

UCSD ECE191 2020 Spring TeamD

PCB4 - PDB

RoboCar Power Distribution Board

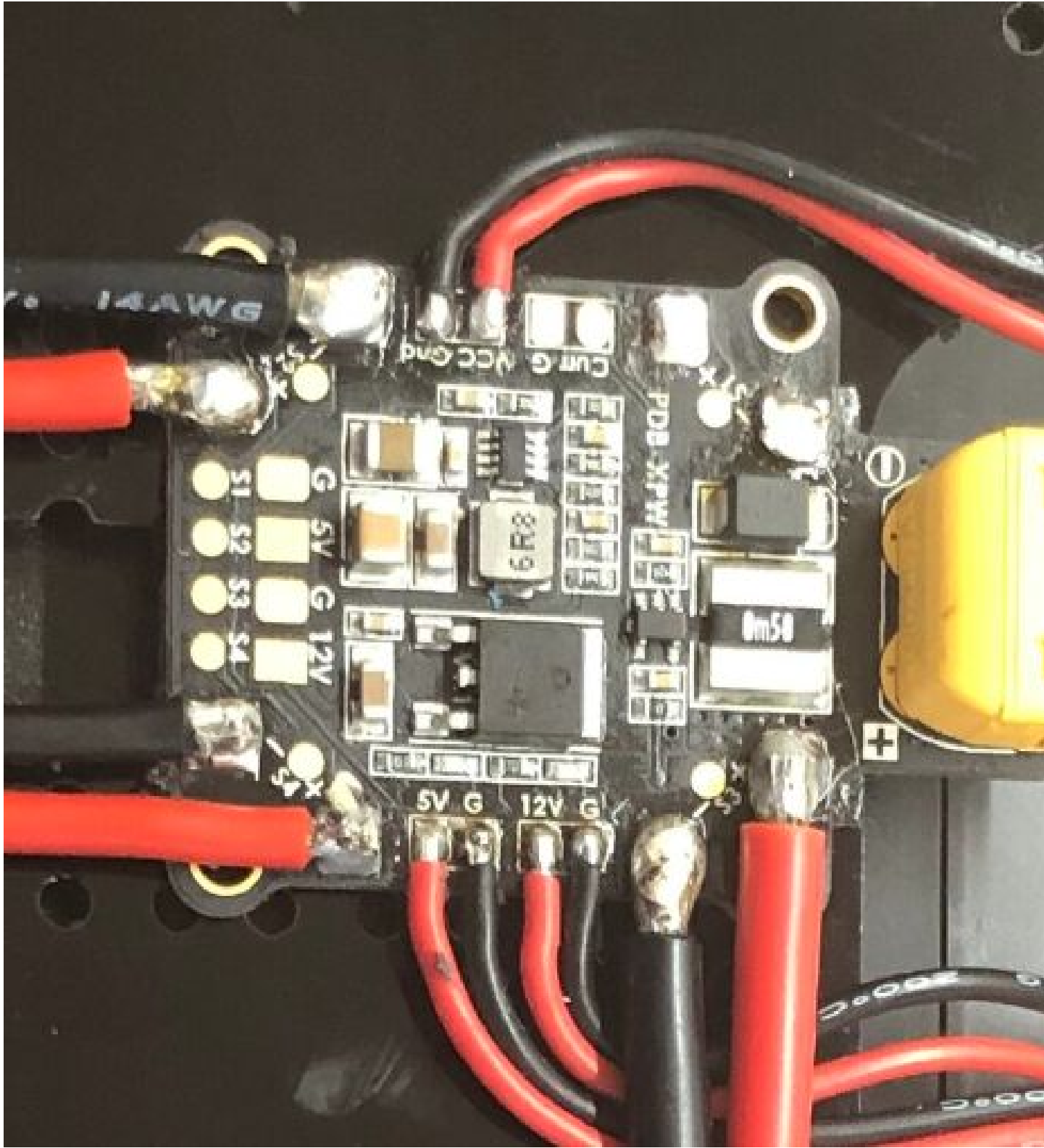
03May20 - V0.04 - edit the date and document version every time the document is updated

We will design, build, and test a Power Distribution Board (PDB) to be used on scale autonomous vehicles.

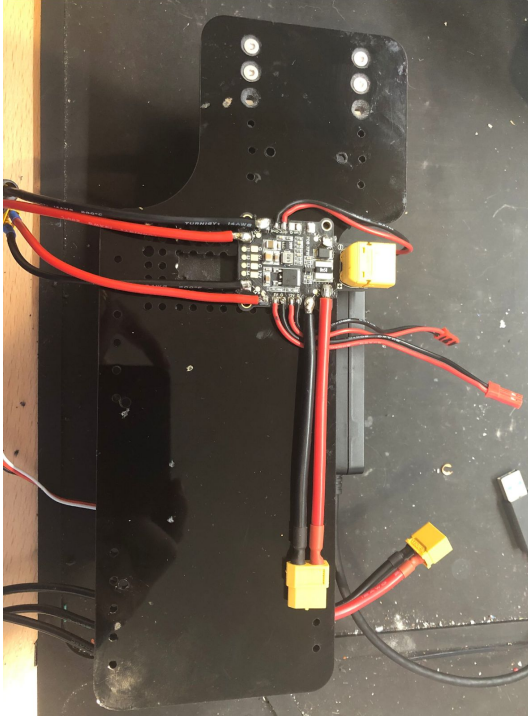
Here is a typical robot where PCB4 will be used



Below is how a drone PDB looks like. We are using one of these at robot above to distribute power and provide 5 and 12V regulated to electronic components.

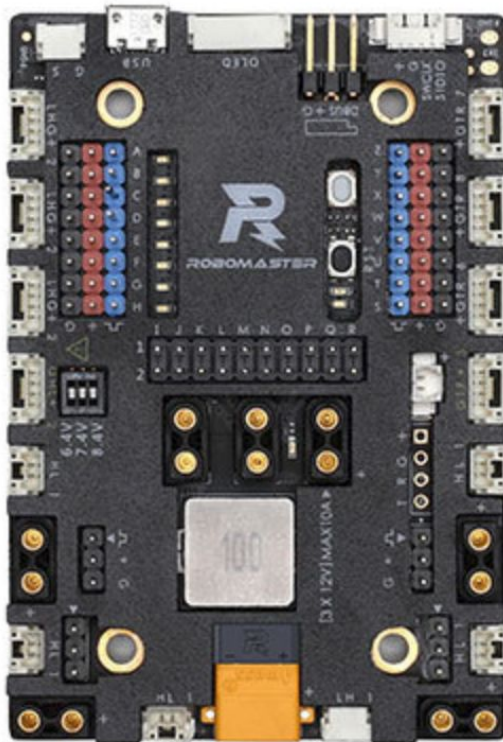


Close-up view of a typical drone PDB



View of the bottom part of the electronic assembly plate

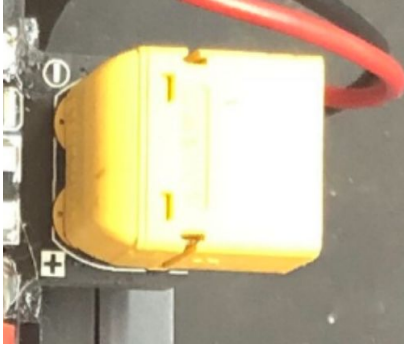
Here is a nice design example how PCB4 can look like at the end



You should look for open source designs to build-on for the individual functions. No need to reinvent the wheel.

Inputs

1. Inputs
 - 1.1. In - VCC - Battery Connector - Here is where the main robot battery will connect. [XT60](#) or [XT90](#) male connectors can be soldered vertically or in a [90 degrees angle](#). Only one connector to be used. Holes overlap. That is, can solder one XT60 or XT90.

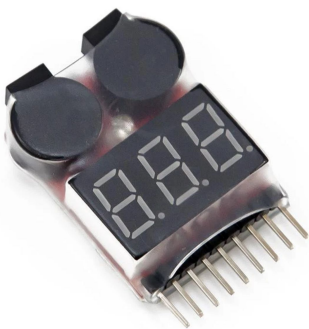


example of XT60 holes.



90-degree PCB mountable XT60 connecto...
reddit.com

- 1.2. In - LiPo Battery Balance Connector - here is where the main battery balance connectors will plug in so we can monitor the voltage per cell. See battery alarm later in this document. Plan for a 6 cell battery connector (7 pins). Therefore, 2, 3, 4, 5 or a 6 cell battery can be connected. We will replicate the functionality of these Lipo Alarms.



Outputs

Note: Continuous current on the specs below

2. Outputs - Note: add a capacitor (size TBD) to each VCC, 12V, 5V, and 3.3V connection

- 2.1. Out - XT 60 female 90 degree or vertical assembly, direct from VCC
- 2.2. Out - XT 60 female 90 degree or vertical assembly, direct from VCC

- 2.3. Out - XT 30 female 90 degree (if exist) or vertical assembly, direct from VCC
- 2.4. Out - XT 30 female 90 degree (if exist) or vertical assembly, direct from VCC
- 2.5. Out - XT 30 female 90 degree (if exist) or vertical assembly, direct from VCC
- 2.6. Out - XT 30 female 90 degree (if exist) or vertical assembly, direct from VCC

- 2.7. Out - XT 30 female 90 degree (if exist) or vertical assembly, 12V (DC/DC 1) - 5A
- 2.8. Out - XT 30 female 90 degree (if exist) or vertical assembly, 12V (DC/DC 1)
- 2.9. Out - XT 30 female 90 degree (if exist) or vertical assembly, 12V (DC/DC 1)
- 2.10. Out - XT 30 female 90 degree (if exist) or vertical assembly, 12V (DC/DC 1)

- 2.11. Out - XT 30 female 90 degree (if exist) or vertical assembly, 5V (DC/DC 2) - 10A
- 2.12. Out - XT 30 female 90 degree (if exist) or vertical assembly, 5V (DC/DC 2)
- 2.13. Out - XT 30 female 90 degree (if exist) or vertical assembly, 5V (DC/DC 2)
- 2.14. Out - XT 30 female 90 degree (if exist) or vertical assembly, 5V (DC/DC 2)
- 2.15. Out - XT 30 female 90 degree (if exist) or vertical assembly, 5V (DC/DC 2)

- 2.16. Out - JST female 90 degree (if exist) or vertical assembly, 3.3V (DC/DC 3) - 3A
- 2.17. Out - JST female 90 degree (if exist) or vertical assembly, 3.3V (DC/DC 3)
- 2.18. Out - JST female 90 degree (if exist) or vertical assembly, 3.3V (DC/DC 3)
- 2.19. Out - JST female 90 degree (if exist) or vertical assembly, 3.3V (DC/DC 3)

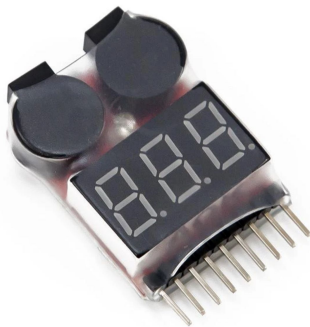
- 2.20. LED red - and JST female 90 degree (if exist) or vertical assembly, resistor
, VCC - for external
<https://www.sparkfun.com/products/9750>
- 2.21. LED yellow - and JST female 90 degree (if exist) or vertical assembly, resistor
, 12V - for external LED
- 2.22. LED green - and JST female 90 degree (if exist) or vertical assembly, resistor
, 5V - for external LED

- 2.23. LED blue - and JST female 90 degree (if exist) or vertical assembly, resistor , 3.3V - for external LED

<https://www.ebay.com/p/21011645145> (JST male + female connectors)

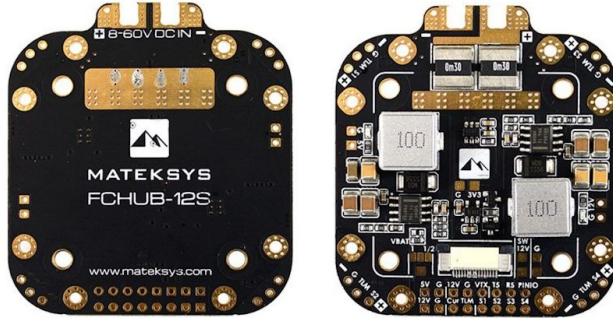
Functionality

3. Functionality
 - 3.1. Integrate a [LiPo battery monitor - alarm](#) buzzer and digital display for voltage, up to 6 cells



For Possible Reference

<http://www.mateksys.com/?portfolio=fchub-12s>



MATEKSYS FCHUB-12S

Input: 8~60V DC (3~12S LiPo)
 BEC 5V, 5A cont. 6A burst
 BEC12V, 4A cont. 5A burst
 LDO 3.3V, 500mA cont.
 PDB 4x70A cont. 440A burst
 High Precision Current-Sense 440A, Scale 75

Switchable 12V output
 Selectable VBAT for FC voltage detection

50*55*6mm, 21g
 Mounting holes 30.5mm Φ 3mm

FFC connection with MATEKSYS FC STD series

JLPCP Part Number: C##### found in link

12V (DC/DC 1) - 5A *

- Vin=8-32v, Vout=0.8v-(0.9Vin), Iout=5A

Asynchronous Step-down Converter

Pgs: 12, 15 https://datasheet.lcsc.com/szlcsc/Anpec-Elec-APW7090KAI-TRG_C125178.pdf

- Vin=8-36v, Vout=Adjustable, Iout=5A

Step-down Converter

Either CC or CV

Pgs: 9 [cc/cv, Vout, Icc]

https://datasheet.lcsc.com/szlcsc/1902221502_Eutech-Microelectronics-EUP3467AWIR1_C370735.pdf

5V (DC/DC 2) - 10A

- Vin=6-42v, Vout=Adjustable, Iout= up to 15A

Synchronous Step-down Controller

Section 9.2.2 (1)

https://datasheet.lcsc.com/szlcsc/Texas-Instruments-TI-LM3150MHX_C48112.pdf

- Vin=6-36v rail, Vout=Adjustable, Iout= up to 10A

***Power Module Switcher**

Section 7.1, 8.1, 8.2, 8.2.1, 8.2.2.3

<http://www.ti.com/lit/ds/symlink/lmz13610.pdf>

3.3V (DC/DC 3) - 3A

- Vin=, Vout=3.3v,5v,12v Adjustable, Iout=3A
https://datasheet.lcsc.com/szlcsc/Diodes-Incorporated-AP1501-33K5G-13_C9982.pdf
- Vin=3.5-28v, Vout=Adjustable, Iout=3A
https://datasheet.lcsc.com/szlcsc/Texas-Instruments-TI-TPS54331DR_C9865.pdf
- Vin=4.75-24, Vout=0.92-15v, Iout=3A
https://datasheet.lcsc.com/szlcsc/1909231507_Richtek-Tech-RT8269GSP_C425777.pdf