CC3D flight control board

Users Manual

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1 Introduction

The CC3D board is an all-in-one stabilization hardware which runs the OpenPilot firmware. It can fly any airframe from fixed wing to an octocopter and is configured and monitored using the OpenPilot Ground Control Station (GCS) software. The CC3D boards have gained great popularity among UAV fans for its small volume, tidy circuit and affordable price.

1. Powerful STM32 32-bit micro controller running at 72MHz, and can reach at 1.25DMips/MHz when performance at 0 wait state memory access.
2. Integrated with MPU6000 (3-axis high-performance gyros and 3-axis high-performance accelerometer), with 16M IC
3. Support GPS and data transmission
4. Operating voltage: 5V

Safety

Operating a powered vehicle of any kind can be a lot of fun. However, nothing will ruin your day at the park more quickly than an accident or running afoul of the law. Since we want you to have a great experience, please make sure that you do all of the following:

- **Operate within all local laws and regulations.** For example, in the United States, current regulations require you to operate most UAVs under 400 foot above ground level, within line of site, and away from obstructions and populated areas. Since these regulations vary from place to place, even within the same country, ensure that you understand what you need to do to stay compliant.
- Never operate the vehicle or software in a way that could be dangerous to you, other people, or property. Propellers, while rotating, could easily cut you; if a UAV fell on a person or object, it
could cause injury; a UAV caught in power lines could cause an outage. As Ben Franklin said, “An ounce of prevention is worth a pound of cure.”

- **Always keep in mind that software and hardware failures happen.** Although we design our products to minimize such issues, you should always operate with the understanding that a failure could occur at any point of time and without warning. As such, you should take the appropriate precautions to minimize danger in case of failure.

- **Never use the software or hardware for manned vehicles.** The software and hardware we provide is only for use in unmanned vehicles.

### 1.1 Overview and Hardware Resources

![Figure 1-1(front and rare side of CC3D)](image)

**CC3D contains:**

1. STM32F103, integrated with 16M FLASH
2. MPU6000: 3-axis high-performance gyros and 3-axis high-performance accelerometer
3.6-channel signal input

4. 6-channel input for servo and ESC.

5. External interface for GPS

6. External interface for data transmission

dimension: 36mm x 36mm x 5mm

weight: 12.6g

1.2 Software Resources

Firmware upload: OpenPilot GCS

Host software: OpenPilot GCS

1.3 Source

OpenPilot GCS:

https://wiki.openpilot.org/display/WIKI/Downloading+and+Installing+the+Ground+Control+Station

2 Interfaces
2.1 Interface Layout

Please note the + and – of the power port, the inverse may burn the chip and circuit board.
2.2 Interface specifications

The main port and the flex port are the GPS and data transmission interfaces of CC3D, when you are using one external port, please choose main port as priority.

3 Development Environment setting

3.1 File Burning

All CC3D board has been through rigorous test and the BOOTLOAD and firmware for X-model has been uploaded, you can use directly.

3.2 Software Setting

1. Connect your CC3D to computer with USB cable, open OpenPilot GCS, then click vehicle setup wizard.
2. Click Next

**Figure 3-1**

**OpenPilot Setup Wizard**

Welcome to the OpenPilot Setup Wizard

This wizard will guide you through the basic steps required to setup your OpenPilot controller for the first time. You will be asked questions about your platform (multirotor/helis/fixed-wing) which this wizard will use to configure your controller for its first flight.

This wizard does not configure all of the advanced settings available in the GCS Configuration. All basic and advanced configuration parameters can be modified later by using the GCS Configuration plugin.

**WARNING:** YOU MUST REMOVE ALL PROPELLERS FROM THE VEHICLE BEFORE PROCEEDING!

Disregarding this warning puts you at risk of injury!
How that your props are removed we can get started. Ready?
3. If you need to upgrade the firmware, please choose Upgrade, or you can choose Next to continue.

![Firmware Update](image)

It is necessary that your firmware and ground control software are the same version.

When you are ready, you can start the upgrade below by pushing the button. It is critical that nothing disturbs the board while the firmware is being written.

It is recommended that you erase all settings on the board when upgrading firmware. Using saved settings for a previous version of the firmware may result in undefined behavior and in worst case danger. It is possible to suppress the erase by deselecting the check box below.

![Erase all settings](image)

Figure 3-3

4. Choose input signal, please choose PWM as default.
OpenPilot Input Signal Configuration

The OpenPilot controller supports many different types of input signals. Please select the type of input that matches your receiver configuration. If you are unsure, just leave the default option selected and continue the wizard.

Some input options require the OpenPilot controller to be rebooted before the changes can take place. If an option that requires a reboot is selected, you will be instructed to do so on the next page of this wizard.

5. Choose vehicle type, the default one is Quadcopter. The current version of CC3D only provides functionality for multicopters and fixed-wing aircraft and surface, the helicopter is not applicable for the moment.
Vehicle Type Selection

To continue, the wizard needs to know what type of vehicle the OpenPilot controller board is going to be used with. This step is crucial since much of the following configuration is unique per vehicle type.

Go ahead and select the type of vehicle for which you want to create a configuration.

The current version only provides functionality for Multirotors and Fixed-wing aircraft.

Figure 3-5

6. Click Next to continue to choose flight mode. Users can choose flexibly as you like. If you are using Quadcopter like our FE500, please choose X-model.

<table>
<thead>
<tr>
<th>Tricopter</th>
<th>Quadcopter X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadcopter</td>
<td></td>
</tr>
<tr>
<td>Hexacopter</td>
<td></td>
</tr>
<tr>
<td>Hexacopter X</td>
<td></td>
</tr>
<tr>
<td>Hexacopter H</td>
<td></td>
</tr>
<tr>
<td>Hexacopter Cone (Y6)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3-6

7. Choose ECS mode, you can choose from standard esc and rapid esc, if you are not sure about this, please chooses Next to continue.
OpenPilot Output Signal Configuration

To set an optimal configuration of the output signals powering your motors, the wizard needs to know what type of Electronic Speed Controllers (ESCs) you will use and what their capabilities are.

Please select one of the options below. If you are unsure about the capabilities of your ESCs, just leave the default option selected and continue the wizard.

Figure 3-7

8. Calibration: click calculate and keep the board level, when you see done, the calibration is finished.
9. Calibrate the ESC signal:

Click Next to continue.

Connect the battery and the ESC, (do not mount the syrup now to avoid danger).

If you are just testing the CC3D board, you can skip this step.
Output calibration

In this step we will set the neutral rate for the motor highlighted in the illustration to the right. Please pay attention to the details and in particular the motor's position and its rotation direction. Ensure the motors are spinning in the correct direction as shown in the diagram. Swap any 2 motor wires to change the direction of a motor.

To find the neutral rate for this motor, press the Start button below and slide the slider to the right until the motor just starts to spin stable.

When done press button again to stop.

Connect the motor and ESC, make sure power supply is normal. Click start button below and slide the slider to the right until the motor starts to spin stable.

After the calibration, the motor will stop and the calibrated data will be saved. You can click Next to continue with the other 3 ESC.

10. Choose the flight model and click SAVE, all the parameters will be saved into CC3D board.
Initial Tuning

This section of the OpenPilot Wizard allows you to select a set of initial tuning parameters for your airframe. Presented below is a list of common airframe types, select the one that matches your airframe the closest, if unsure select the generic variant.

![QAV250 Drone](image)

**Name of Vehicle:** QAV250  
**Name of Owner:** nick (soundpos)  
**Size:** 250mm  
**Weight:** 435g Excluding battery  
**Motor(s):** Tiger MM1006-14 2500kv  
**ESC(s):** Tiger 12amp Simonek  
**Servo(s):**  
**Battery:** 3S 1300  
**Propellers(s):** HQ 6x4  
**Controller:** CC3D  
**Comments:**

![OpenPilot Setup Wizard](image)
OpenPilot configuration ready to save

The wizard is now ready to save the configuration directly to your OpenPilot controller.

If any of the selections made in this wizard require a reboot of the controller, then power cycling the OpenPilot controller board will have to be performed after you save in this step.

Press the Save button to save the configuration.

Figure 3-11

3.3.2 RC calibrate

1. Connect your CC3D to the receiver and operate as the following steps in the picture:
Figure 3-12

Figure 3-13
2. Click next to continue with the flight mode switch setting, as shown in the picture, the default mode is for American: Throttle and Rudder are on the left hand, if you are used to Japanese mode, please choose the one with Throttle and Rudder on the right hand. You can choose as you like.

Then click Next to continue.

3. Move the joystick according to the picture on the screen, after you finished, you will see next/skip.

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Figure 3-14
Keep the joystick at neutral, as shown in the following picture, click next, then you will be reminded to move the stick to their Maximums and minimums.
4. Arm airframe using throttle off and YAW left, arming timeout in 30 seconds as default, click save.
4 Extensible Applications

Support GPS and data transmission.