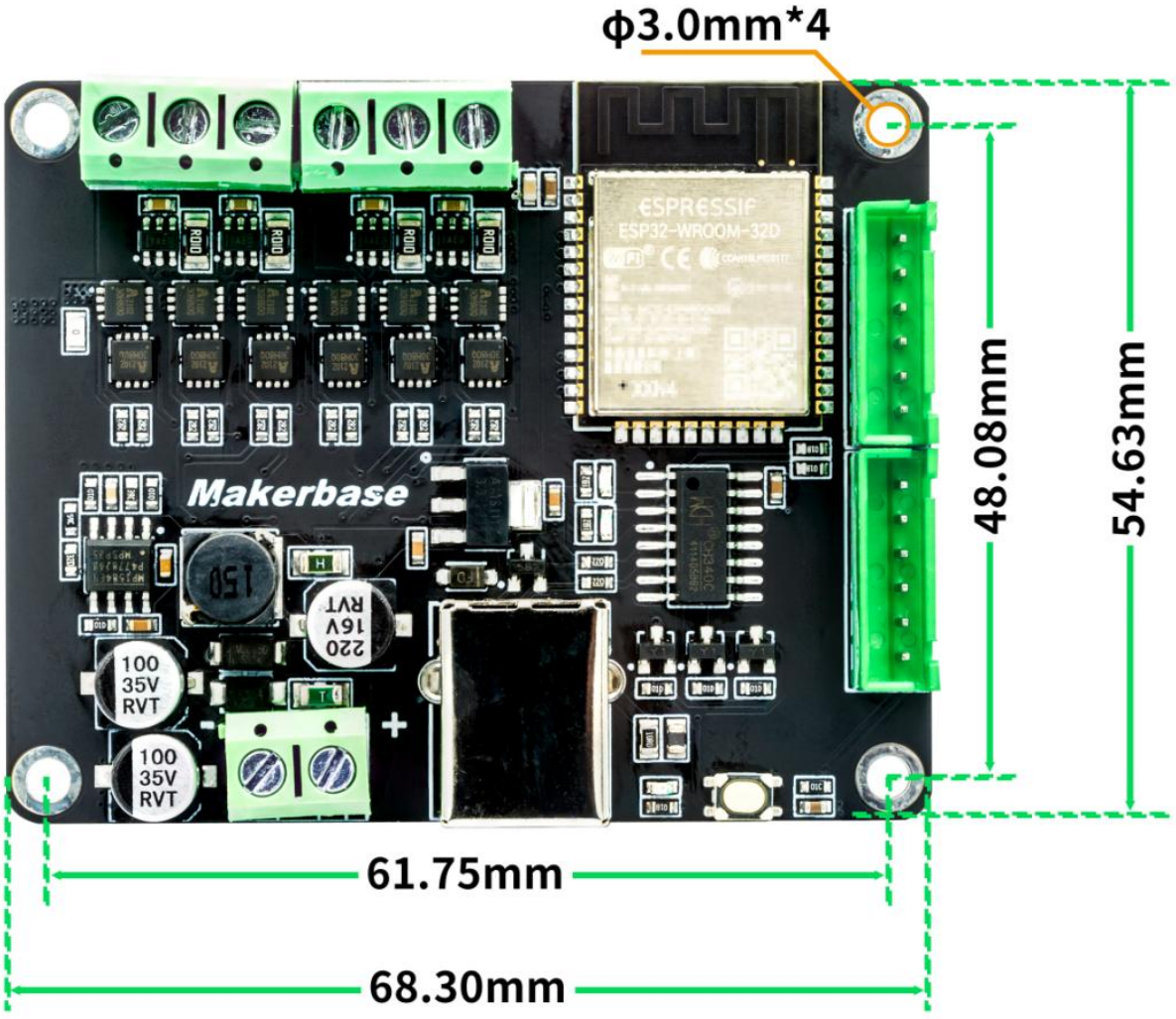
Version change record

Data	Update	Version	Remark
2023-04-26	Makerbase	V1.00	Document creation

1 Product Instruction

The driver board supports the open and closed loop control of FOC position, speed and torque of most gimbal motors. It can be expanded to support some aircraft model motors in the future. The encoder supports common IIC and ABI, PWM, HALL, SPI formats. By sampling the voltage of the sampling resistor connected in series with the motor, the online current of phase A and phase B is obtained to realize the current loop control.Build a truly complete FOC algorithm.



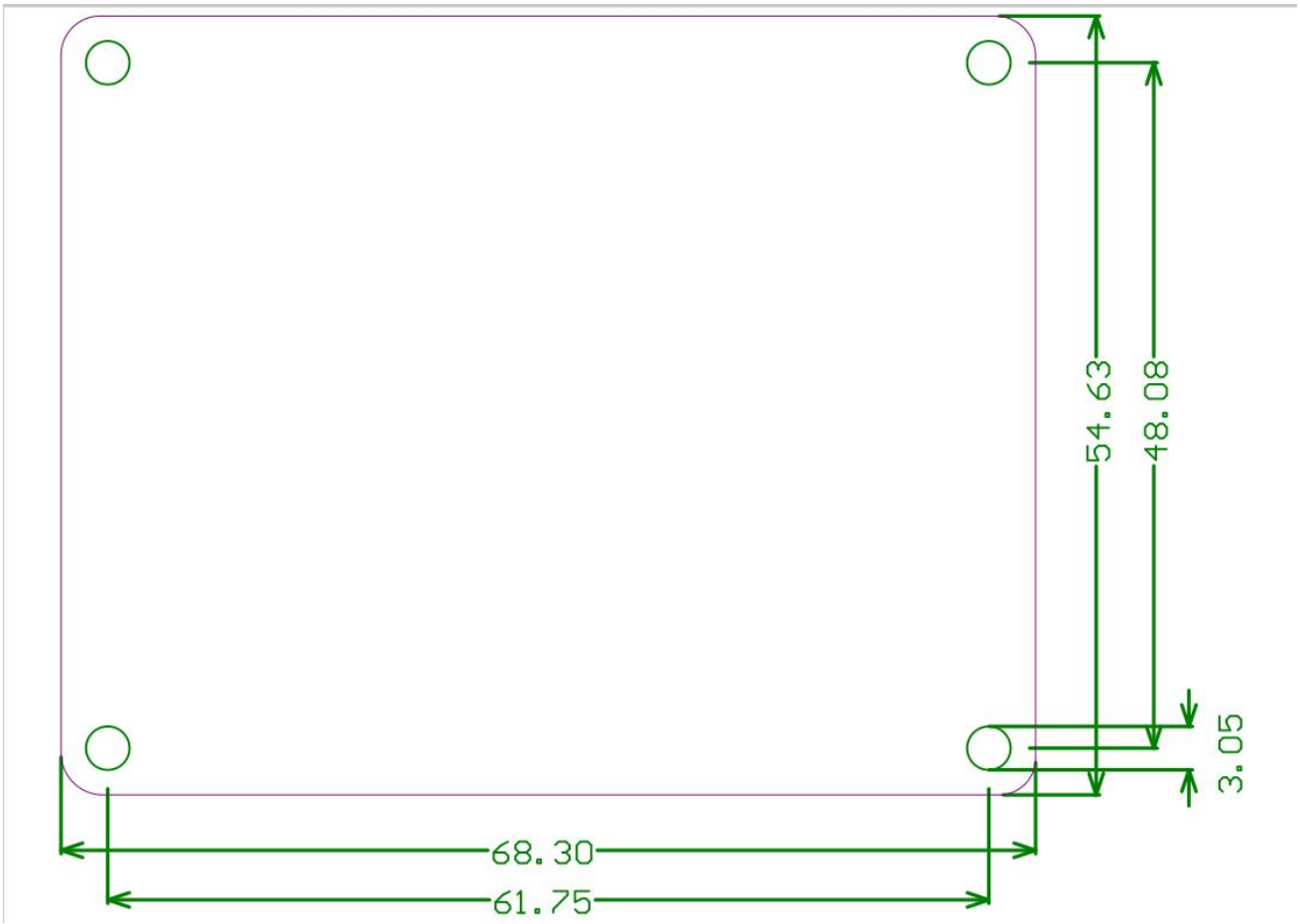
1.1 Functional block diagram

Three-phase half-bridge drive circuit	A total of two three-phase half-bridge drivers, each routed to the 3-way PWM control of ESP32, mainly composed of gate drive IC and MOS, please refer to the schematic for details
Regulator circuit	Composed of DC-DC power supply IC and LDO, respectively stabilize the bus voltage to 5V and 3.3V
Interface	Lead out the remaining ports of the ESP32 development board, which can be used as power ports, encoder ports and other sensor ports

1.2 Hardware Parameters

Size	54.6mm*68.3mm
Input voltage range	12-24V
Number of supported motors	2
Peak current	12A(Single channel maximum 6A) under good heat dissipation
Master chip	ESP32 WROOM 32D
Encoders supported	IIC、ABI、SPI、HALL
Current Sense Resistor	10mR(Can be replaced with 1mR, support some aircraft model motors)
Current detection range	±33A(With 1mR)

1.3 Size



2 User's guidance

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
- MKS ESP32 FOC V1.0 board
- USB-B Cable (Not for charging cable)
- 12V-24V Power
- One or two gimbal motors
- One or two encoders (magnetic encoder, Hall encoder, etc.) Recommended magnetic encoder AS5600, AS5047P

2.2 Hardware preparation

MKS ESP32 FOC has been fully tested before delivery. In order to ensure the quality of use, it is recommended that users check it before powering on for the first time.
Inspection content includes:

1. Use a multimeter to check whether there is a short circuit between the positive and negative terminals 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 shorted to GND, as shown in Figure 2

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

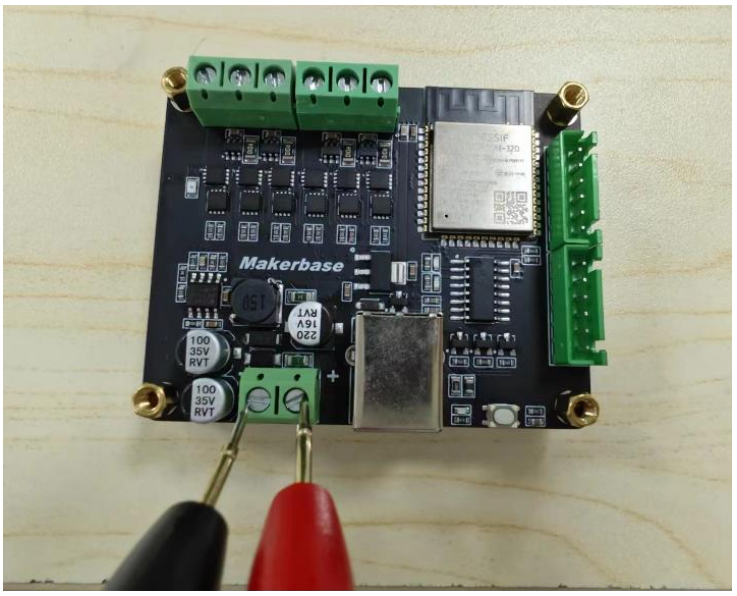


Figure 1 Test whether Vin is short-circuited

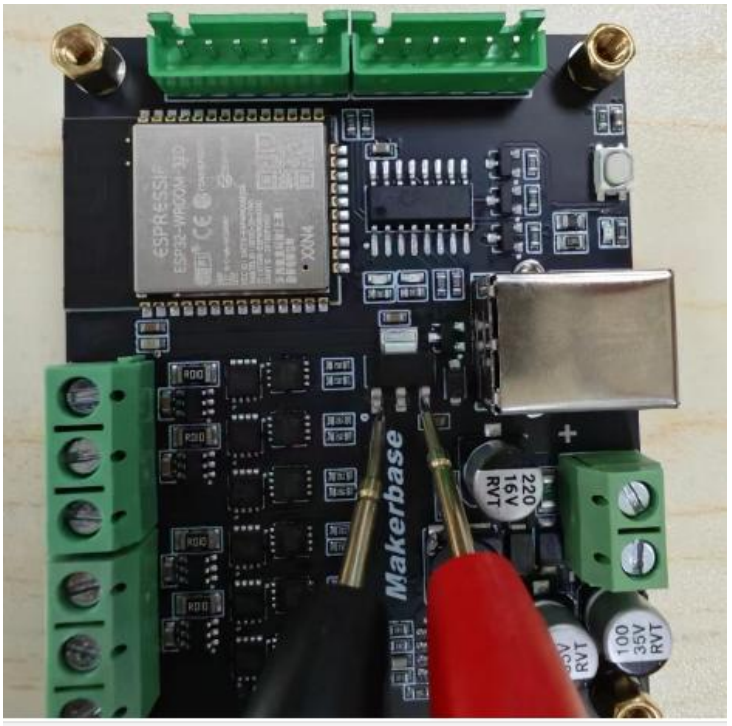


Figure 2 Test whether 5V and GND are short-circuited

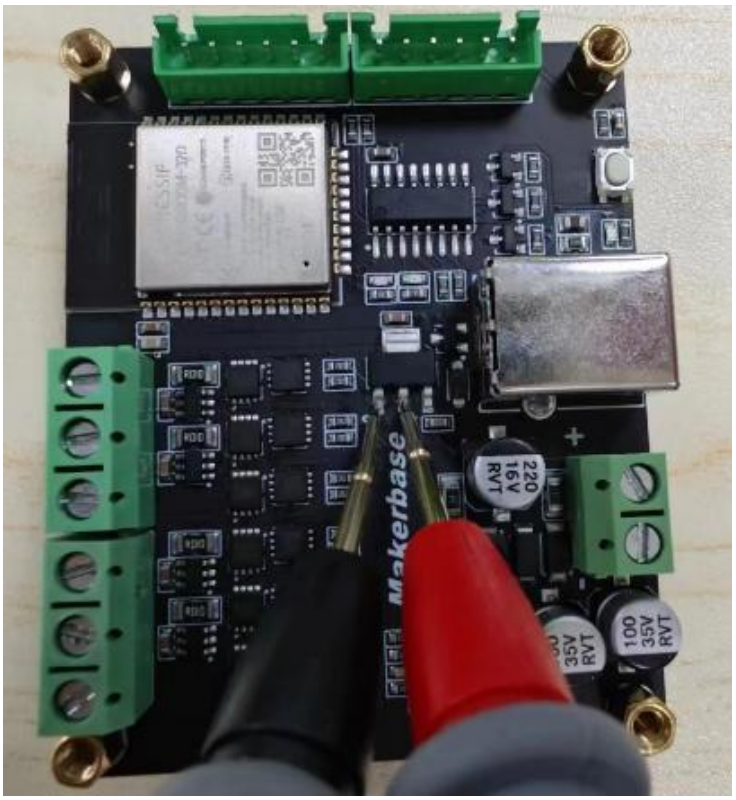


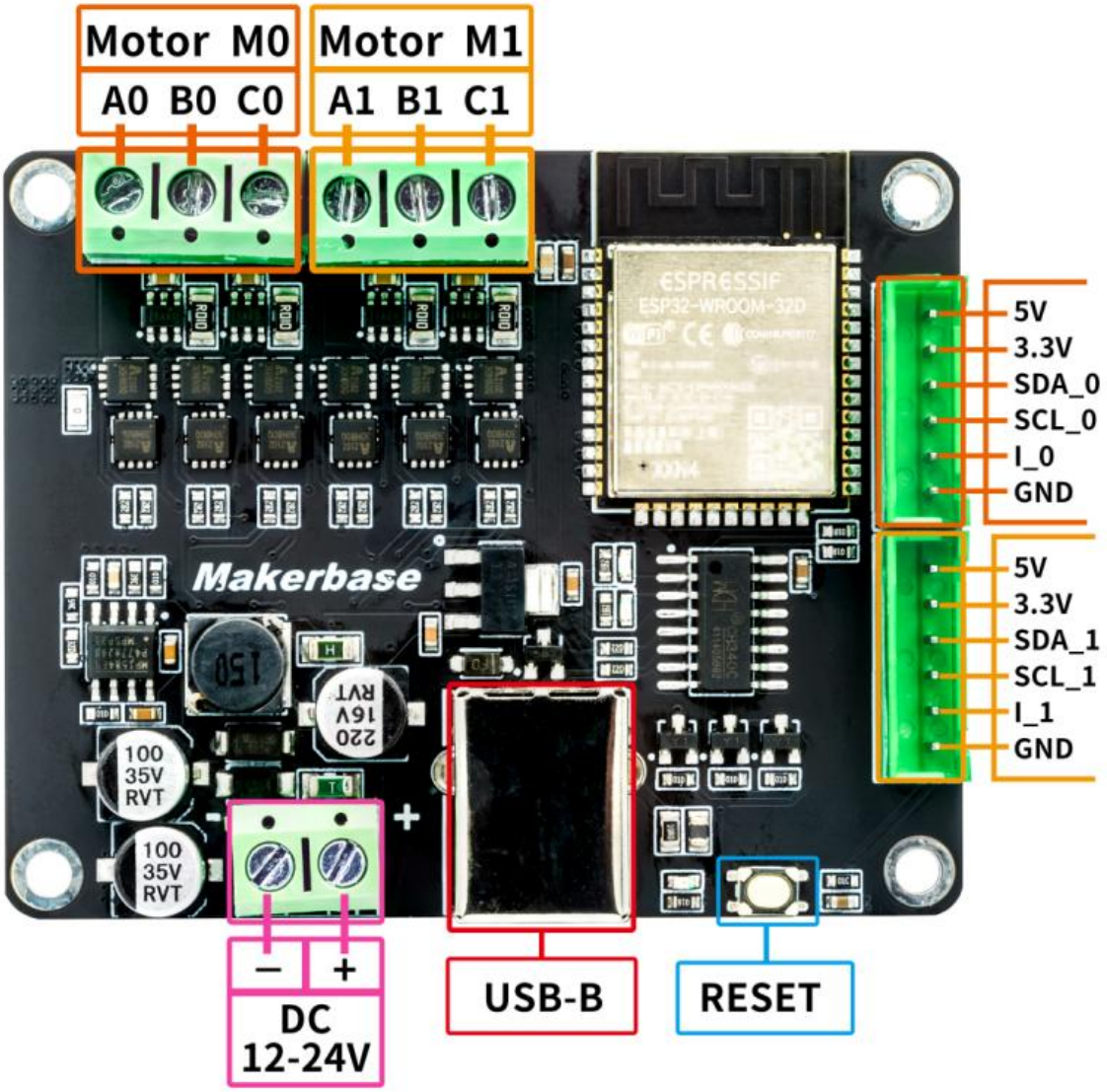
Figure 3 Test whether 3.3V and GND are short-circuited

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

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

At this time, the green light of the power indicator light at the lower right corner of the driver board is on, indicating that the startup is normal

2.3 Connection



Encoder Interface Description

For the connection of other encoders, please refer to the notes of the routine and the wiring reference below

IIC interface (based on AS5600 as an example)

	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/Hang	DIR

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

SPI Interface

MISO——19Pin——Corresponding to the silk SDA_0

MOSI——23Pin——Corresponding to the silk SDA_1

SCLK——18Pin——Corresponding to the silk SCL_0

SS——5Pin——Corresponding to the silk SCL_1

ABI Interface

A0——19Pin——Corresponding to the silk SDA_0

B0——18Pin——Corresponding to the silkn SCL_0

I_0——15Pin

A1——23Pin——Corresponding to the silk SDA_1

B1——5Pin——Corresponding to the silk SCL_1

I_1——13Pin

Hall encoder interface

Encoder 0 interface：18Pin、19Pin、15Pin（Corresponding to board pins SCL_0, SDA_0, I_0）

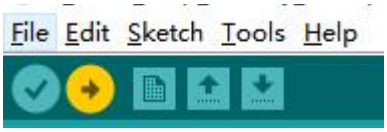
Encoder 1 interface：5Pin、23Pin、13Pin（Corresponding to board pins SCL_1、SDA_1、I_1）

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

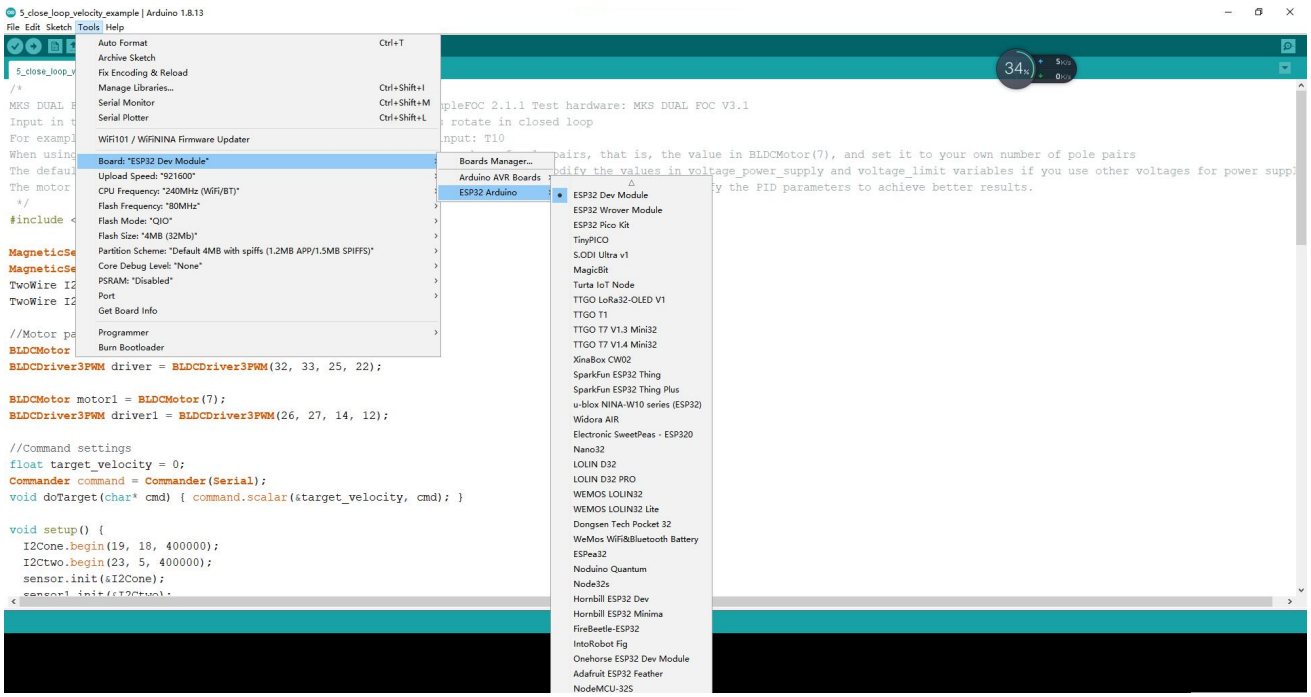
2.4 Programming environment configuration

Since MSK ESP32 FOC uses the SimpleFOC-based library to run, the software environment configuration is also the same as the SimpleFOC library, and Arduino IDE is used 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 the FOC control panel, click the "small 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	AS5600 Dual Encoder Test
4	AS5047 Dual Encoder Test
5	Dual-motor closed-loop speed control
6	Dual-motor closed-loop position control
7	Dual-motor closed-loop position-torque control

3 Common problems and solutions

3.1 An error occurs at I2Ctwo.begin

Solution: add a UL after 400000.

3.2 When using routine 3 IIC dual encoder test (AS5600), the value printed by the serial port will not be updated

Solution: Add sensor0.update() and sensor1.update() to the loop, this is where the new version of the SimpleFOC library needs to be modified.

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

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

3.4 Wiring problem with hall encoder

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

3.5 After the power-on program runs, the serial port keeps reporting errors and restarts

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

3.6 Program burning error

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

3.7 When using the dual motor control routine, the serial port input command motor control does not respond.

Solution: check whether there is a newline character added when the serial port debugging assistant enters the command and whether the baud rate setting is correct.

3.8 Hall encoder wiring problem when using Hall motor

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

3.9 After the power-on program runs, 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 an open circuit, and then check whether the motor encoder wire is connected incorrectly.