

For the sake of personal safety and avoidance of property loss, please read these safety precautions carefully before test running and use of the driver.

The following safety measures must be strictly followed:

- Read this user manual carefully.
- 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.
- Follow related technical specifications and electric installation standards during installation. The driver must be securely grounded with the cross section of the ground cable not less than 1.25 mm^2 .

- 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.

Chapter 2 Product Overview

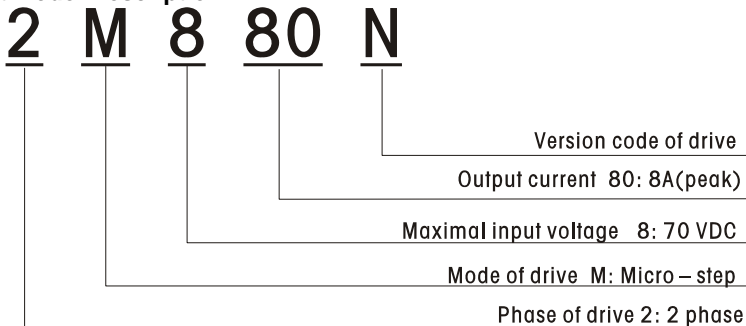
2.1 Product Acceptance

Upon receiving the product, please check the following items:

- Make sure the driver model is consistent with that ordered.
- Unpack the product and make sure it is free from damage and no part is missing.
- Make sure all set screws in the driver are securely tightened.
- Check the received product against the packing list and contact our customer service center in time if any part is missing.

Packing List	
Article	Qty.
2M880N driver	1 pcs
After-sales Service Registration Form	1 pcs
Product Service Terms and Conditions	1 pcs
User Manual	1 pcs
Certificate of Conformity	1 pcs
2k Ω metal film DIP resistor	3 pcs

2.2 Product Model Description



2.3 Product Overview

N series drivers are the latest high-resolution stepper motor drivers launched by Kinco Electric (Shenzhen) Ltd. With the DSP single-chip control core.

These products adopt vector current control algorithm and are suitable for driving 2-phase hybrid stepper motors under various brand names. The application of advanced vector control

algorithm reduces remarkably the noise and vibration of the motors during operation, and enables the stepper motors to deliver a noise and stability level comparable to that of servo motors. The brand-new radiator design enables the drivers to meet the strict safety requirements while keeping a compact structure.

2.4 Product Features

- Automatic parameter adjustable regulation
- Supporting driver test running function
- Supporting phase memory function
- Supporting PLS+DIR and CW/CCW control signal
- Supporting optocoupler isolation ERR signal output function and interaction with the upper computer
- Supporting half-current function
- Opto-isolation signal input, with pulse response frequency up to 400 KHz
- the maximum micro-step is 256
- With the protection function of over-voltage, under-voltage, over-current, overheat

2.5 Product Functions

2M880N stepper motor drivers adopt DSP single-chip as its control core, which

greatly enriches their applications. Meanwhile, the intelligent firmware design frees the users from complicated function setting steps and delivers the optimum performance of the motors easily.

- **Motor auto adaptation:** 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 it is not the first time for the driver to drive the motor, please run the driver under no load before connecting the motor. Then, the driver will clear the motor parameters stored before. Turn off the power, connect the motor, and turn on the power again; the driver will automatically detect the optimum drive parameters for the current motor.
- **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.
- **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 high-voltage alarm if the internal 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.
- **Short-circuit alarm:** The driver will activate the over-current protection function in the case of short-circuit or wrong wiring of the motor to driver, so as to prevent the damage to the driver. In this case, turn off the power supply in time and check the wiring of the motor. To clear the alarm, reboot the driver.
- **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.

2.6 Scope of 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.

Chapter 3 Product Parameters and Installation

3.1 Product Parameters

Please learn carefully the driver parameters before use. Make sure the power supply and operating environment conform to relevant requirements.

Table 1 Electrical Specifications

Parameter	Description
Input voltage	24~70VDC
Output current(peak, Unit: A)	2.4; 2.8; 3.2; 3.6; 4.0; 4.4; 4.8; 5.2; 5.6; 6.0; 6.4; 6.8; 7.2; 7.6; 8.
Micro step	2, 4, 5, 8, 10, 16, 20, 25, 32, 40, 50, 64, 100, 128, 200, 256
Input signal	PLS(CW), DIR(CCW), FREE; Current range: 6 ~16 mA
Control mode	PLS+DIR; CW/CCW
Output signal	ERR, open collector output, maximum current: 20mA
Protection	Over-voltage, under-voltage, short circuit, overheat

Table 2 Operating Environment

Cooling method		Nature air 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°C ~ +40°C
	Storage temperature	-20°C ~ +70°C
Weight (net)		0.71Kg
Dimensions		140×96×52.5 mm
Ingress protection		IP20

3.2 Description of Wiring Terminal

Wiring terminals of the driver are divided into three types: control signal port, motor power cable port, and power input port.

The twisted pairs are recommended as signal lines for enhanced interference immunity in environments with strong electromagnetic interference. The definitions of the driver ports are detailed below:

Table 3 Definition of Control Signal Port

Signal	Functional Description
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. The high-level time shall not be less than 1.25uS to ensure reliable response of the internal optocoupler. The maximum input frequency of the pulse signal is 400 KHz
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. A direction signal shall be set up 20uS earlier than a pulse signal.
DIR-(CCW-)	In the CW/CCW control signal mode, the signal is the reverse rotation control signal and the rising edge is effective. To ensure reliable response of the internal optocoupler, the high-level time in this mode shall not be less than 1.25uS. The maximum input frequency of the pulse signal is 400 KHz

FREE+	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). Adequate measures must be adopted to prevent the motor from causing equipment damage or personal injury when it is in the offline status.
FREE-	
ERR+	Alarm output signal. This signal port is the optocoupler output port for open collector. When the driver has an exception alarm or power failure alarm, this signal port outputs a low-level signal. For this port, the maximum allowable input voltage is 30V DC. The maximum flow current is 20mA.
ERR-	

Table 4 Definition of Motor Power Port

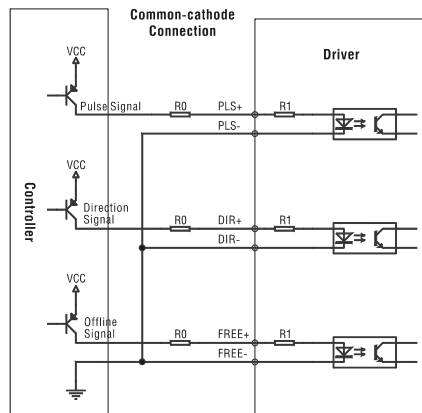
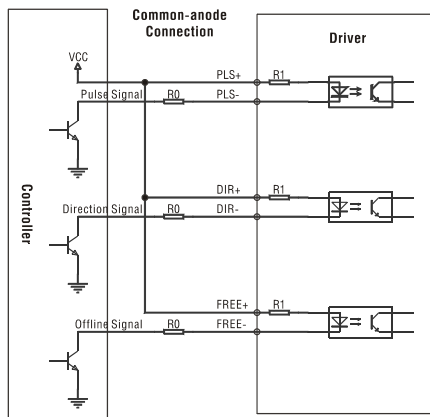
Signal	Functional Description
A+	Phase A of motor. The switching between A+ and A- can change motor rotation direction.
A-	
B+	Phase B of motor. The switching between B+ and B- can change motor rotation direction.
B-	

Table 5 Definition of Power Input Port

V+	Power input ports for the driver. Input voltage is range from 24VDC~70VDC.
GND-	

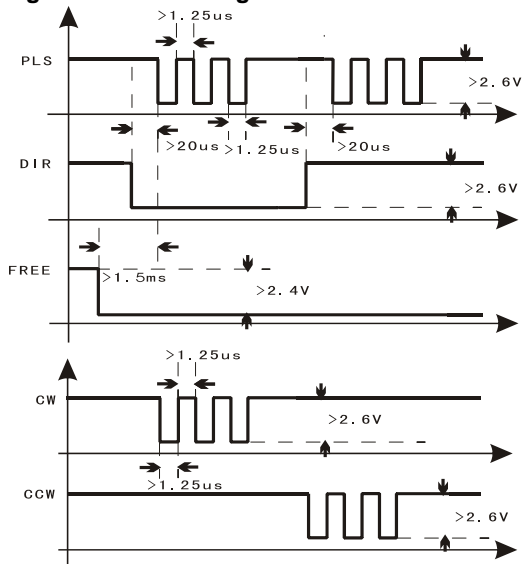
3.3 Wiring Diagram

- If control signal is at 12VDC, 1 K resistor can be connected. The current at the input port of the driver must be within 6~16 mA; otherwise, it may cause damage to the equipment.
- ERR signal is open collector output and requires an external power supply. The maximum external voltage cannot exceed 30V. Never connect the ERR signal port in reversed polarity; otherwise, it may cause damage to the port.
- The input circuits of all control signals of the driver have been reliably isolated through optocoupler elements, which minimize the interference from external electrical noises.
- In the figure, R0 is an external current limit resistor used to curb the input signal current of the driver. When control signal is at 24VDC, a 2K resistor can be connected; when the



Control Signal Wiring Diagram

3.4 Time Sequence Diagram of Control Signal



 **Precautions on Control Signal:**

- The maximum frequency of the input pulse is 400 KHz.
- A direction signal shall be set up 20uS earlier than a pulse signal.
- A free signal shall be set up 1.5ms earlier than a pulse signal.

 **Precautions on 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 1.5mm² are recommended for the motor cabling, or even thicker ones as appropriate.
- 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. Pull out or connect the wire

forcibly may cause equipment damage and personal injury.

- The length of bare wires at the inputs of the power line of the motor and the power input cable of the driver shall be around 10mm; it may result in poor contact if the length is too short and may cause electric shock if the length is too long.

3.5 DIP Switch Settings

The 10 bit DIP switch is used to enable the test running function, the half current function, and to chosen of the “DIR+PLS” or “CW/CCW” control mode.

1. Control mode select: SW5=ON, “DIR+PLS” mode; SW5=OFF, “CW/CCW” mode.
2. Half current function: SW6= on, enable; SW6=off, disable.
3. Test running enable: SW2=ON, SW4=ON, others=OFF

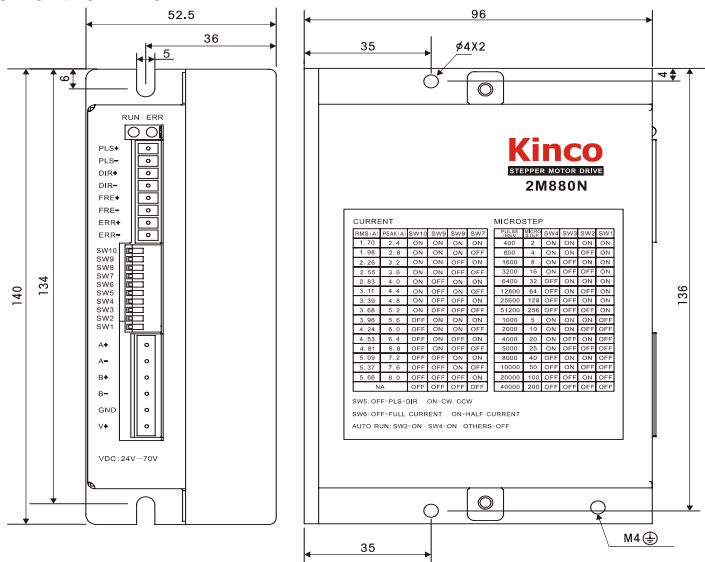


Precautions on rotary switch:

- When setting the status of the DIP switch, do not apply an axial force; otherwise, it may cause damage to the DIP switch.

Micro step setting					Current setting, unit A(Peak)				
SW2	SW3	SW4	SW1=ON	SW1=OFF	SW7	SW8	SW9	SW10=ON	SW10=OFF
On	On	On	2	5	On	On	On	2.4	5.6
Off	On	On	4	10	Off	On	On	2.8	6.0
On	Off	On	8	20	On	Off	On	3.2	6.4
Off	Off	On	16	25	Off	Off	On	3.6	6.8
On	On	Off	32	40	On	On	Off	4.0	7.2
Off	On	Off	64	50	Off	On	Off	4.4	7.6
On	Off	Off	128	100	On	Off	Off	4.8	8
Off	Off	Off	256	200	Off	Off	Off	5.2	NA

3.6 Installation of the Driver



Mechanical Dimensions (Unit: mm)



Precautions on Installation:

- 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. Never block or cover the air vents of the driver; otherwise, the normal use of the driver may be prevented by possible frequent overheat alarms.
- For better heat dissipation, two drivers shall be installed at a clearance of at least 50mm.
- 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.

Chapter 4 FAQ

4.1 Indications of Driver Indicators

N series stepper motor drivers are equipped with complete protection circuits to protect their safety to the greatest extent possible. In addition, the rich indications of indicators help the user to learn the working status of the driver in time.

Indications of Indicators:

Alarm			Solution
	Run	Error	
Power failure	Off	Off	Check the power supply
Motor wires error	Blink per 4 second	On	Check the connection of motor wire
Short circuit alarm	OFF	Blink quickly	Check the connection of motor wire
Over-voltage alarm	Blink quickly	Blink quickly	The motor power supply disconnects and the motor shaft releases
Overheat alarm	Off	Blink slowly	Make sure the driver work in required environment or use a fan
Under-voltage	Off	On	Check the power of power supply

alarm			
DIP switch error	Blink slowly	On	Don't set the DIP switch to NA!
Motor cable not connected	On	On	Check the connection of motor wire
Normal running	On	Off	
Test running	Blink slowly	Off	



Note:

- Blinking slowly means blinking at a frequency of 0.5 Hz, and blinking quickly means blinking 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.
- Except for the normal running, test running, the driver ERR signal will output an effective signal.
- If any indication not covered in the above table occurs, please contact our customer

service personnel.

4.2 FAQ on the Driver and 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°C, so it is normal if the surface temperature of a stepper motor remains at 80°C - 90°C.

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 $\omega = 2\pi * n / 60$, indicates the angular speed and M indicates the output torque.

3. 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.

Kinco

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