

# MC Series Brush less Servo Driver Manual

Version Number: V3.0

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## Chapter 1 Product Description

MC series driver is a new generation of high-performance brushless servo driver launched by Suzhou Micro Actuator Technology Ltd Co., This series is based on years of experience in the low-voltage DC servo market and combined all kinds of end-customer demand feedback ingeniously created, It can be widely used in the drive of various BLDC/PMSM motors.

The driver has the following characteristics:

(1) More than 95% of the chip localization rate, guaranteed supply and moderate cost

(2) Rich models, covering all power levels within 0-1000w

(3) Various versions support built-in integrated on-axis/off-axis installation, external independent installation

(4) Support CAN BUS and RS485 and other communication protocols, the baud rate is adjustable.

(5) Integrated position sensor, small size and space saving

(6) Matching graphical debugging tools, easier to use

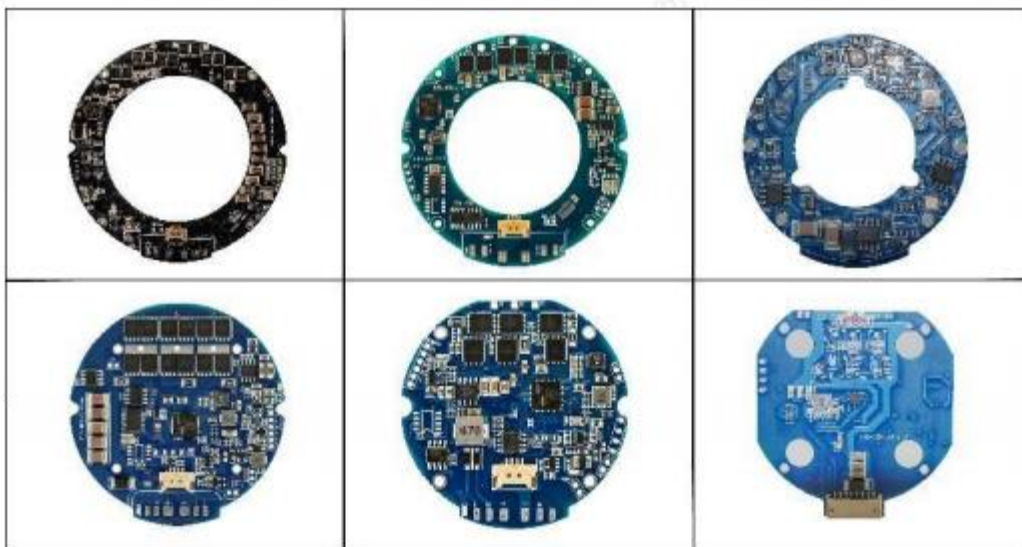
(7) Perfect protection functions, such as: overcurrent/overtemperature/communication interruption/anti-reverse protection, etc /

(8) Support various features: such as power-off memory/bus current sampling / motion mode / brake release

(9) The whole series of software and hardware support customization and development, with low threshold and high efficiency

(10) Supporting secondary development resources, convenient for users to quickly engineer

## Products picture Of MC drive



## Chapter 2 Driver Model Description

### 2.1 The specific description of the driver model

**MC – L – 100 – O – C – 24**



**MC** (Motor controller) : brushless motor control drive.

**L** Adapted Motor Type : L: L series direct drive motor

L Series : The motor without reducer and the encoder is installed on the axis.

H: H series direct drive motor

H Series : Brushless Outer Rotor Permanent Magnet Synchronous Motor without Reducer and Encoder is installed off-axis installation.

X: X series planetary actuator

X Series : Brushless outer rotor permanent magnet synchronous integrated joint motor with planetary reducer (encoder is installed on the axis)

R: R series harmonic actuator

R Series : Brushless outer rotor permanent magnet synchronous integrated joint harmonic motor with built-in harmonic reducer (Encoder is installed off-axis installation)

**100** Rated power, optional power:100W 300W 500W (The highest power can be used under the rated voltage) .

**O** Encoder Adaptation Method

O: On axis encoder is installed on the axis

H: Off axis(hollow) encoder off-axis installation

**C** Communication Mode

C: CAN BUS communication ( 500K/1M baud rate, the standard is 1M, 500K can be configured )

R : RS485 communication (15200/1M/2.5M , the standard is 115200 , 1M and 2.5M can be configured )

## 06 Supply Voltage

24 : 12V-24V (The motor controller without reducer only supports up to 24v)  
48 : 24V-48V

\* Use ambient temperature range (-20 degrees to 55 degrees) Air temperature (please contact sales for higher specifications)

\* All encoders in this document are magnetic encoders

## 2.2 Introduction of the driver matched with the actuator motor

		Module Components		
RMD Series Module	Module type	Motor Type	Driver Type	Reducer Type
L series direct drive module	L4005	3510-(25T/40T)	MC-L-100-O	
	L4015	3510-20T		
	L4010	3510-27T		
	L5005	35T		
	L5010	10T/35T		
	L5015	10T/35T		
	L7010	23T/45T	MC-L-200-O	
	L7015	10T/23T/45T		
	L7025	10T/28T		
	L9010	17T/35T		
	L9015	16T/35T		
	L9025	16T/35T		

X series planetary reduction module	X6 V3	6010	MC-X-300-O	Planetary Spur Gear (1: 8)
	X6-H V3			planetary helical gear (1: 5/6)
	X6S2			Planetary Spur Gear (1: 36)
	X8-H	8010	MC-X-500-O	planetary helical gear (1: 6)
	X8PRO-H	8015		planetary helical gear (1: 6)
	X10V3	10010		Planetary Spur Gear (1: 7)
	X10S2V3	10015		Planetary Spur Gear (1: 35)
R series harmonic module	R14	5005-45T	MC-R-100-H	harmonic (1: 50/80 /100)
	R17	7605-75T		harmonic (1: 50/80 /100)
	R20	7612-40T	MC-R-300-H	harmonic (1: 50/80 /100)
	R25	10606-10T	MC-R-500-H	harmonic (1: 50/80 /100)
	R32	10612-10T	MC-R-500-H	harmonic (1: 50/80 /100)

## Chapter 3 Product Parameters And Hardware Description

### 3.1 Drive Parameter Table

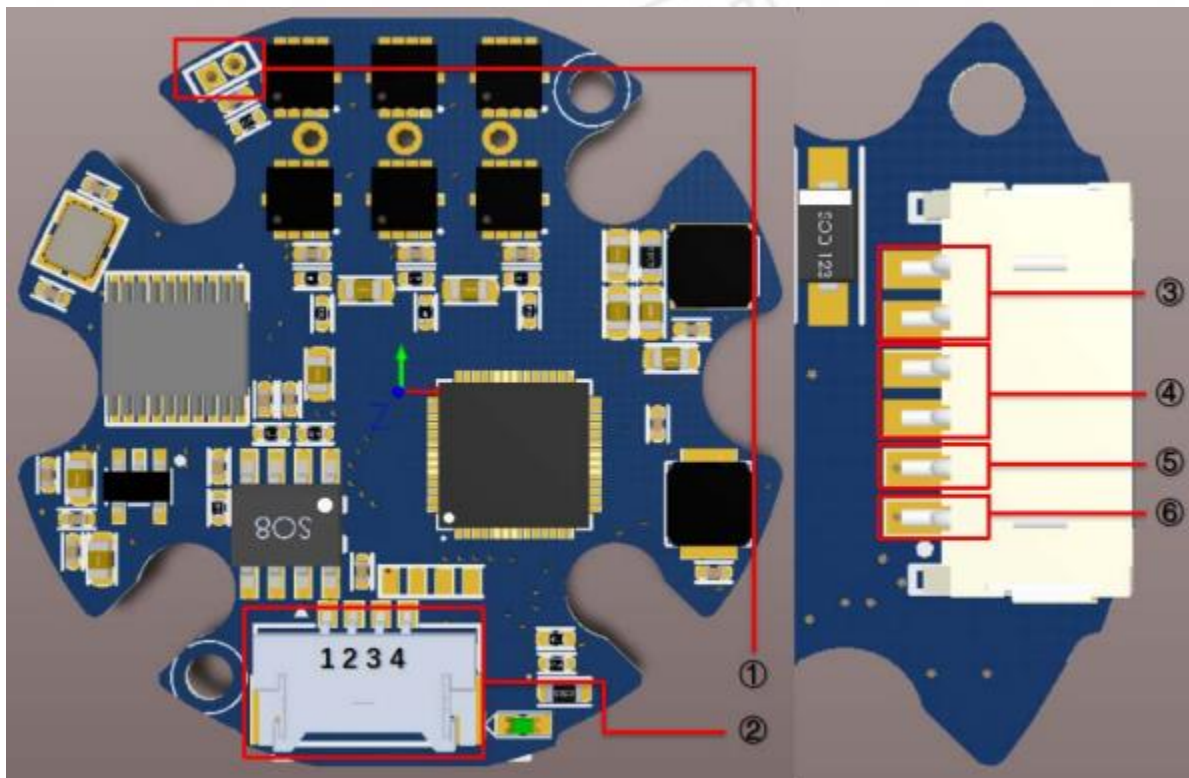
Driver Type	MC-L-100-0	MC-L-200-0	MC-X-300-0	MC-X-500-0	MC-R-100-0	MC-R-300-0	MC-R-500-0	MC200
Input Voltage(V)	12-24	12-24	24-48	24-48	24-48	24-48	24-48	12-48
Rated Current (A)	3	6	5	10	3	5	10	5
Rated Power (W)	100@24V	200@24V	300@48V	500@48V	100@48V	300@48V	500@48V	200@48V
Instantaneous current (A)	6	12	10	20	6	10	20	10
Instantaneous Power(W)	150	300	500	1000	150	500	1000	400
Support second encoder	NO	NO	YES	YES	NO	NO	NO	YES
Support electromagnetic brake	NO	NO	YES	YES	NO	YES	YES	YES
Battery charge and discharge circuit	NO	NO	YES	YES	NO	NO	NO	YES
Serial port isolation	Support	Support	Support	Support	Support	Support	Support	Support
Integrated encoder	YES	YES	YES	YES	NO	NO	NO	NO
installation method	On axis	On axis	On axis	On axis	off-axis	off-axis	off-axis	External independent installation
protection mechanism	Over current protection/ over temperature protection/over velocity protection/over voltage protection/BUS Timeout protection							
control mode	servo mode ( Torque/Speed/Position ) ; motion mode							
communicationmethod	CAN BUS (500K/1Mbps) ; RS485(115200/1M/2.5Mbps)							
Three-loop control frequency	Current loop: 15KHZ Speed loop: 5KHZ Position loop: 1KHZ							
Software	MYACTUATOR ASISTANT 3.0							



## 3.2 Hardware Interface

### MC-L-100-O

The green LED is the MCU running status display



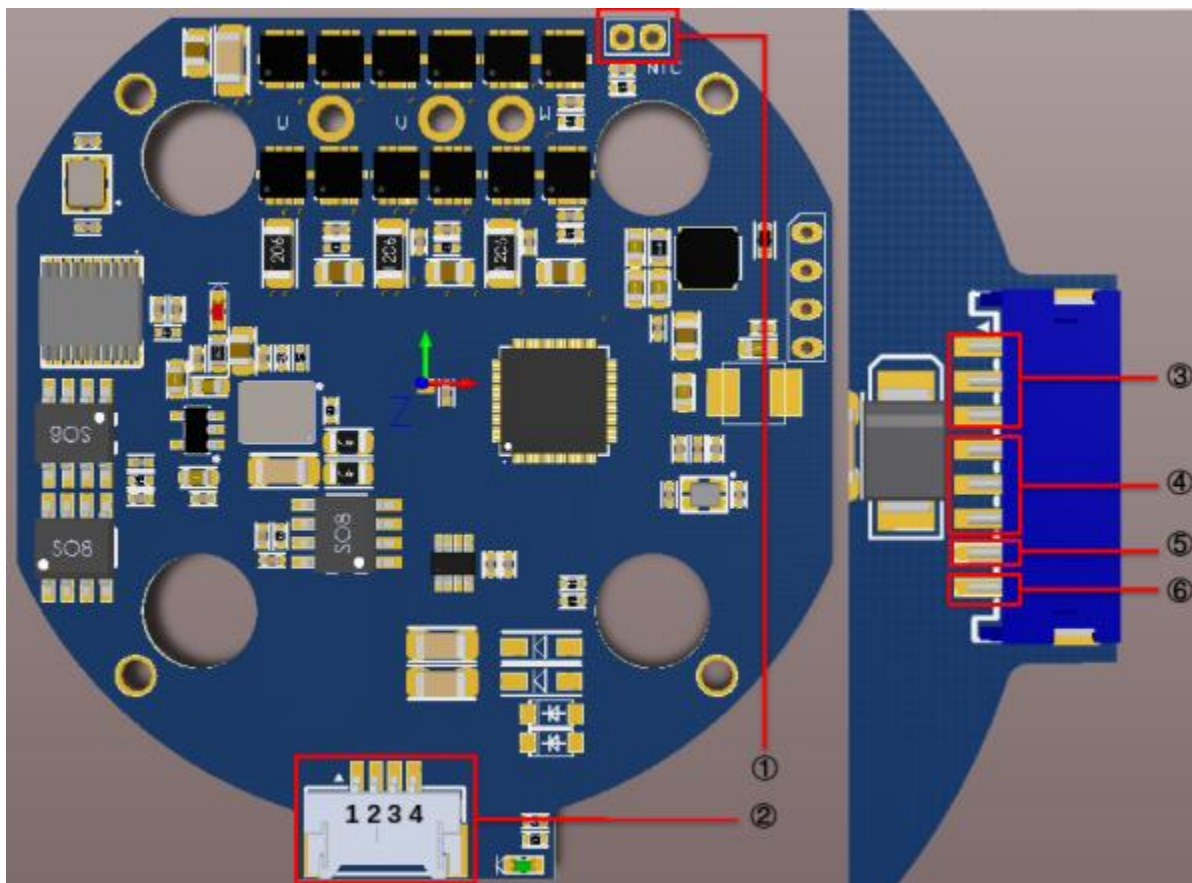
No	Interface	Explanation	Connector Type
1	Thermistor Interface		Pad
2	Serial Communication Interface	1:5V 2:TX 3:RX 4:GND	A1254WR-S-4P
3	Power Supply +	12V-24V	ZH-6PWB
4	Power Supply -	12V-24V	
5	CAN_L / B	CAN Communication / 485 Communication (optional)	
6	CAN_H / A	CAN Communication / 485 Communication (optional)	

**\*Note that the GND of the serial port communication interface and the GND of the power supply are not the same and cannot be mixed.**



## MC-L-200-O

The green LED is the MCU running status indicator, and the red LED is the 5V power supply light

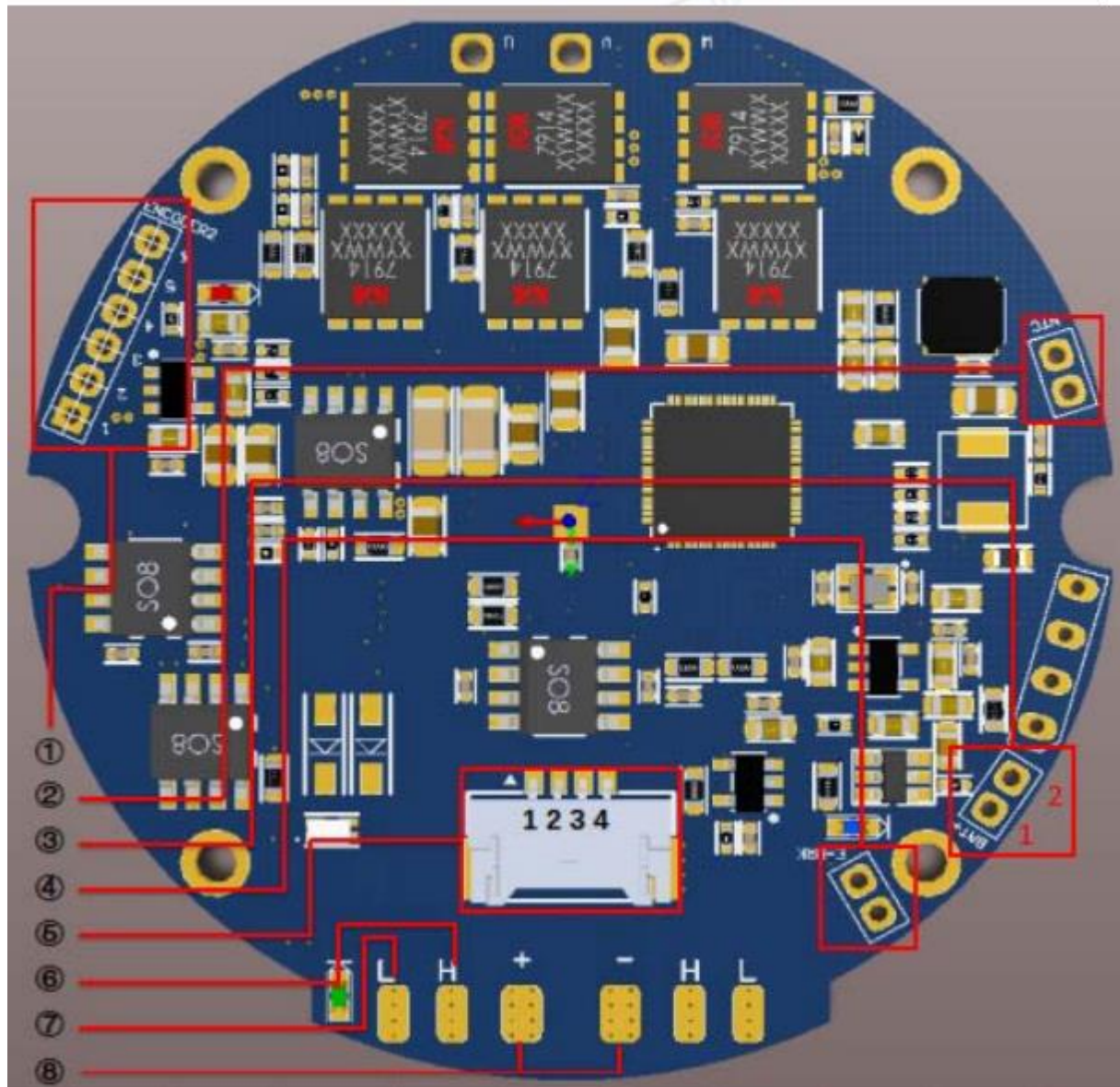


No	Interface	Explanation	Connector Type
1	Thermistor Interface		Pad
2	Serial Communication Interface	1:5V 2:TX 3:RX 4:GND	A1254WR-S-4P
3	Power Supply +	12V-24V	HC-ZH-8PWT
4	Power Supply -	12V-24V	
5	CAN_L / B	CAN Communication / 485 Communication (optional)	
6	CAN_H / A	CAN Communication / 485 Communication (optional)	

**\*Note that the GND of the serial port communication interface and the GND of the power supply are not the same and cannot be mixed.**

## MC-X-300-O 732

The green LED is the MCU running status indicator, the red LED is the 5V power indicator, and the blue LED is the battery charging indicator.



No	Interface	Explanation	Connector Type
1	Second (Output shaft) Encoder Interface	1:5V 2:GND 3:CLK 4:MOSI 5:MISO 6:CS	Pad
2	Thermistor Interface		Pad
3	External Battery Interface	3.0-4.2V (1: :Battery+ 2: :Battery-)	Pad
4	Brake Interface	No positive or negative , 12V brake is recommend	Pad

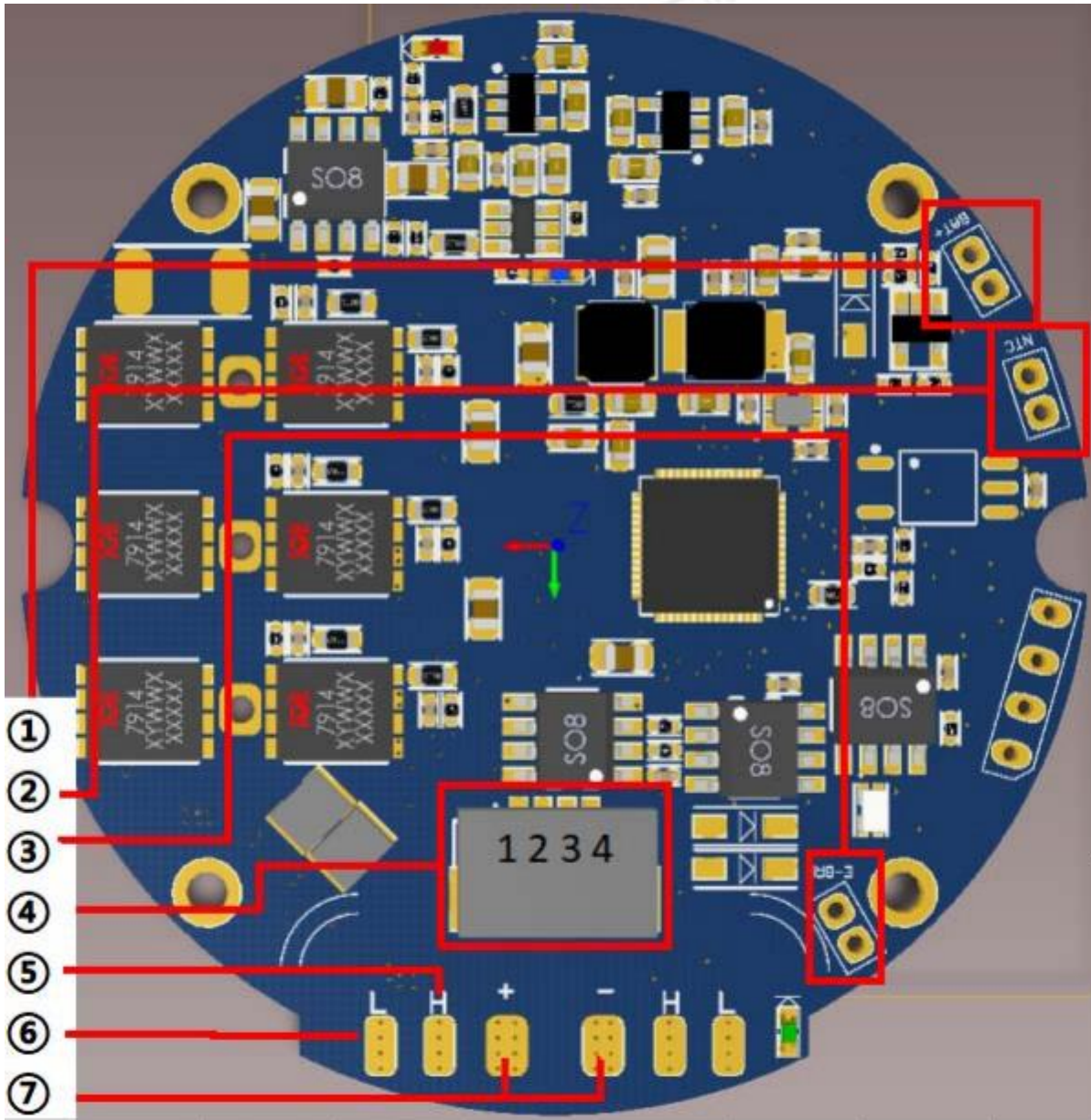
5	Serial Communication Interface	1:5V 2:TX 3:RX 4:GND	A1254WR-S-4P
6	CAN_H / A	CAN Communication / 485 Communication (optional)	Pad
7	CAN_L / B	CAN Communication / 485 Communication (optional)	Pad
8	Power Supply	24V-48V	Pad

**\*Note that the GND of the serial port communication interface and the GND of the power supply are not the same and cannot be mixed.**



## MC-X-300-O 6825

The green LED is the MCU running status indicator, the red LED is the 5V power indicator, and the blue LED is the battery charging indicator.



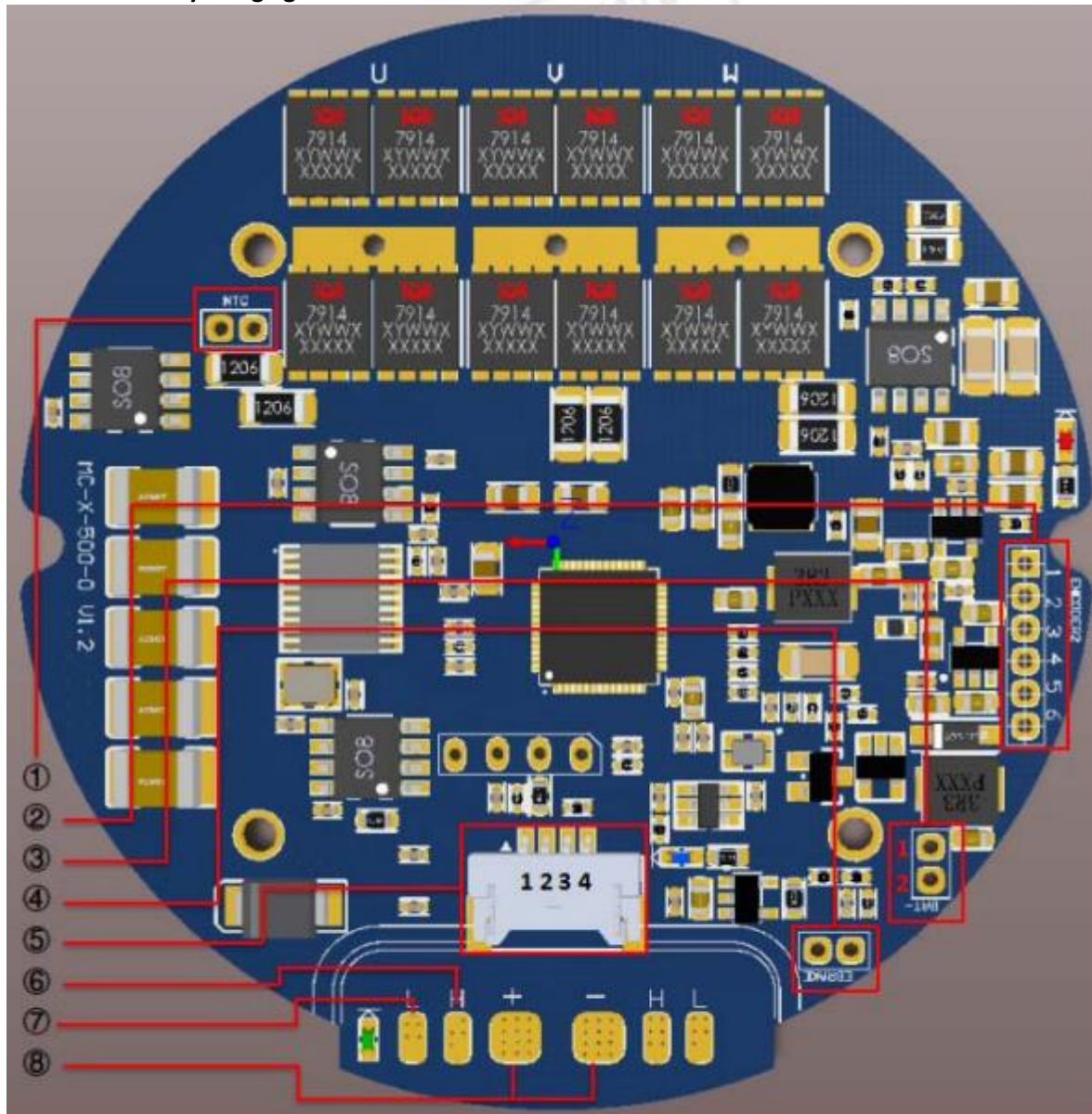
NO	Interface	Explanation	Connector Type
1	External Battery Interface	3.0-4.2V (1: :Battery+ 2: :Battery-)	Pad
2	Thermistor Interface		Pad
3	Brake Interface	No positive or negative , 12V brake is recommend	Pad

4	Serial Communication Interface	1:5V 2:TX 3:RX 4:GND	A1254WR-S-4P
5	CAN_H / A	CAN Communication / 485 Communication (optional)	Pad
6	CAN_L / B	CAN Communication / 485 Communication (optional)	Pad
7	Power Supply	24V-48V	Pad

**\*Note that the GND of the serial port communication interface and the GND of the power supply are not the same and cannot be mixed.**

## MC-X-500-O

The green LED is the MCU running status indicator, the red LED is the 5V power indicator, and the blue LED is the battery charging indicator



No	Interface	Explanation	Connector Type
1	Thermistor Interface		Pad
2	Second (Output shaft) Encoder Interface	1:5V 2:GND 3:CLK 4:SIMO 5:SOMI 6:CS	Pad
3	External Battery Interface	3.0-4.2V (1: :Battery+ 2: :Battery-)	Pad

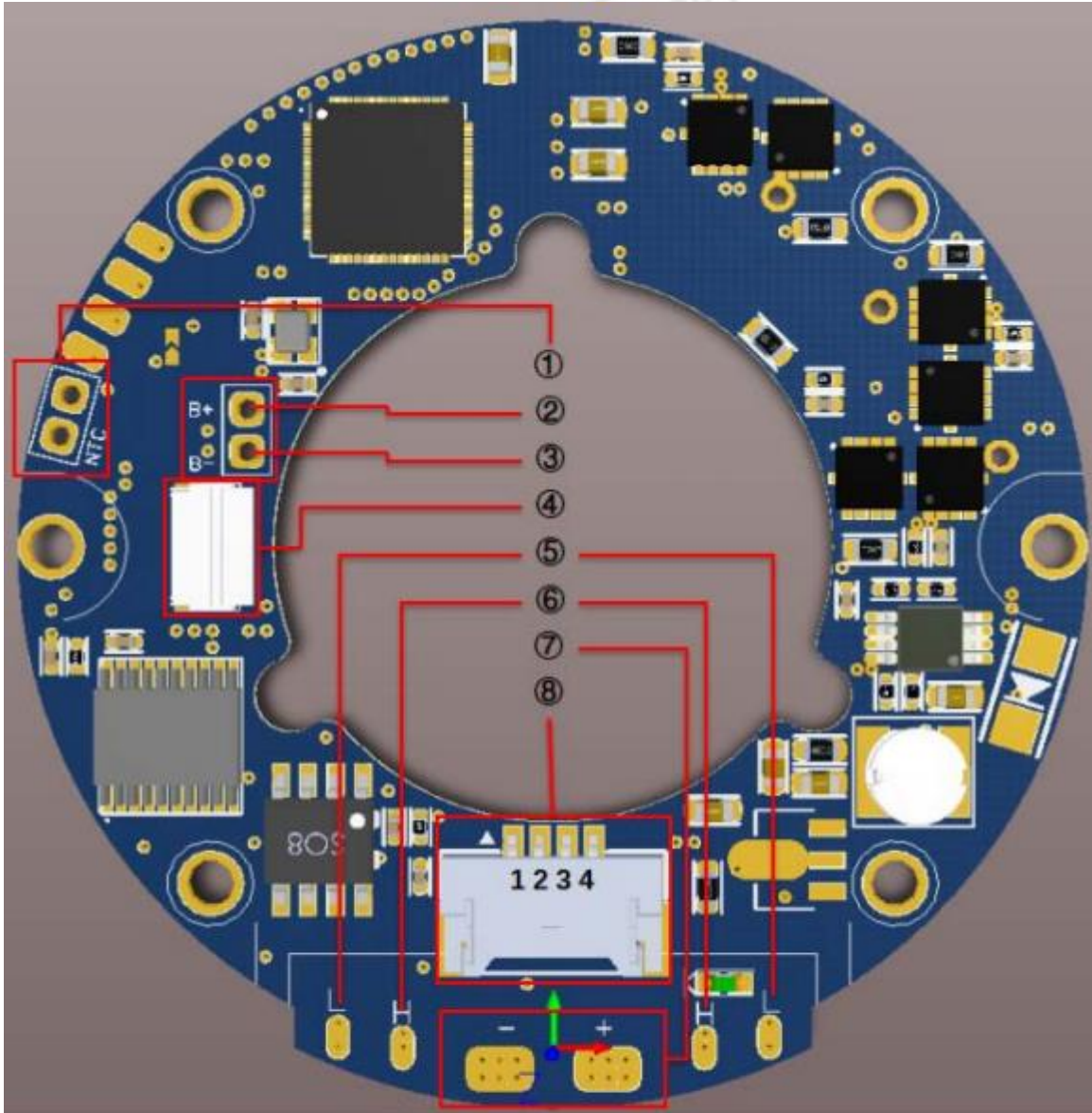
4	Brake Interface	No positive or negative , 12V brake is recommend	Pad
5	Serial Communication Interface	1 (Red) :5V 2 (Yellow) :TX 3 (White) :RX 4 (Black) :GND	A1254WR-S-4P
6	CAN_H / A	CAN Communication / 485 Communication (optional)	Pad
7	CAN_L / B	CAN Communication / 485 Communication (optional)	Pad
8	Power Supply	24V-48V	Pad

**\*Note that the GND of the serial port communication interface and the GND of the power supply are not the same and cannot be mixed.**



## MC-R-100-H

The green LED is the MCU running status indicator



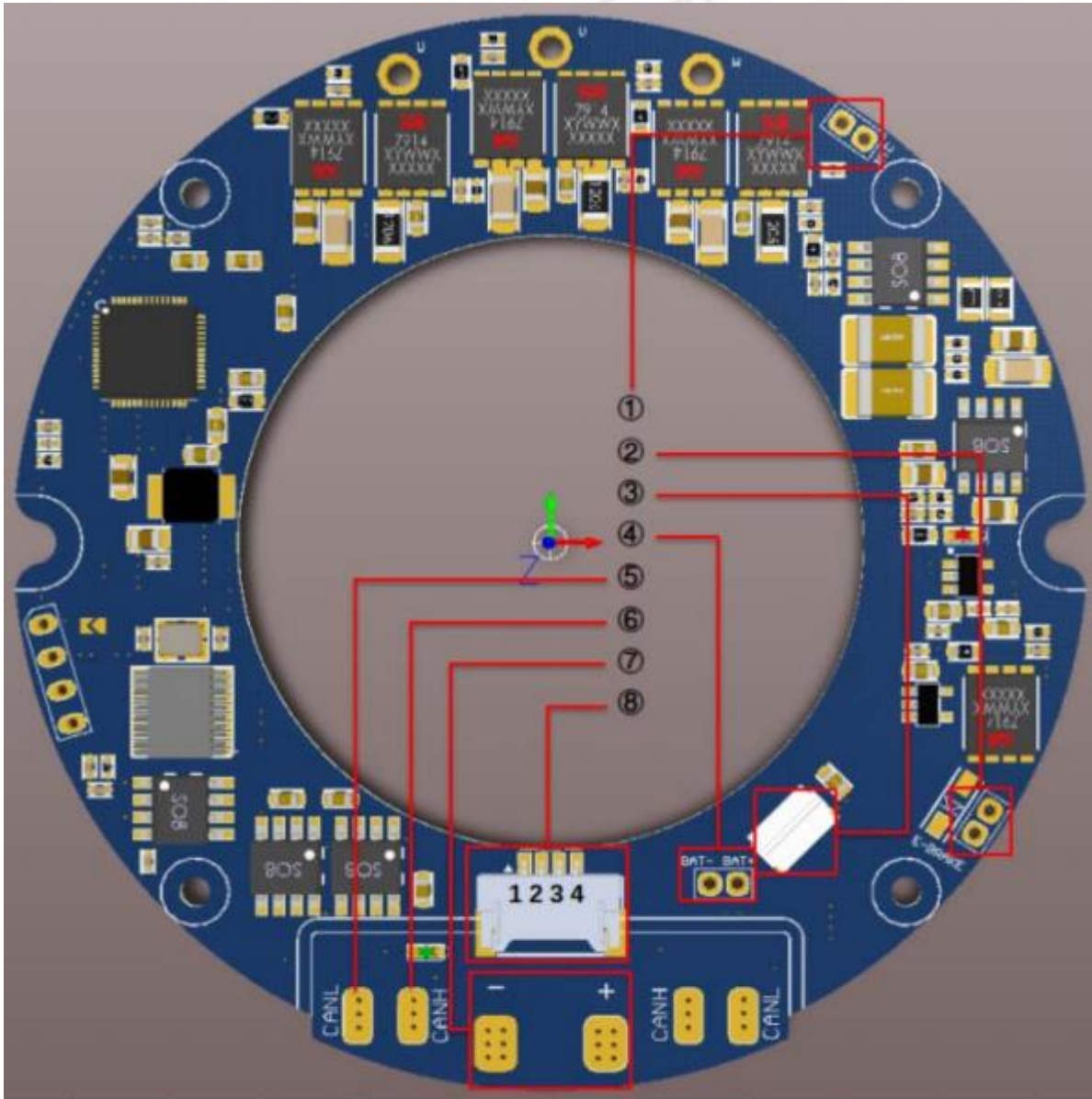
No	Interface	Explanation	Connector Type
1	Thermistor Interface		Pad
2	Encoder battery + interface	1.5-4.2V (1S lipo)	Pad
3	Encoder battery - interface	1.5-4.2V (1S lipo)	Pad

4	Encoder interface	External hollow encoder	FPC0.5mm-8P
5	CAN_L / B	CAN Communication / 485 Communication (optional)	Pad
6	CAN_H / A	CAN Communication / 485 Communication (optional)	Pad
7	Power Supply	24V-48V	Pad
8	Serial Communication Interface	1:5V 2:TX 3:RX 4:GND	A1254WR-S-4P

**\*Note that the GND of the serial port communication interface and the GND of the power supply are not the same and cannot be mixed.**

## MC-R-300-H

The green LED is the MCU running status display, and the red LED is the 5V power indicator



No	Interface	Explanation	Connector Type
1	Thermistor Interface		Pad
2	Brake Interface	No positive or negative , 24V brake is recommend	Pad
3	Encoder interface	External hollow encoder	FPC0.5mm-8P

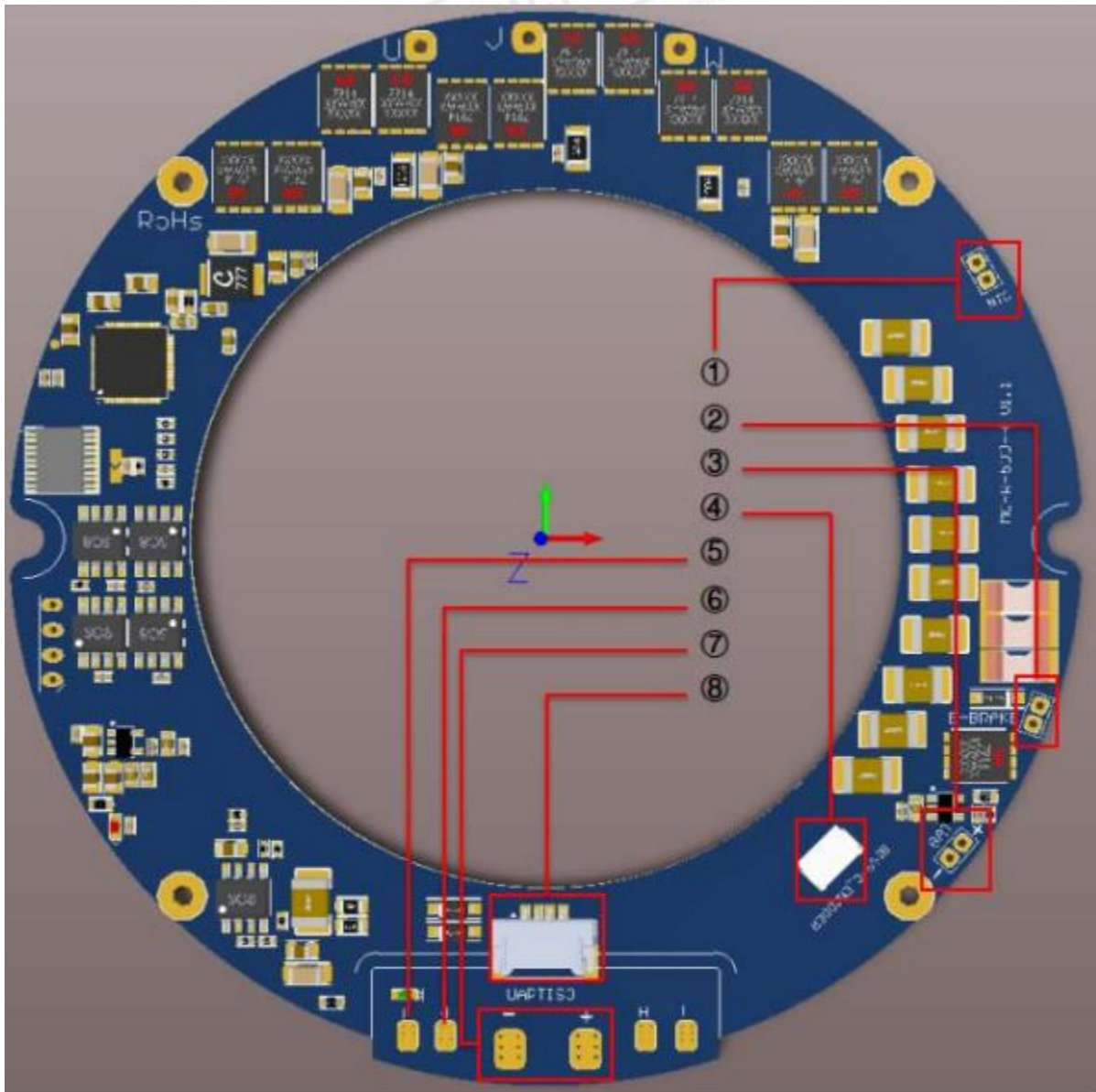
4	Encoder battery power supply interface	1.5-4.2V (1S lipo)	Pad
5	CAN_L/ B	CAN Communication / 485 Communication (optional)	Pad
6	CAN_H/ A	CAN Communication / 485 Communication (optional)	Pad
7	Power Supply	24V-48V	Pad
8	Serial Communication Interface	1:5V 2:TX 3:RX 4:GND	A1254WR-S-4P

**\*Note that the GND of the serial port communication interface and the GND of the power supply are not the same and cannot be mixed.**



## MC-R-500-H

The green LED is the MCU running status display, and the red LED is the 5V power indicator



No	Interface	Explanation	Connector Type
1	Thermistor Interface		Pad
2	Brake Interface	No positive or negative , 24V brake is recommend	Pad
3	Encoder battery interface	1.5-4.2V (1S lipo)	Pad

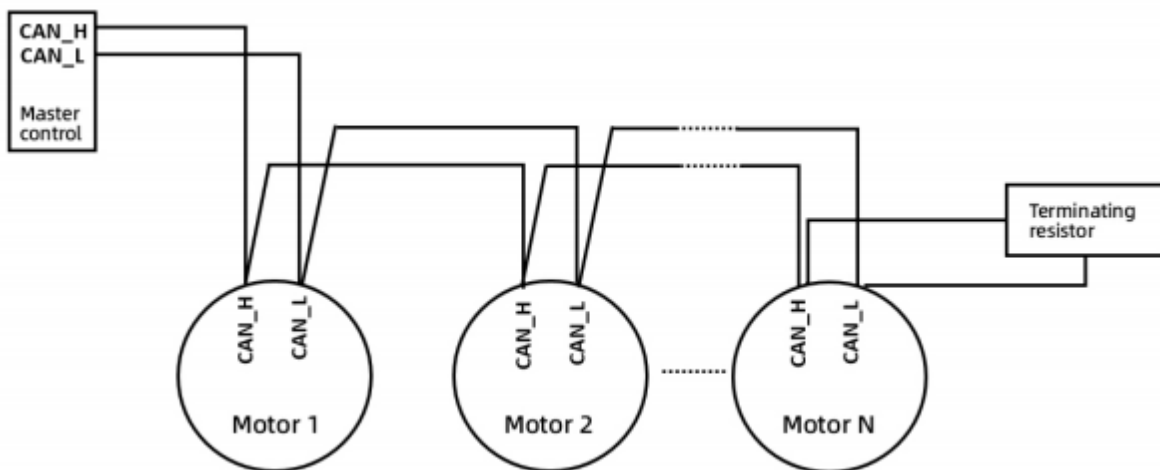
4	Encoder interface	External hollow encoder	FPC0.5mm-8P
5	CAN_L/ B	CAN Communication / 485 Communication (optional)	Pad
6	CAN_H/ A	CAN Communication / 485 Communication (optional)	Pad
7	Power Supply	24V-48V	Pad
8	Serial Communication Interface	1:5V 2:TX 3:RX 4:GND	1.25mm-4P

**\*Note that the GND of the serial port communication interface and the GND of the power supply are not the same and cannot be mixed.**

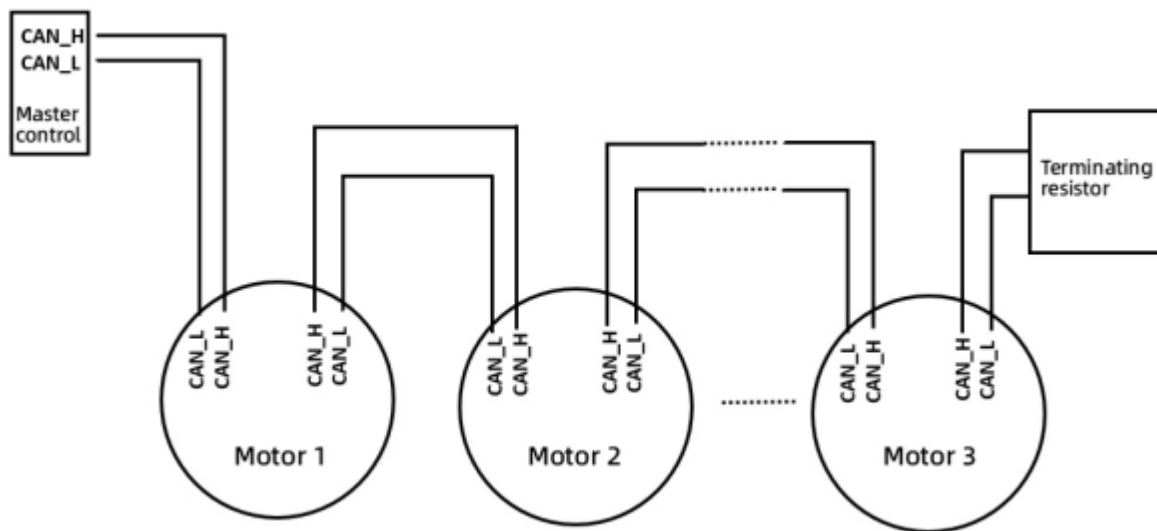
### 3.3 CAN Communication Connect

#### Schematic Diagram

(direct drive)



(X Series)



Note: The end of the motor needs to be connected to a 120 ohm terminal resistor.



### 3.4 LED Indicator Status Definition

- LED indicator is always on during normal operation;
- The LED indicator flashes slowly when a warning error occurs, and the LED indicator returns to steady light after the fault is recovered;
- Fast blinking LEDs when serious errors occur;
- Error and warning messages are described in detail in the servo protocol manual;

## Chapter 4 Precautions for installation and use

### 4.1 Precautions

\* In order to prevent harm to people and damage to property, the instructions must be followed.

MC-L/MC-R Series: There is no positioning pin, and it is locked after positioning according to the positioning hole. It is necessary to pay attention to the length of the screw. The specific threaded hole length and specifications must be installed strictly according to the drawing installation manual.

MC-X Series: There are positioning pins, which need to be positioned according to the positioning pins and then locked. Pay attention to the length of the screws. The specific threaded hole length and specifications must be installed strictly according to the drawing installation manual.

1. Please strictly follow the voltage characteristics of the interface to input the voltage. It is strictly forbidden to reverse the interface. If the interface access voltage exceeds the interface withstand voltage range, the circuit board will be burned, and the positive and negative polarities will also be burned.

2. Welding of the interface is strictly forbidden to short-circuit due to false welding. Customers must strictly check when operating the welding process.

3. In non-waterproof products, it is forbidden to soak in water and rain. The air humidity is less than 85%, and the ambient temperature must not exceed the specified temperature.

4. It is strictly forbidden to disassemble the drive board of the integrated product, which contains the encoder calibration information. If it has been disassembled, the customer will run the control command without calibration and there will be a risk of burning the circuit board and the motor.

5. Overload use is prohibited. The company is not responsible for damage to the motor or circuit board caused by long-term overload use.

6. The mechanical casing of the circuit board controller must not have a structure that hinders heat conduction, otherwise poor heat dissipation will easily lead to overheating and damage to the control board.

7. To ensure that the power of the power supply is sufficient, the power supply cannot enter the protection in the case of twice the current overload.

8. Please use the motor/driver combination specified by our company. When combining with other motors, please confirm its performance and safety with your company and our company.

9. Do not damage the wire or subject it to excessive external force, gravity, pinch.

10. Do not place near heating elements such as heaters or large winding resistors. (Please install a heat shield to prevent the product from being affected by the heating element)

11. Do not drive the power supply over 20% of the rated voltage.
12. Do not use in places with strong vibration and impact. When installing the driver near a vibration source, please install a vibration-proof device on the driver mounting plate.
13. Do not put your hands into the inside of the servo drive.
14. Do not perform wiring work with wet hands.
15. Be sure to wire correctly. Dodgy, incorrect wiring could be the cause of a runaway or burned motor. During installation and wiring work, do not let conductive objects such as wires enter the drive.
16. Please confirm that the cable connection is firm, and the electrified part is indeed insulated with an insulator.
17. When the wires are placed together in a metal tube, the temperature rise will cause the allowable current of the wires to decrease and cause the wires to burn out. Please consider the current reduction factor when selecting the wire.
18. Please do a good job in the installation work to prevent fire or other personal accidents when an earthquake occurs.
19. In terms of parameter debugging of the servo drive, do not change the gain or setting in extreme or large-scale at one time, otherwise it may lead to unforeseen unstable actions.
20. Do not frequently switch on or off the main power supply of the drive.
21. Pay attention to the thinness of the back shell of the circuit board, do not squeeze.

## Chapter 5 Common problems and solutions

### 5.1 Diagnosis of Common Problems

#### **1. The drive light is off, and the debugging software v3.0 cannot be connected.**

Step 1: Confirm whether there are parts burned on the appearance of the driver board

Step 2: Confirm whether the power supply voltage is within the rated voltage range

Step 3: Confirm whether the 5V power supply light inside the driver board is always on. If the light is normal, it means that the driver chip program is lost or damaged. If the light is not on, it means that the power supply module is damaged.

#### **2. The motor is not calibrated**

Step 1: Check whether the screws fixing the driver board are loose

Step 2: Check whether the motor is blocked, whether the welding of the three-phase wires is firm, and use a multimeter to measure the resistance of the three-phase wires to see if they are consistent

Step 3: Check whether there is any foreign matter between the encoder and the magnet on the driver board

Step 4: Check whether the number of pole pairs set by the drive is correct, and whether the motor operates during the calibration process. If the motor does not rotate, check whether the MOS tube is short-circuited (use a multimeter to measure whether the resistance between pin 1 and pin 4 of the MOS tube is 10KΩ or 5KΩ). If the motor rotates normally, check whether the encoder connection is normal.

Step 5: If the above inspections are normal, it may be judged that the main control chip is damaged.

#### **3. The motor does not turn suddenly, and it still does not turn after re-powering**

Step 1: Check whether the motor is blocked, whether the welding of the three-phase wires is firm, and use a multimeter to measure the resistance of the three-phase wires to see if they are consistent.

Step 2: Confirm whether there are parts burned on the appearance of the driver board.

Step 3: Power on to see if the LED light is blinking. If it is, connect to the software or send a command to check the current error status, and reset to see if it continues to blink (see the instruction description for details on the error status)

Step 4: Check whether the MOS tube is short-circuited (use a multimeter to measure whether the resistance between pin 1 and pin 4 of the MOS tube is 10KΩ or 5KΩ).