Building a 130mm Bolt drone

Li-Ion 1-cell setup

Li-Po 2-cell setup

Components

- 1 x Custom designed 130mm 3D printed frame (latest v5)
    - https://github.com/bitcraze/bitcraze-mechanics/tree/master/models
- 1 x Crazyflie Bolt flight controller
    - https://store.bitcraze.io/collections/kits/products/crazyflie-bolt
- 2 x pin-header and long pin-header soldered together
    - https://store.bitcraze.io/collections/spare-parts/products/male-long-deck-connector
    - https://store.bitcraze.io/collections/spare-parts/products/male-deck-connector
- 4 x Gemfan Hurricane 3018 (2xCW + 2xCCW)
    - Match prop hole size to motor shaft size (1.5mm or 2mm)
- **Li-Ion 1 cell setup**. Around 17min hover time
    - 4 x Flywoo ROBO RB 1202.5 11500 Kv motors
    - 1 x Li-Ion Sony 18650 VTC6 3000mAh 30A
    - 1 x XT30 Female with 20AWG cables to solder to the battery
    - Li-Ion 18650 charger
- **Li-Po 2-cell setup.** Around 10min hover time. More thrust
    - 4 x Flywoo ROBO RB 1202.5 5500 Kv motors
    - 1 x Tattu R-Line 550 mAh 2S 95C LiPo with XT30
    - 2-cell Li-Po charger
- 4 x Flash hobby 7A 1-2S ESC
- 2 x Zipties to fasten battery
- 4 x 7mm M3 Anti-vibration fixed screw spacers
- M3 Nylon screws, nuts and standoffs
- Soldering tools

Pointers

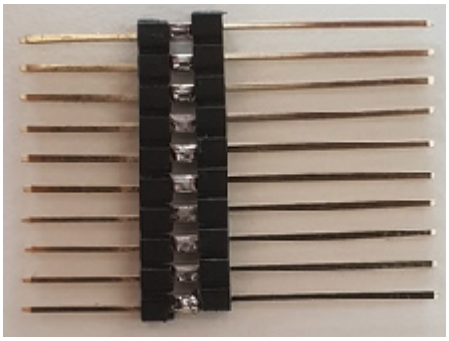
Some help along… It assumes previous experience of building drones.

Soldering the ESCs

The ESC cables included with the Bolt are quite stiff and the signal pad on the Flash hobby 7A ESC is quite brittle. After soldering the wires apply hot glue to fixate the wires at the ESC to prevent the signal pad from being ripped off.

Solder pin-headers together

Even the long pin-header is not long enough to reach from the bolt, thought the frame, to above the battery. By soldering pin-headers together longer pins can be created. Match e.g long and shot pin-headers to get the wanted length. The picture below is the short and medium length headers. For this setup the short and long headers are probably needed.



Solder the battery (Li-Ion setup)

When soldering the battery don’t heat for too long as it could damage the battery.

Shorten the Bolt battery wires if needed

The bolt battery wires can be unsoldered, cut and soldered back.

Problems (Li-Ion battery, 1-cell)

When the Bolt is running on one cell battery (3-4.2V) the off current is higher than expected and around 1mA.

Workaround: Unplug the battery when drones are not used and don’t just use the power off button.

When the Bolt is running on one cell battery (3-4.2V) don’t connect USB at the same time as the battery as the USB is leaking current and charging the battery unintentionally which potentially damages the battery after a while.

Workaround: Don’t have the battery and the USB connected at the same time.

Tuning

Tuning the PID controllers is recommended and currently the values has to be hardcoded in pin.h. The values below us a good starting point and will probably work well. Live tuning can be done by changing the parameters in the cfclient but they can't be stored.

```
#define PID_ROLL_RATE_KP  70.0
#define PID_ROLL_RATE_KI  200.0
#define PID_ROLL_RATE_KD  2
#define PID_ROLL_RATE_INTEGRATION_LIMIT    33.3

#define PID_PITCH_RATE_KP  70.0
#define PID_PITCH_RATE_KI  200.0
#define PID_PITCH_RATE_KD  2
#define PID_PITCH_RATE_INTEGRATION_LIMIT   33.3

#define PID_ROLL_KP  7.0
#define PID_ROLL_KI  3.0
#define PID_ROLL_KD  0.0
#define PID_ROLL_INTEGRATION_LIMIT    20.0

#define PID_PITCH_KP  7.0
#define PID_PITCH_KI  3.0
#define PID_PITCH_KD  0.0
#define PID_PITCH_INTEGRATION_LIMIT   20.0
```

For the 2-cell setup and possibly the 1-cell the position_controller_pid.c hover thrust might have to be tuned. Probably lowered as these drones have more thrust. Somewhere around the value below is probably good instead of 36000.

```
  .thrustBase = 30000
```

Compiling for Bolt

When building, in the config.mk file set:

```
# Bolt/bigQuad compile flags. Set CF_MASS in kg and DEFAULT_IDLE_THRUST to
# appropriate idle trust value.
CFLAGS += -DCF_MASS=0.1f
CFLAGS += -DENABLE_ONESHOT125
CFLAGS += -DSTART_DISARMED
CFLAGS += -DDEFAULT_IDLE_THRUST=5000
```

The START_DISARMED probably needs some explanation. It is a safety mechanism and you can decide if you like to use it or not. To arm the motors the parameter system.forceArm needs to be set to 1. This will arm the motors and spin them up to the idle thrust set.