Version change history

date	updater	Version	Remark
2023-04-26	Maker Base	V1.00	Document creation.

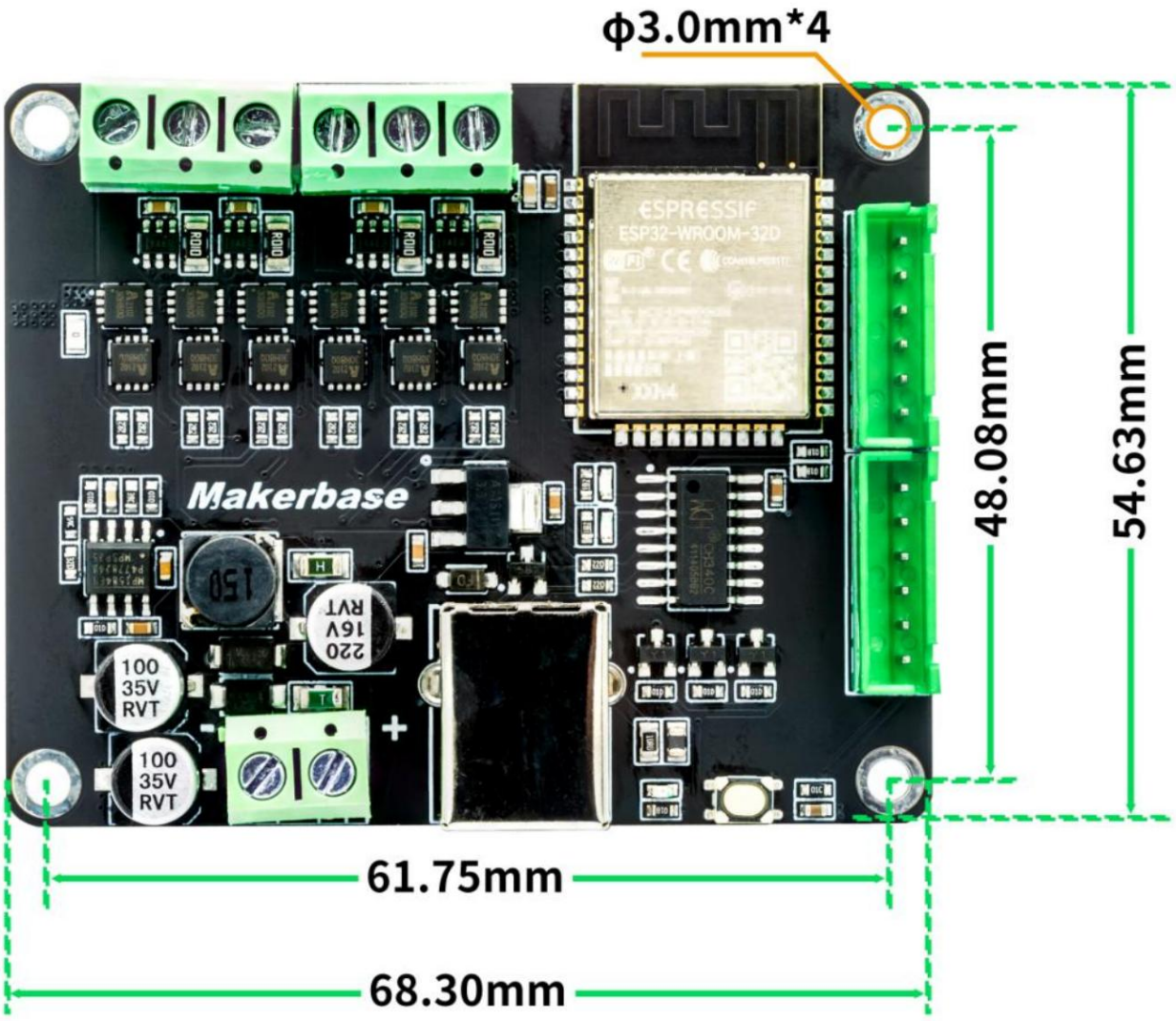
1. Product introduction

The dual-channel total power of this driver board is 280W, and the single-channel maximum power is 140W. It supports most gimbal motor FOC positions, speeds,

Torque open and closed loop control can be expanded to support some aircraft model motors in the future. The encoder supports common IIC and ABI, PWM,

HALL, SPI format. By sampling the voltage of the sampling resistor connected in series with the motor, the A and B phase online currents are obtained to achieve current loop control.

Construct a truly complete FOC algorithm.



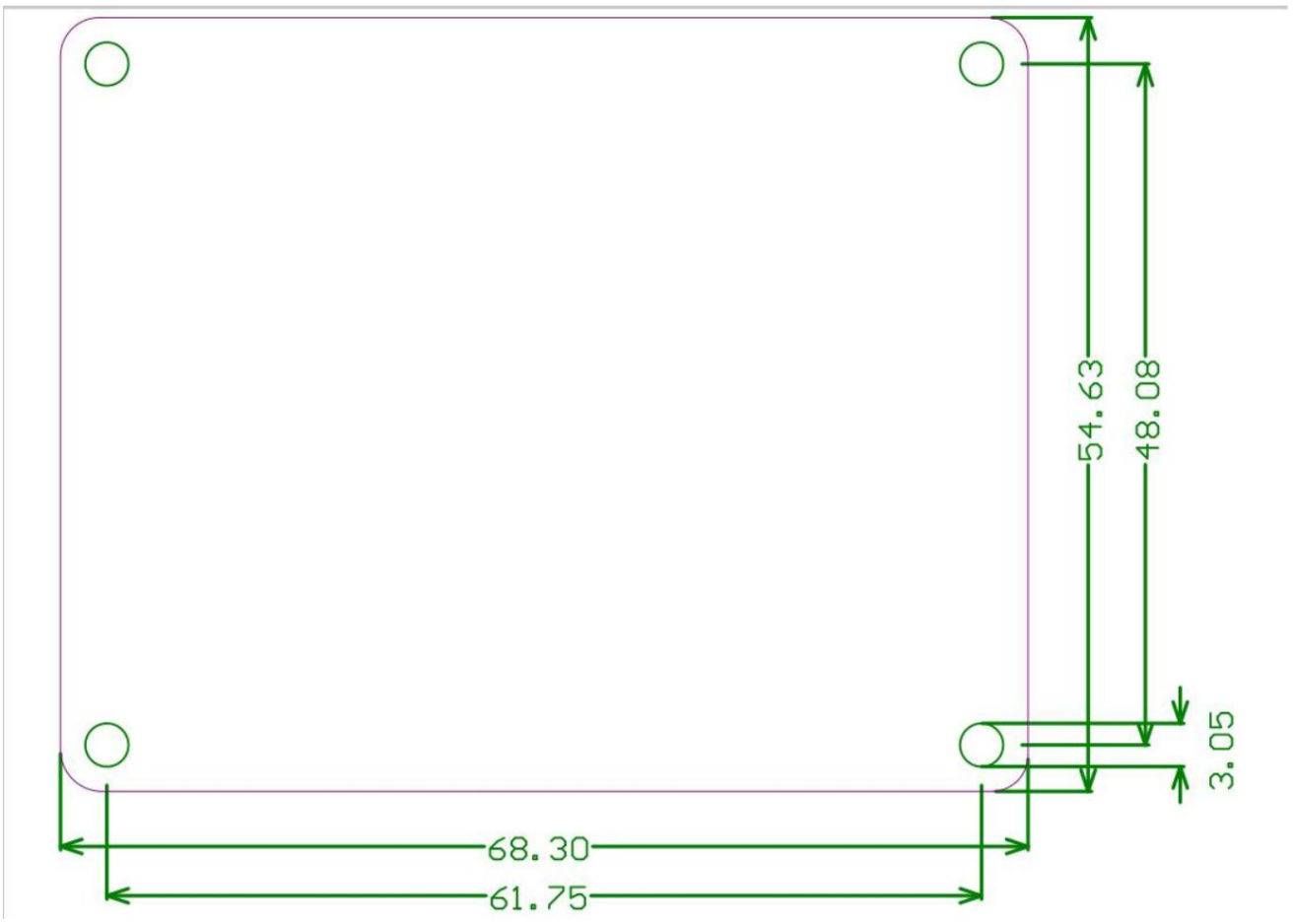
1.1 Functional block diagram

Three-phase half-bridge drive circuit	There are two three-phase half-bridge drivers in total, each route The 3-channel PWM control of ESP32 is mainly driven by the gate It is composed of dynamic IC and MOS. Please refer to the schematic diagram for details.
Regulator circuit	It consists of DC-DC power IC and LDO, respectively connecting the mother Line voltage regulated to 5V and 3.3V
Board side interface	Lead out the remaining lead-out interfaces of the ESP32 development board for For power interface, encoder interface and other sensors interface

1.2 Hardware features

size	54.6mm*68.3mm
Input voltage range	12-24V
Number of supported motors	2
Peak current	12A
master control	ESP32 WROOM 32D
Supported encoders	IIC, ABI, SPI, HALL encoders
Current sampling resistor	10mR (can be replaced by 1mR, supports some model aircraft motors)
Current detection range	±33A (under 1mR sampling resistor)

1.3 Mechanical dimensions



2. User Guide

This section will briefly introduce MKS ESP32 FOC V1.0, and explain the relevant preparations before using MKS ESP32 FOC V1.0.

2.1 Necessary hardware

- PC with Windows system
- MKS ESP32 FOC V1.0 driver board
- USB-B data cable (not a charging cable)
- 12V-24V power supply
- One or two gimbal motors
- One or two encoders (magnetic encoder, Hall encoder, etc.) are recommended to use magnetic encoders AS5600, AS5047P

2.2 Hardware preparation

MKS ESP32 FOC has been fully tested before shipment. In order to ensure the quality of use, it is recommended that users perform self-checks before powering on for the first time.

Check it out.

Inspections include:

1. Use a multimeter to check whether there is a short circuit between the positive and negative poles of VIN on the driver board, as shown in Figure 1.

2. Use a multimeter to check whether the 5V of the driver board is short-circuited to GND, as shown in Figure 2

3. Use a multimeter to check whether the 3.3V of the driver board is short-circuited to GND, as shown in Figure 3

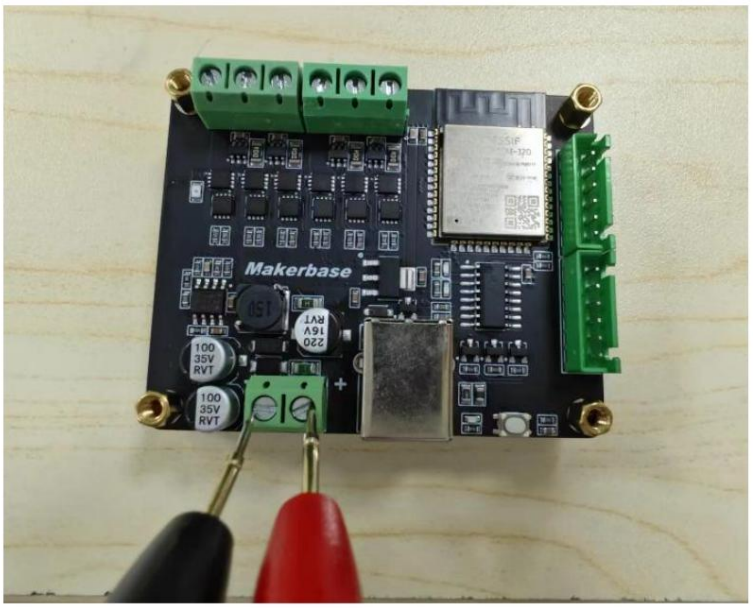


Figure 1 Testing whether Vin is short-circuited

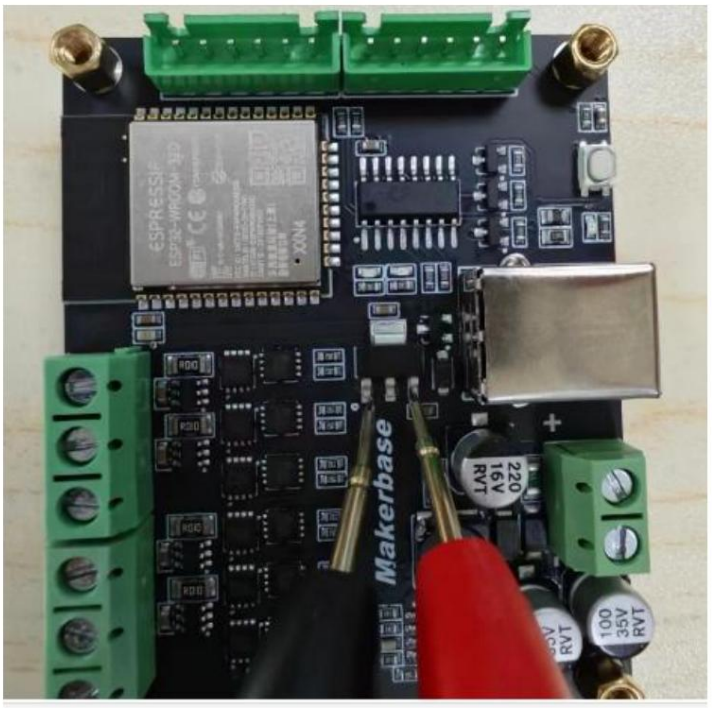


Figure 2 Test whether 5V and GND are short-circuited

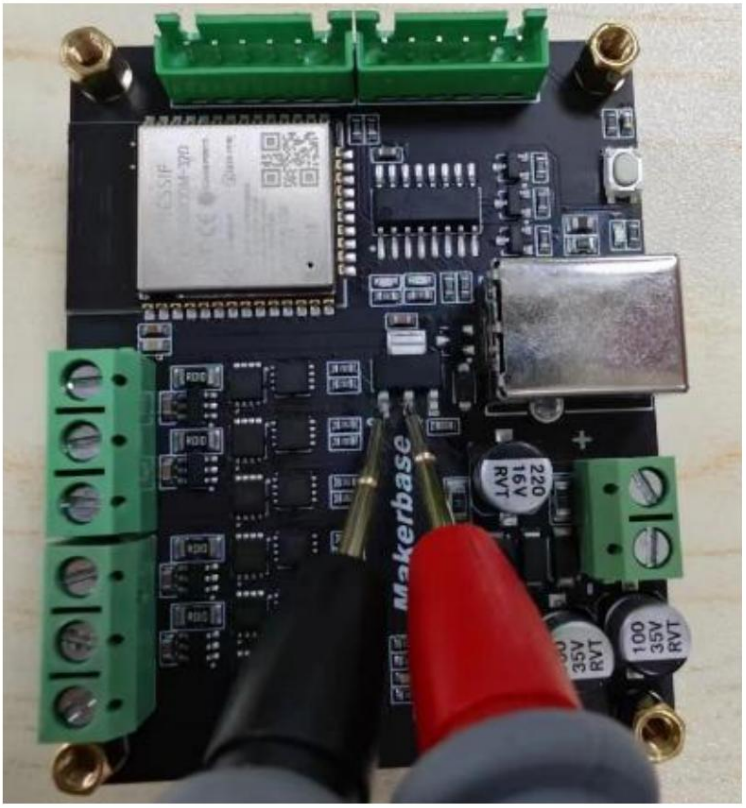


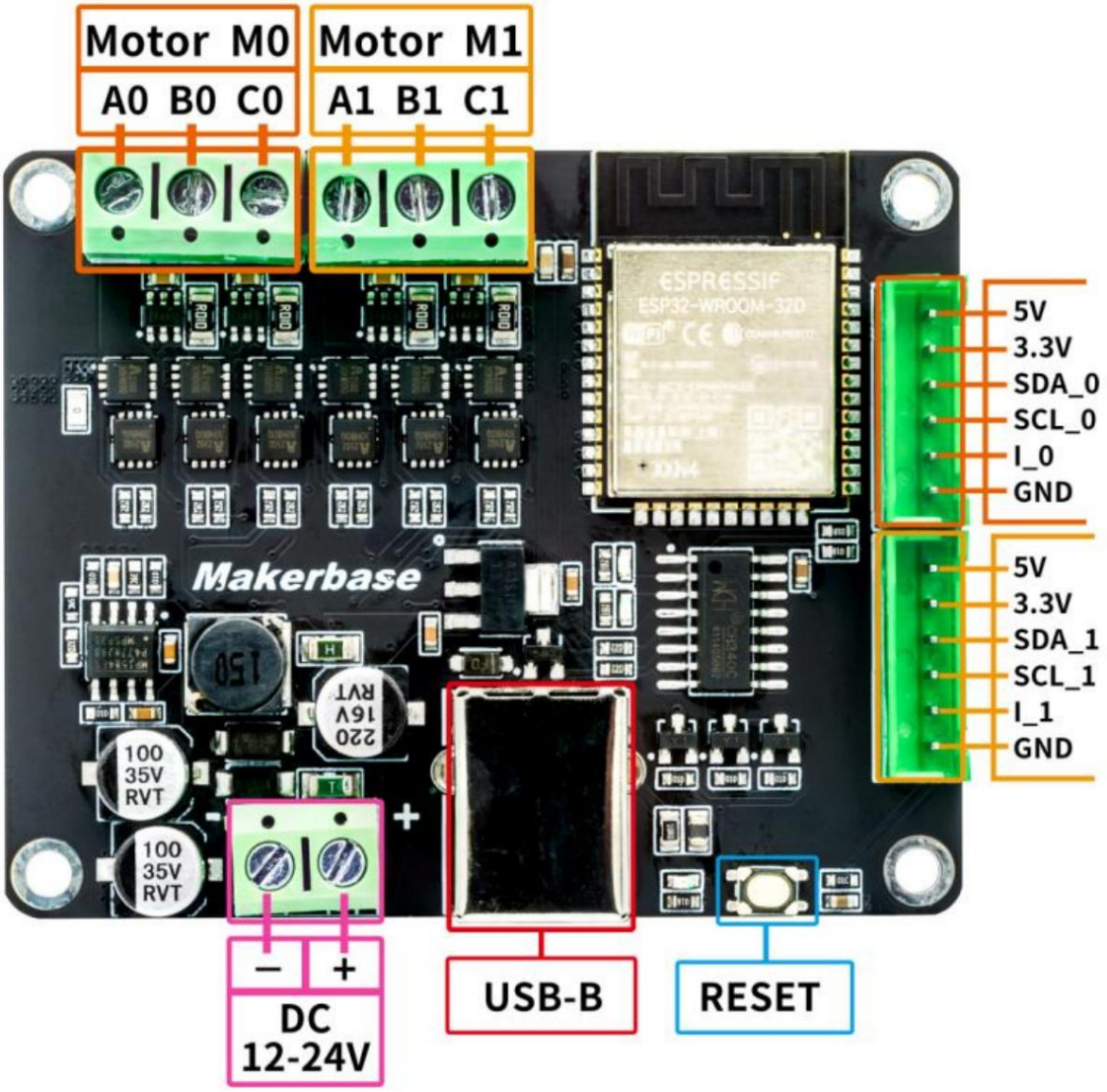
Figure 3 Test whether 3.3V and GND are short-circuited

After the above inspection is completed, connect the 12V-24V power supply to the VIN positive and negative poles of the motor driver board.

Attention! Do not reverse the positive and negative poles of the power supply!

At this time, the power indicator light in the lower right corner of the driver board lights up green, indicating that the startup is normal.

2.3 Power line connection



Encoder interface description

For the connection methods of other encoders, you can refer to the routine comments and the wiring reference below.

IIC interface (based on AS5600 as an example)

serial number	MKS ESP32 FOC V1.0	AS5600
1	SCL_0(SCL_1)	SCL
2	SDA_0(SDA_1)	SDA
3	3.3V	3.3V
4	GND	GND
5	GND/3.3V/not connected	DIR

Note: Any exchange of the two phases of the motor can change the direction of rotation.

SPI interface

MISO——19Pin——corresponds to SDA 0 on the silk screen

MOSI——23Pin——corresponds to SDA_1 on the silk screen

SCLK——18Pin——corresponds to SCL_0 on the silk screen

SS——5Pin——corresponds to SCL_1 on the silk screen

ABI interface

A0——19Pin——corresponds to SDA 0 on the silk screen

B0——18Pin——corresponds to SCL_0 on the silk screen

I_0——15Pin

A1——23Pin——corresponds to SDA_1 on the silk screen

B1——5Pin——corresponds to SCL_1 on the silk screen

I_1——13Pin

Hall encoder interface

Encoder 0 interface: 18Pin, 19Pin, 15Pin (corresponding to the board pins SCL 0, SDA 0, I 0 respectively)

Encoder 1 interface: 5Pin, 23Pin, 13Pin (corresponding to the pins SCL 1, SDA 1, I 1 on the board respectively)

If it is an open loop, just skip steps 1, 2, and 4.

2.4 Programming environment configuration

Since MSK ESP32 FOC uses a library based on SimpleFOC to run, the software environment configuration is also the same as

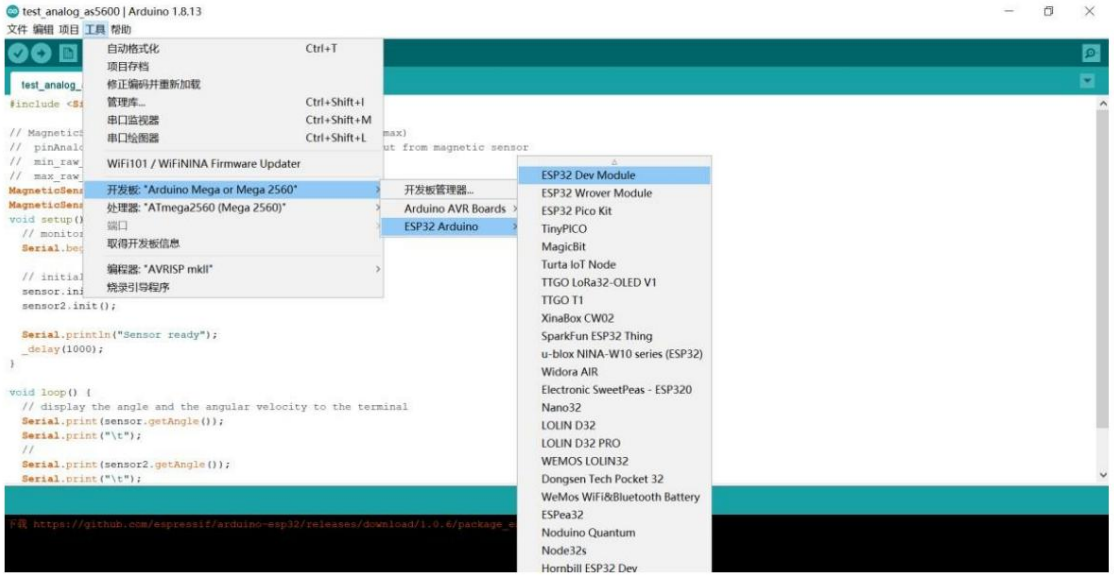
The SimpleFOC library is the same and uses Arduino IDE as the main program programming/compilation software by default .

In the next picture, click the "hook" in the upper left corner to compile the program. When the computer is connected

After entering the FOC control panel, click the "little arrow" in the upper left corner to upload the program.

Note that the development board must be selected: ESP32 DEV Module. The specific selection method is as follows:

It must be set up as shown in the figure before it can be compiled and used:



2.5 Routines

1	Dual motor open loop speed control
2	Dual motor open loop position control
3	IIC dual encoder test (AS5600)
4	ABI dual encoder test (AS5047P)
5	Dual motor closed loop speed control
6	Dual motor closed loop position control
7	Dual-motor closed-loop position and torque mutual control

3. Common problems and solutions

3.1 An error occurs at I2Ctwo.begin

Method: add a UL after 400000

3.2 When using routine 3 IIC dual encoder test (AS5600), the data printed out by the serial port

Value will not be updated

Solution: Add sensor0.update() and sensor1.update() to the loop. This is the new version of simplefoc.

Where the library needs to be modified.

3.3 When printing data through the serial port, question marks or other special symbols are printed.

Solution: Check whether the serial port baud rate is set to 115200. If not, set the baud rate to 115200.

3.4 Wiring problems when using Hall encoder

Solution: Check the Hall encoder test (5-wire) code for relevant wiring comments and wire according to the comments.

3.5 After the power-on program is run, the serial port keeps reporting errors and restarting.

Solution: Check whether the installed simplefoc library is version 2.2.2. If so, change it to version 2.2.1.

3.6 Program burning error

Solution: Confirm whether the com port is selected correctly, and check whether the line used to connect the computer and esp32 is a data line.

3.7 When using the dual motor control routine, there is no response to the serial port input command motor control.

Solution: Check whether newlines are added when inputting commands in the serial port debugging assistant and whether the baud rate is set correctly.

3.8 Hall encoder wiring problems when using Hall motors

Solution: Check the Hall encoder test (5-wire) code for relevant wiring comments and wire according to the comments.

3.9 After the power-on program is run, the motor does not rotate and the serial port displays MOT: Failed to notice movement

Solution: Check whether the motor wiring is connected stably, whether there is any open circuit, and then check whether the motor encoder wire is connected incorrectly.