MKS DUAL FOC V3.1

Instruction document V3.1

2022.12.12 update

1 Overview

The MKS DUAL FOC Controller is a low-cost brushless motor dual FOC drive control board based on the Apache 2.0 open source protocol and the ESP32 main control chip. The total power of two channels is 240W, and the maximum power of one channel is 120W. It supports most of the head motor. Encoder, support common IIC and ABI encoder. Is a good and inexpensive dual brushless FOC drive.

2 Performance

2.1 Performance

Maximum power of a single channel	120W（dual 240W）
Supporting voltage	12V-24V
Brushless motor types supported	Gimbal motor（Phase resistance>10 Ω）
Support the number of motors driven at the same time	2
Supported encoder communication methods	IIC Analog ABI PWM

Supported external control methods	Serial port WIFI

2.2Motor selection supported by the driver board

MKS DUAL FOC currently supports common gimbal motors, and there are two specific selection indicators:

- Motor phase resistance>10Ω
- The maximum operating current is around 5A

These two selection indicators can basically cover most of the gimbal motors. If you choose according to the KV number, it is recommended to choose a motor below 200KV.

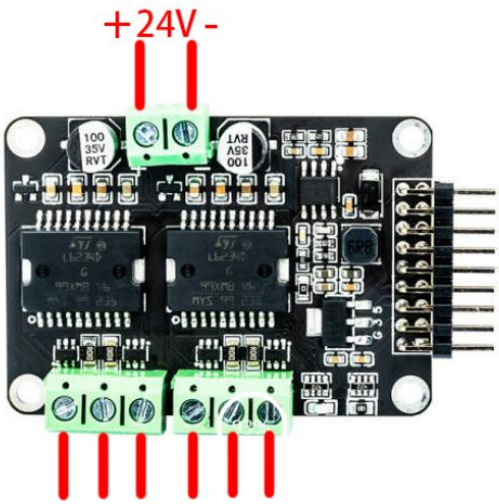
3 Basic configuration and operation

3.1 Connection and examples

The line connection of MKS DUAL FOC is very simple, only need to connect the power line and motor line, it can make the board run normally open-loop control; on this basis, and then connect the encoder, the FOC control board can realize Closed-loop control.

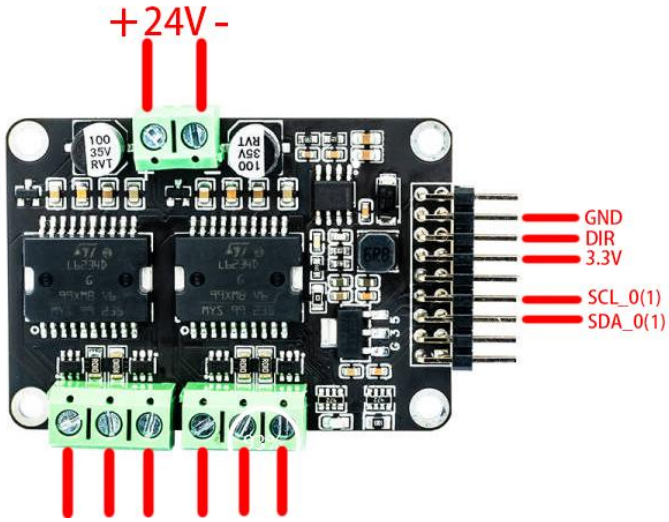
Note: If you need to debug or use for a long time, you need to add a heat sink. Good heat dissipation can make the performance of FOC fully play! Experiments have proved that there are sudden freezes during most operations. Vibration comes from poor FOC heat dissipation! ! In the case of high voltage and current, poor FOC heat dissipation may cause the driver chip to burn out. By default, it is recommended to add a heat sink to use. The recommended heatsink size is a 25x25 aluminum heatsink.

3.1.1 Schematic diagram of open-loop control wiring



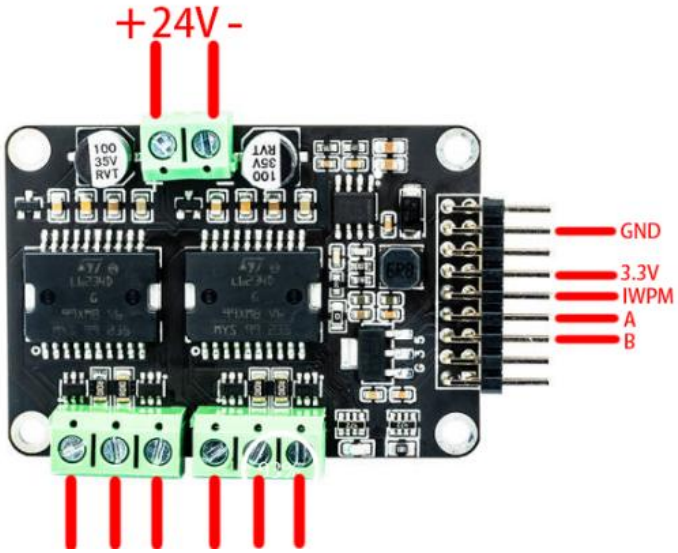
3.1.2 Closed-loop control wiring diagram (based on AS5600)

Due to the limitation of the picture space, only the wiring of one motor and one encoder is shown, and the wiring of two motors is the same

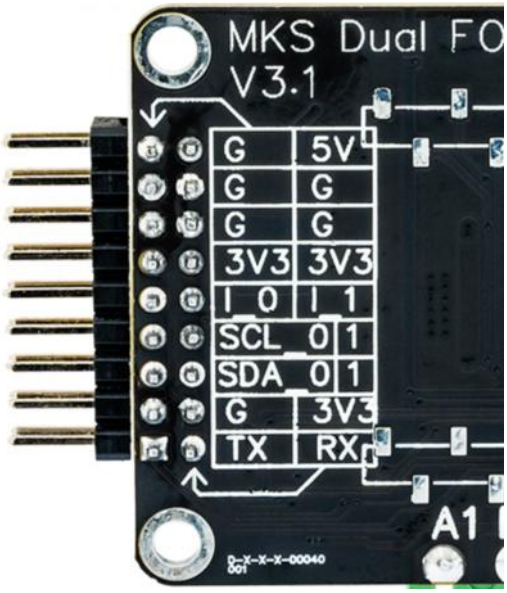


3.1.3 Closed-loop control wiring diagram (based on AS5047)

Due to the limitation of the picture space, only the wiring of one motor and one encoder is shown, and the wiring of two motors is the same



There are pins at the bottom, as shown in the figure:



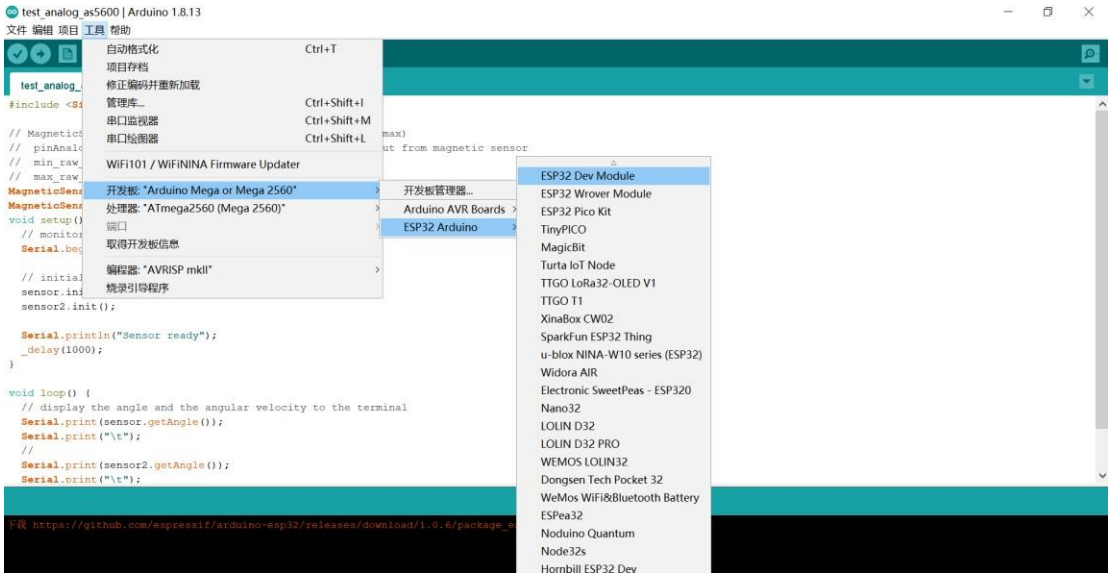
After completing the corresponding wiring and confirming that the driver board light is on after powering on, we can enter our next step: programming environment configuration

3.2 Programming environment configuration

Since MSK DUAL FOC uses a library based on SimpleFOC, the software environment configuration is also the same as that of the SimpleFOC library. By default, Arduino IDE is used as the main program programming/compilation software.

In the next figure, click the "hook" in the upper left corner to compile the program, and when the computer is connected to the FOC control board, click the "small arrow" in the upper left corner to upload the program.

Note :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 compiling and using:



4 Routines

	Routine Details
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

5 Common Problems and Solutions

5.1 The motor does not turn

1. Check whether the wiring of the motor is normal
2. Check whether the power supply is out of power
3. Check whether the program is correct
4. Check whether the wire inside the motor is broken

5.2 Vibration when the motor is running

1. Check the motor wiring, whether there is a phase loss
2. Check whether the pole logarithm setting in the program is correct (most of the general vibration phenomenon comes from the wrong pole logarithm setting)
3. When testing the open-loop speed routine. If the speed is too high to cause vibration, you can set the speed lower

5.3 The motor or chip heats up violently

1. Do not move the motor in a state of vibration
2. Open-loop speed routine, do not set the speed to 0 for a long time (otherwise it will be like a stall and heat up), if you want to achieve practical results, it is recommended to close loop

3. The open-loop position routine, the position should not remain unchanged for a long time (otherwise it will be like a stalled rotor and will generate heat). To achieve practical results, it is recommended to close loop

5.4 Encoder reading jump

1. Check whether the encoder magnet is installed correctly (the axial and radial magnets should be distinguished)
2. For AS5600, check whether dir is connected to high level or low level (GND))
3. Check whether the distance between the magnet and the encoder is too far