

Whitebox™ Developer's Guide

Revision 1.0

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Contents

1	Introduction	3
2	Equipment Not Included	3
3	How to Disassemble the Whitebox	4
4	ESC Programming	9
5	Teensy LC Microcontroller Programming	12

1 Introduction

This document is meant for technical professionals or people who have years of experience with strong magnets, LiPo batteries, high current carrying wires, and motors. Disassembly of the Whitebox is not recommended, especially for any users who do not possess the experience referenced above. However, since the Whitebox is an experimental prototype developer kit, below is some supporting information for how to disassemble and interface with the Whitebox.

2 Equipment Not Included

As was done in the User Guide, a list of additional components that we have found useful for developing with the Whitebox is given below.

1. [USB to Micro-USB Cable](#)
2. [ESC Programming Card](#)

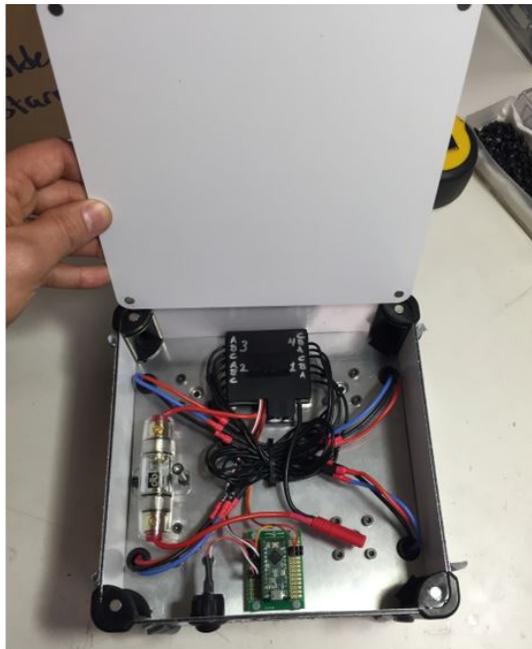
3 How to Disassemble the Whitebox

Required Tools:

1. #2 Phillips Screwdriver
2. 3mm Allen key
3. 2mm Allen key

Steps:

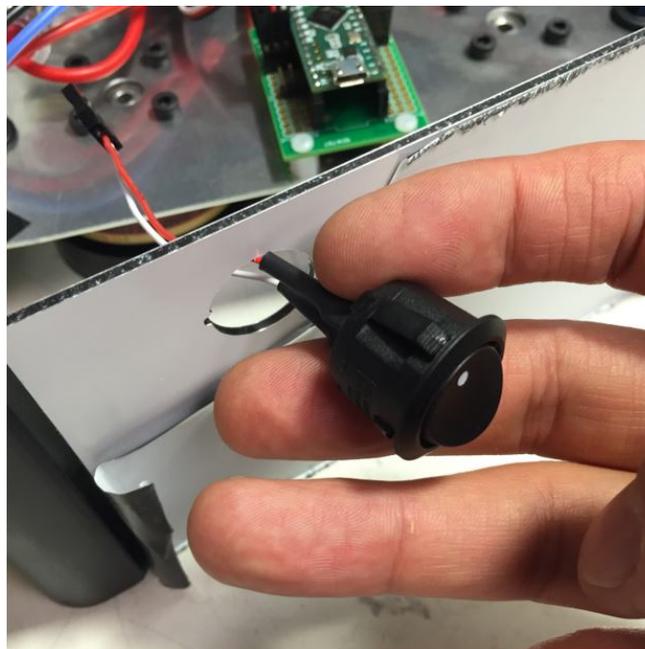
1. Remove the top lid.



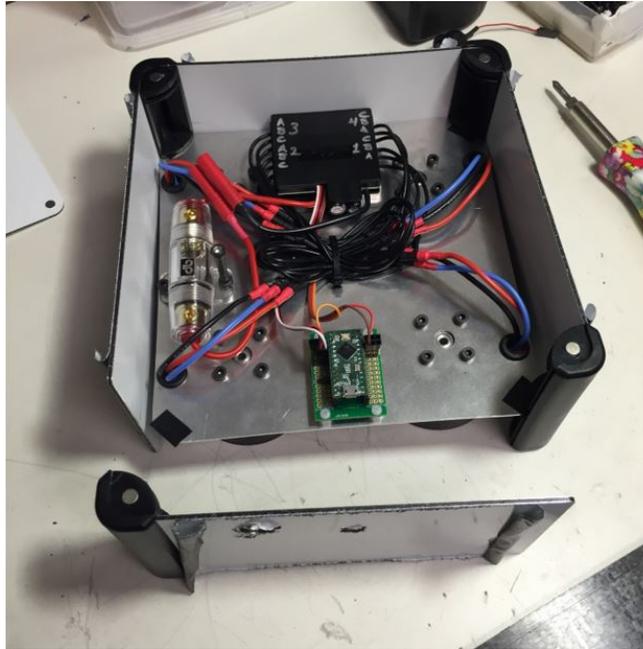
2. Use Phillips Screwdriver to unscrew the bottom panel.



3. Unplug and remove the power switch from side panel.



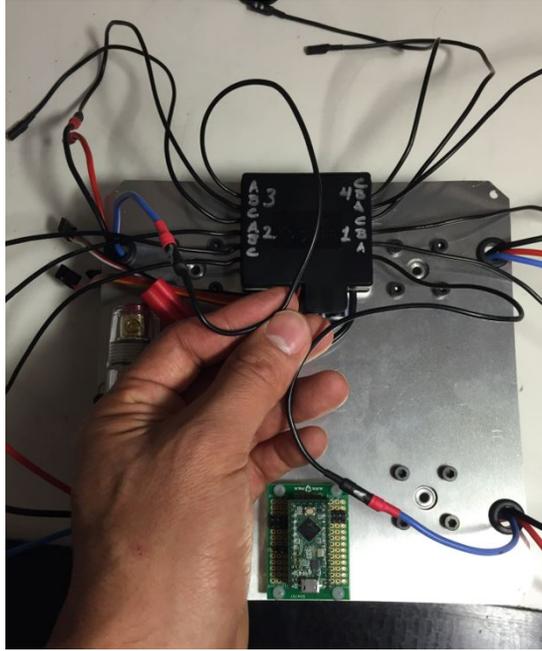
4. Remove the side panels and corner clips.



5. Carefully cut the zip tie to loosen the ESC wires.



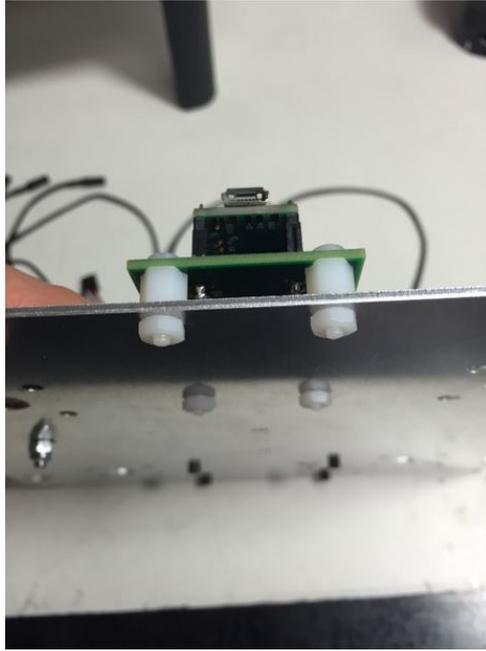
6. Disconnect all Motor and ESC wires.



7. Remove all Hover EnginesTM from the chassis using 3mm hex key. **Be extra careful with this part of the process.** DO NOT place engines on ferromagnetic (steel, iron, nickel, etc.) surfaces. Also, keep loose ferromagnetic hardware away from engines. Remove one engine at a time, making sure it is carefully placed on a non-ferromagnetic surface (i.e. a wooden or plastic table). At least 12 inches of space should be maintained between Hover Engines.



8. Unscrew the nylon hex nuts to separate the Teensy Microcontroller from the chassis.



9. Use the 2mm hex key to remove the bolts and detach the ESC and Heatsink from the chassis.

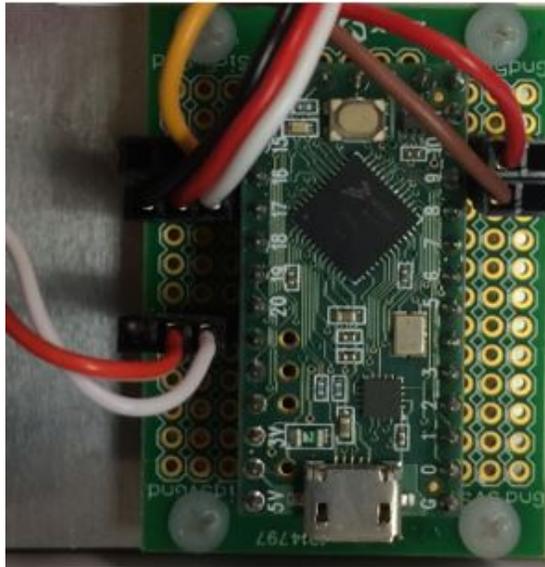


10. Do not disassemble the Starm™ from the motor. The Starm is the black cylindrical component that contains the permanent magnet array. DO NOT disassemble the Starm itself. In addition, bypassing the fuse is not recommended and can result in overheating or over-discharging the battery.

4 ESC Programming

The steps below utilize a Turnigy Programming Card (not included with the Whitebox). The included ESC can be reprogrammed to control the brake, battery type, cutoff type, cutoff voltage, start mode, timing mode, music, and governor mode.

1. Disconnect the servo connector with black, red, and white wires from the Teensy breakout board (pin 17).



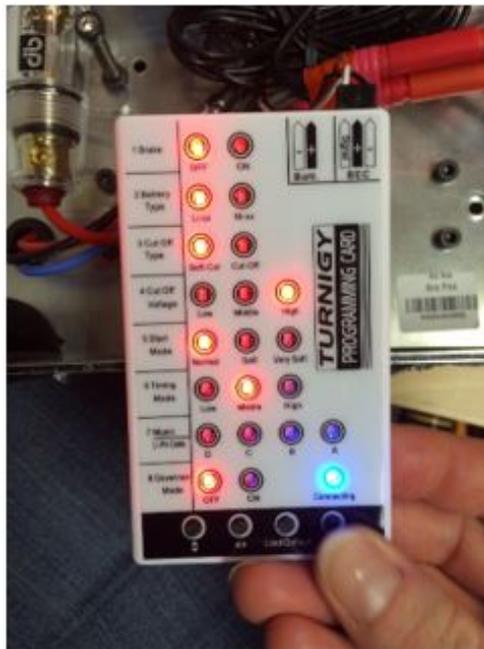
2. Plug this servo connector into the slot marked BEC on the Turnigy Programming card. The white wire is the signal wire.



3. Plug in battery. The ESC will beep. Wait for a moment and the settings will light up on the program card.



4. Use the up/down and left/right arrows at the base of the card to choose your desired settings. Press OK to program. After blue "connecting light turns off, unplug the battery. For reference, the settings that came on the Whitebox are shown below.



5. Unplug the servo connector with black, red, and white wires from the BEC slot of programming card. Plug this connector into the slot marked "Batt." on the programming card. Next, disconnect the servo connector with an orange wire from the Teensy breakout board (pin 16) and plug it into the slot marked "BEC" on the Turnigy Programming card. The orange wire is the signal wire.



6. Repeat steps 2 - 4.
7. Repeat steps 5 and 6 for the servo connectors with red and brown wires. Using a 4 to 1 servo connector for programming does not reliably program all 4 individual channels.

5 Teensy LC Microcontroller Programming

To download the source code that comes programmed on the Teensy LC Microcontroller, go to the Whitebox tab on <http://hendohover.com/>. There are three relevant files for programming the Teensy microcontroller; Run_Whitebox (Arduino file), Whitebox.cpp, and Whitebox.h. Note that changing the timer that is in the code could result in overheating or over-discharging the battery.

Teensyduino, a software add-on for Arduino, is required to program the Teensy LC using Arduino. The download instructions and support can be found on the [Teensyduino web page](#).

On the side of the Whitebox that has the power switch, there is also a slot to allow for programming the Teensy LC without having to disassemble the Whitebox. Although this slot has been tested with a few Micro USB cables, smooth connection is not guaranteed. If this fit is slightly off for your Micro USB connector, you can adjust the position of the Teensy breakout board (the mounting holes for the breakout board are slots to allow for slight adjustments).



Only 5 of the pins of the Teensy LC are currently in use for Hover Engine operation. This leaves many opportunities to attach sensors, LEDs, and other components that can interface with your Whitebox. The full list of Technical Specifications for the Teensy LC can be found [here](#). For quick reference, the pinout is given below.

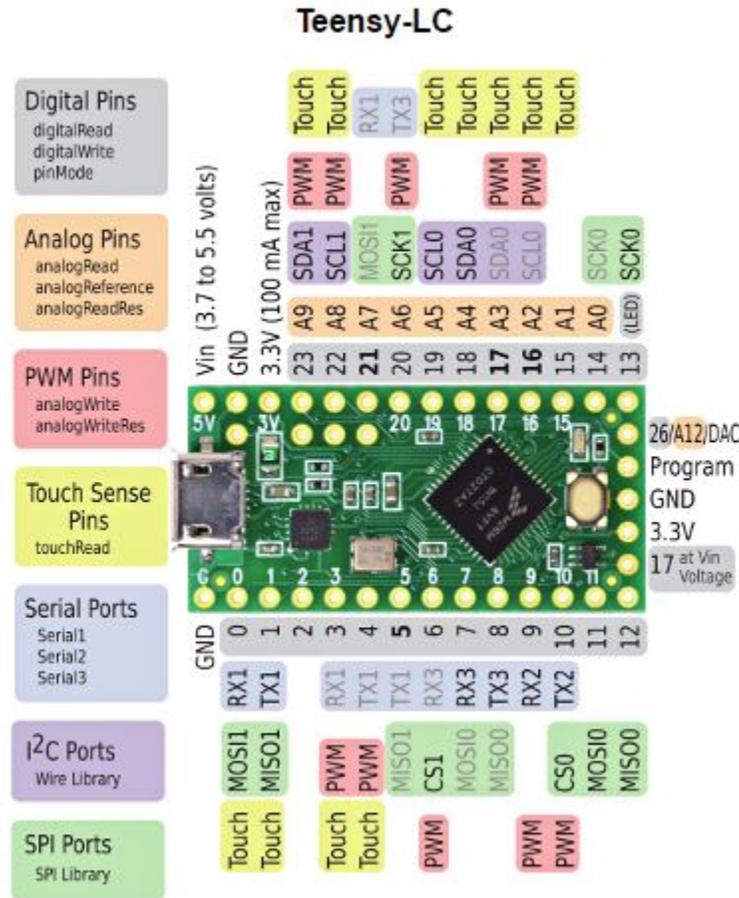


Figure 1: Teensy LC Pinout. Pins 9, 10, 16, and 17 are used for Hover Engine control and Pin 21 reads the power button signal. Photo credit: PJRC.com