RIOT 250R PRO

USER GUIDE

THRUSTUAV

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The Riot 250R Pro

The Riot 250R Pro is the premiere FPV racing drone on the market. With its next generation integrated flight system, light and extremely durable gel coat carbon fiber frame and unique design, it is built to get you noticed! Thrust UAV takes great pride in the quality of our products and provides distributors unmatched support to ensure successful sales and growth in the UAV market.

Index

RIOT 250R PRO

Built and Manufactured in the U.S.A.

RIOT SET UP

1 Install your receiver

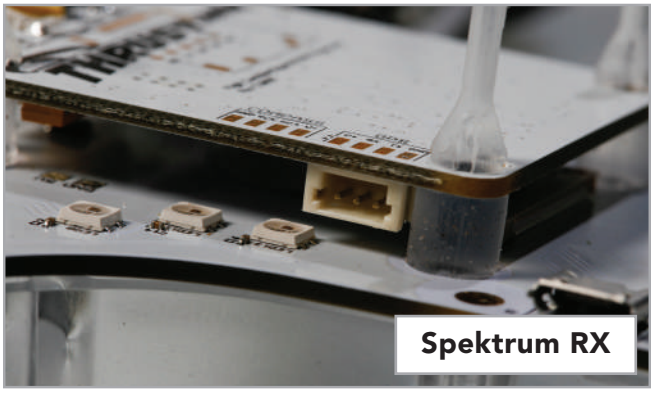
WARNING! Remove props and disconnect battery before connecting the RX (receiver).

The Riot is compatible with any PPM, SBUS or DSMX receiver so you can choose the one that works best for you. For optimum performance, we recommend the FrSky XSR. Depending on the type of receiver, either solder to the corresponding pads or connect to the Spektrum plug on the flight controller.

WARNING! Do not solder a DSMX receiver to the receiver pads.

For Spektrum RX

For all DSMX receivers, connect to the I.E. SPM4648 Spektrum plug on the flight controller. Spektrum receivers are only rated for 3.3v and shouldn't be soldered to the RX pads.



For FrSky PPM or SBUS RX

Solder a PPM or SBUS receiver such as the FrSky XSR to the corresponding pads on the flight controller. With soldering iron in hand, see the directions below.

a. Remove the top plate of the Riot's frame using the included torx driver.

b. Tin the pads on the flight controller.

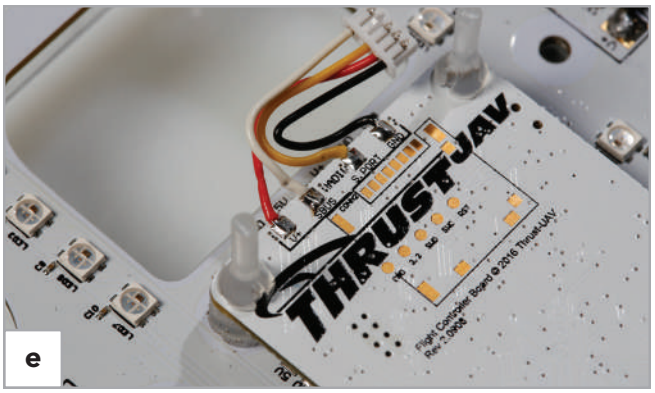
c. Cut the receiver wires to the desired length. 2 inches is a good place to start.

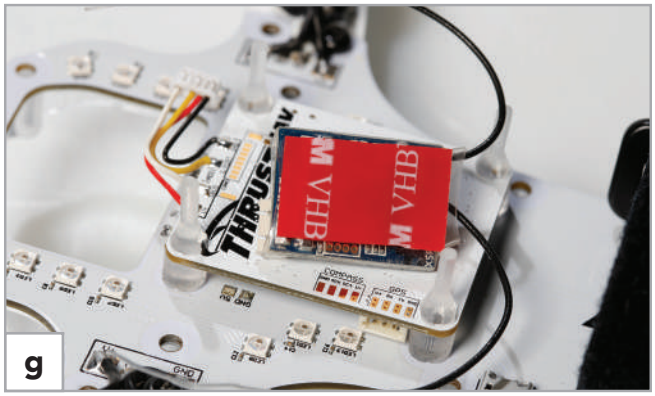
d. Strip and tin the receiver wires.

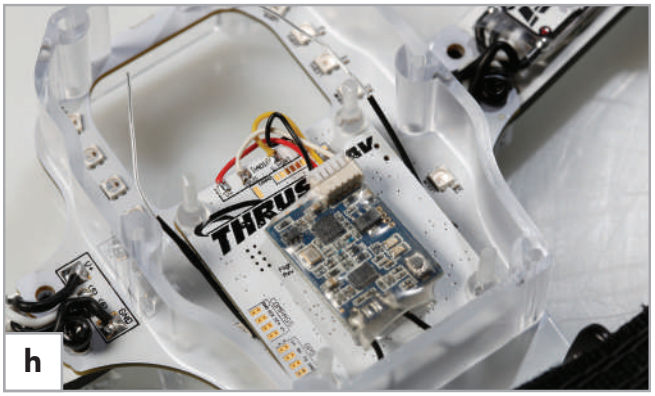
e. Solder the receiver wires to the corresponding pads.

- GND = black
- SBUS = white
- S-port = yellow
- V+ = red

f. Plug the wires into the receiver.







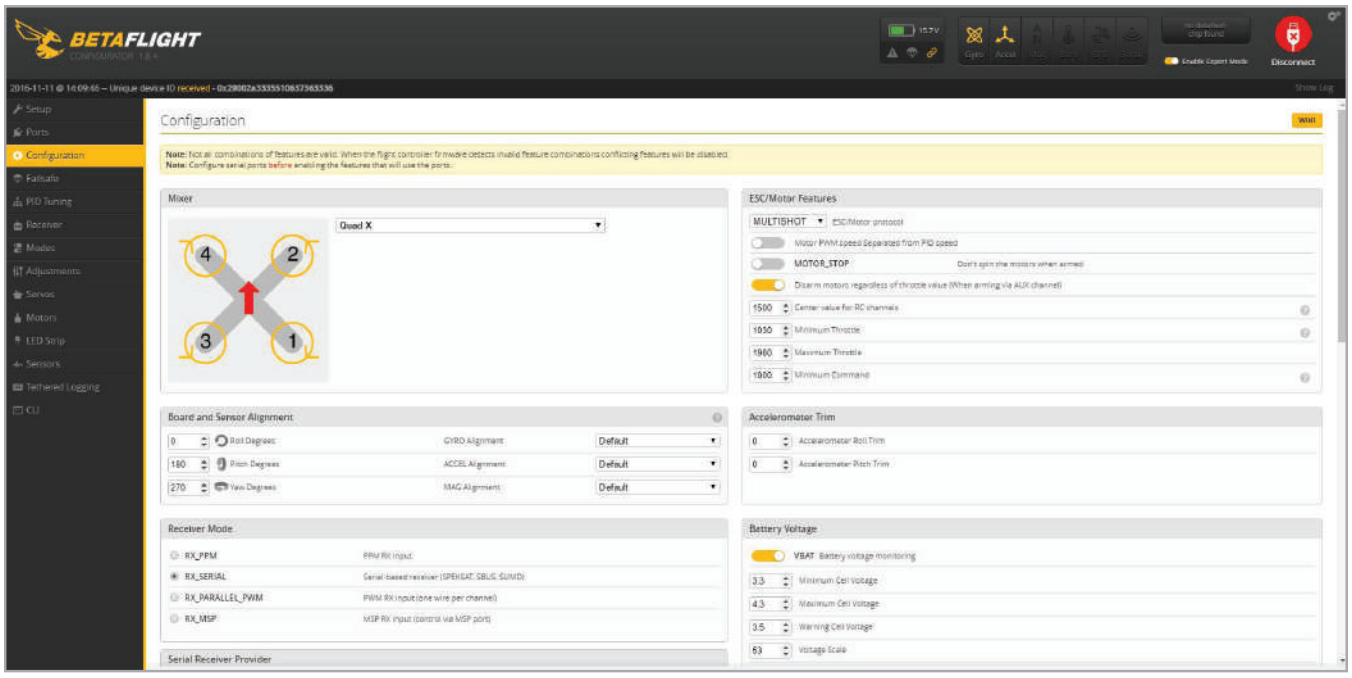
g. Attach the receiver to top of flight controller with a sticky dot or sticky tape.

h. Tuck the receiver antennas below top plate.

2 Configure the receiver

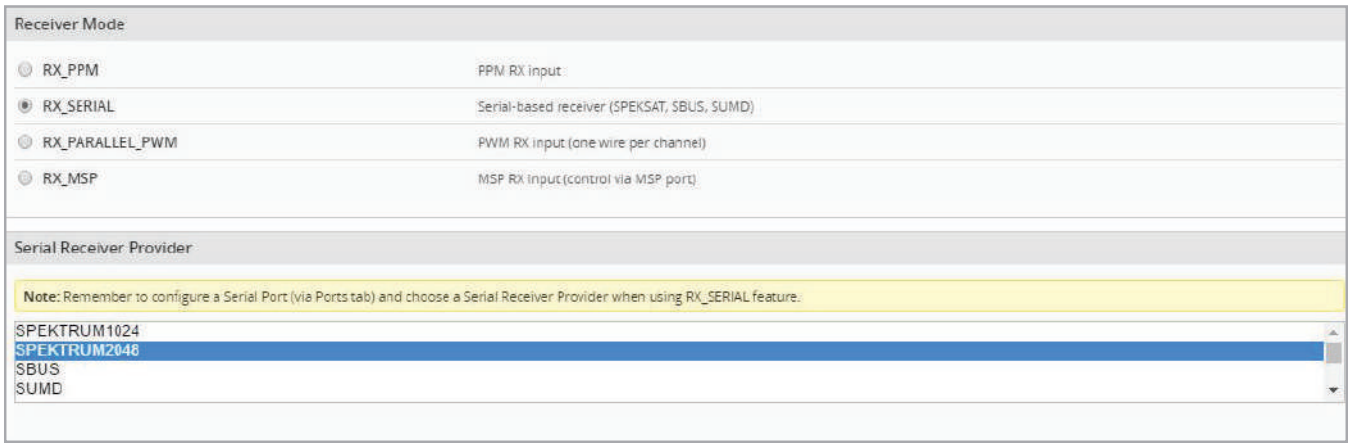
The Riot comes configured for the FrSky XSR/X4R receiver. For other receivers, these settings can be customized in Betaflight - Configurator, an open source flight controller software available for free from the Google Chrome Store. Chrome web browser is required to run the Betaflight software.

- Launch the app and connect the Riot to your computer via micro USB.
- Press the Connect button in the top right corner and open the Configuration tab.

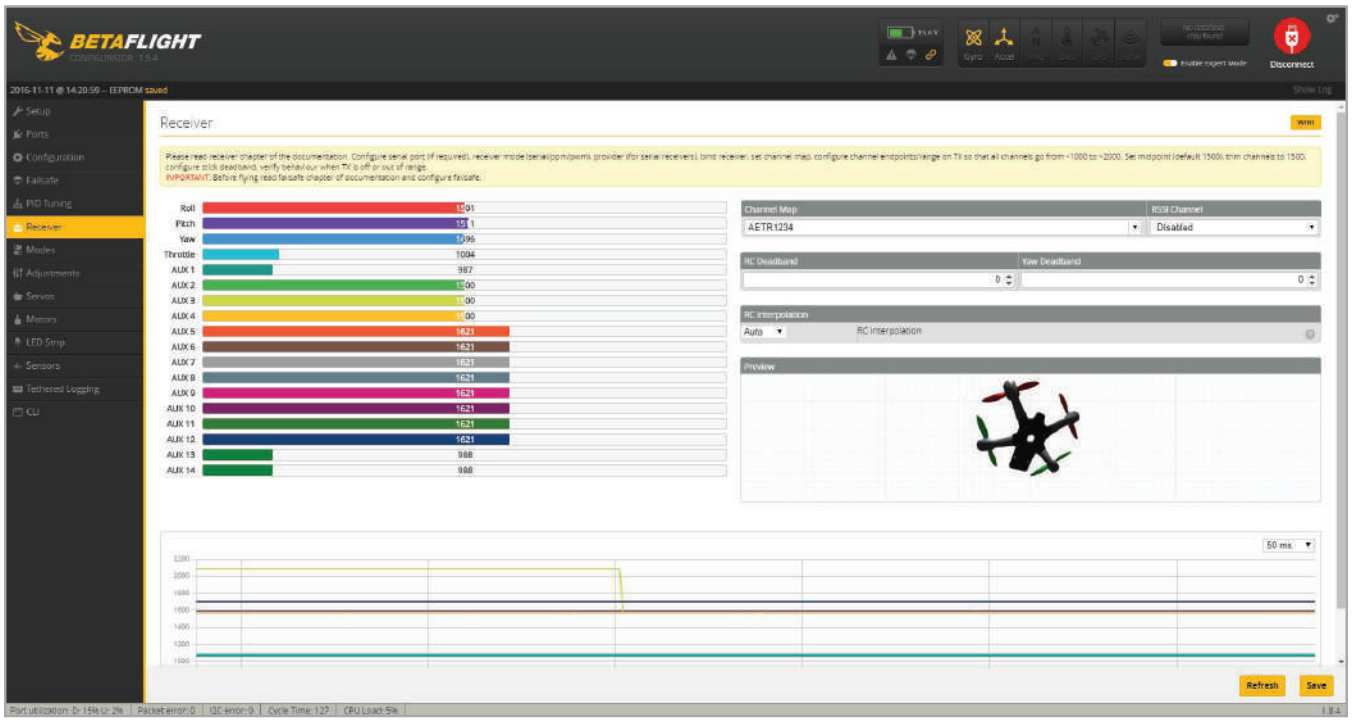


For Spektrum receivers

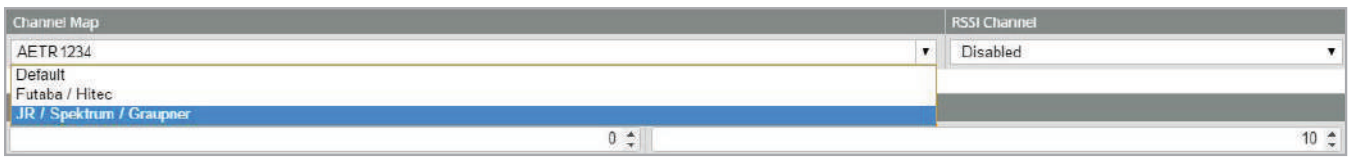
From the Configuration tab, change Serial Receiver Provider to SPEKTRUM2048.



Switch to the Receiver tab in BetaFlight.

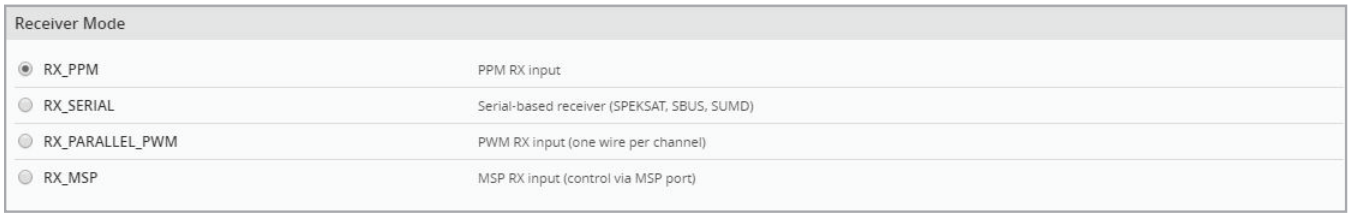


From the Receiver tab, change the Channel Map to Spektrum. Click save in the lower right corner of Betaflight to adjust the configuration.



For FrSky PPM receivers

From the Configuration tab, switch the Receiver Mode from RX_SERIAL to RX_PPM. Click save in the lower right corner of Betaflight to adjust the configuration.



For FrSky SBUS receivers

The Riot is pre-configured for FrSky XSR/X4R, so this step is already done!

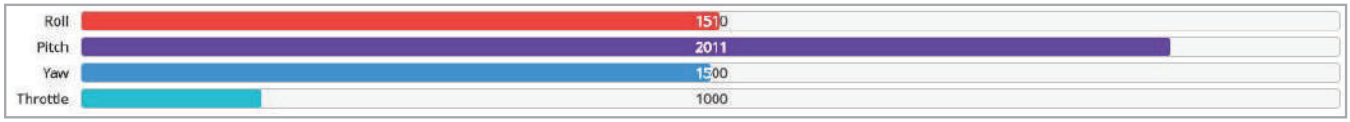
3 Bind the receiver to the radio & verify the RX (receiver) channel mapping

Each type of radio operates differently. Refer to your radio instruction manual to bind the receiver to the radio and to set the failsafe.

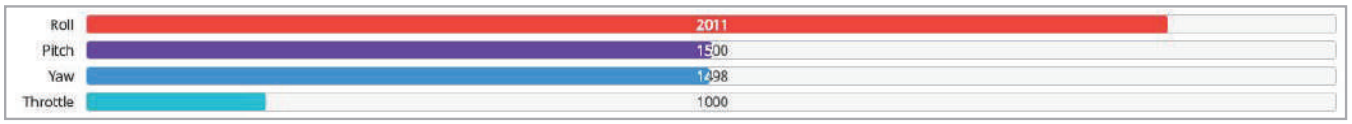
WARNING! Remove props and disconnect battery before RX (receiver) verification.

Verify the Riot's connection to the radio from the Receiver tab in Betaflight:

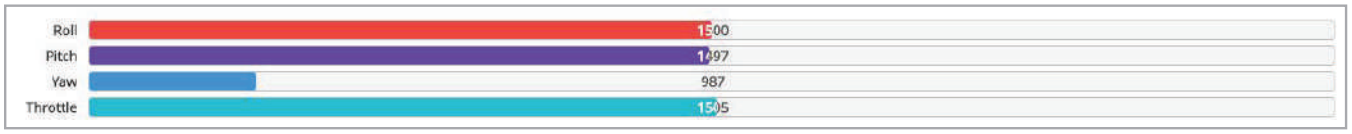
- Using Mode 2 controls, pitch forward and throttle down. Watch the graph in Betaflight to verify the channel mapping. The pitch bar graph should move right as the throttle bar moves left.



- Roll right and verify on Betaflight that the roll graph moves right.



- Yaw left and verify on Betaflight that the yaw graph moves left.

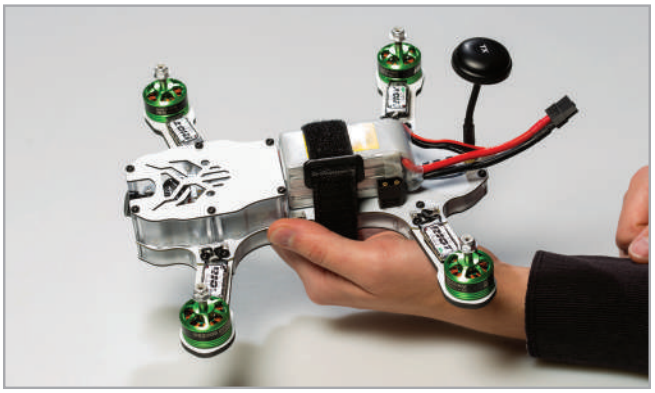


For optimal racing control, refer to your radio manual to correct the sub trim if the stick values don't hit 1000 at one extreme, 2000 at the other and 1500 in the middle.

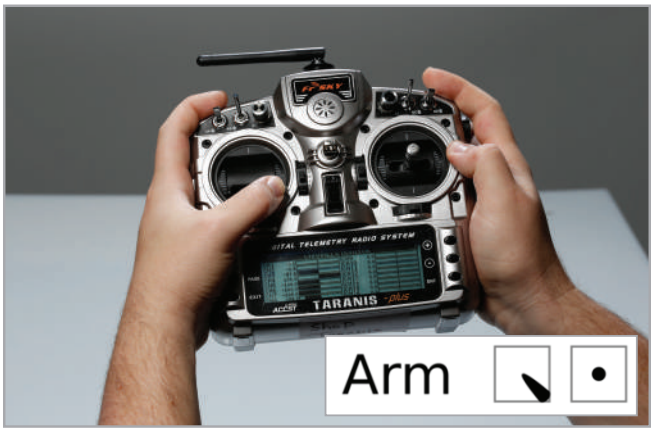
4 Verify motor direction

WARNING! Be sure props are removed props before connecting the drone to power.

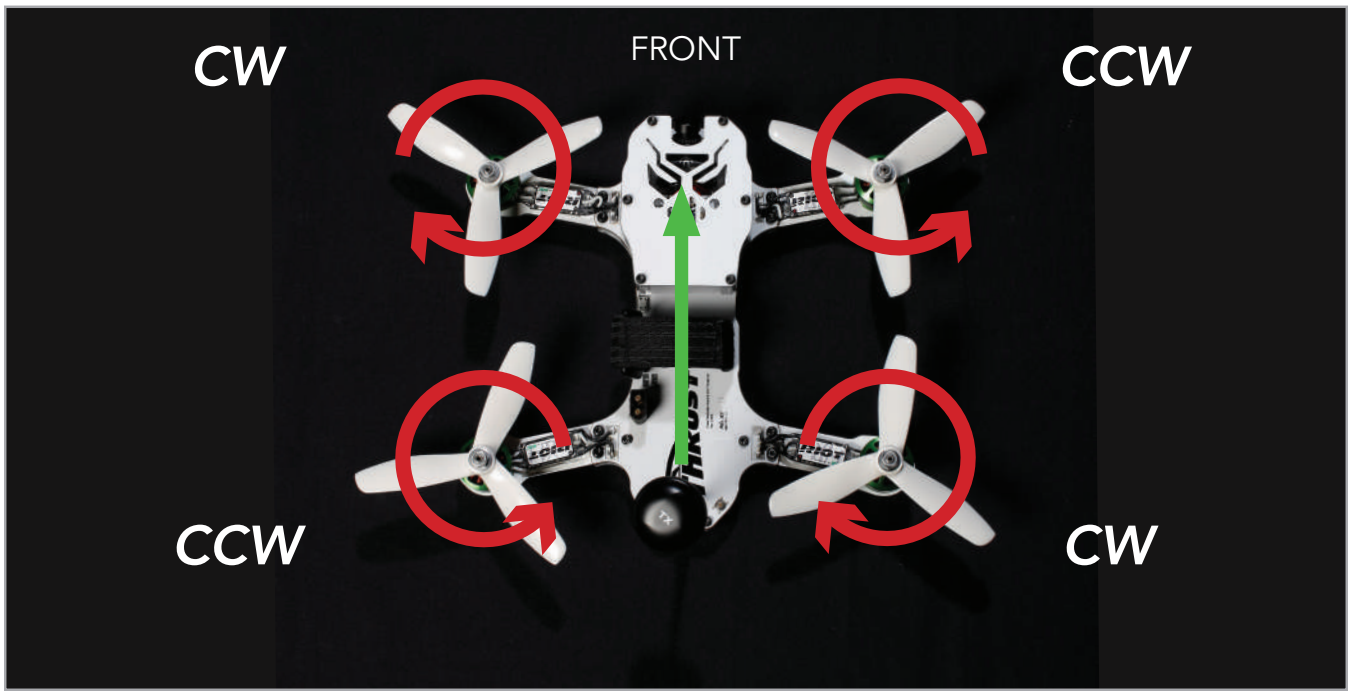
- Attach and plug in the LiPo battery. Be sure the battery is firmly mounted against the top plate.



- Arm the drone with mode 2 stick commands: right rudder with zero throttle.



- Gently check motor direction.
  Each motor should spin as shown:



- Disarm with standard mode 2 stick commands

To correct the motor configuration, see Troubleshooting for ESC configuration.

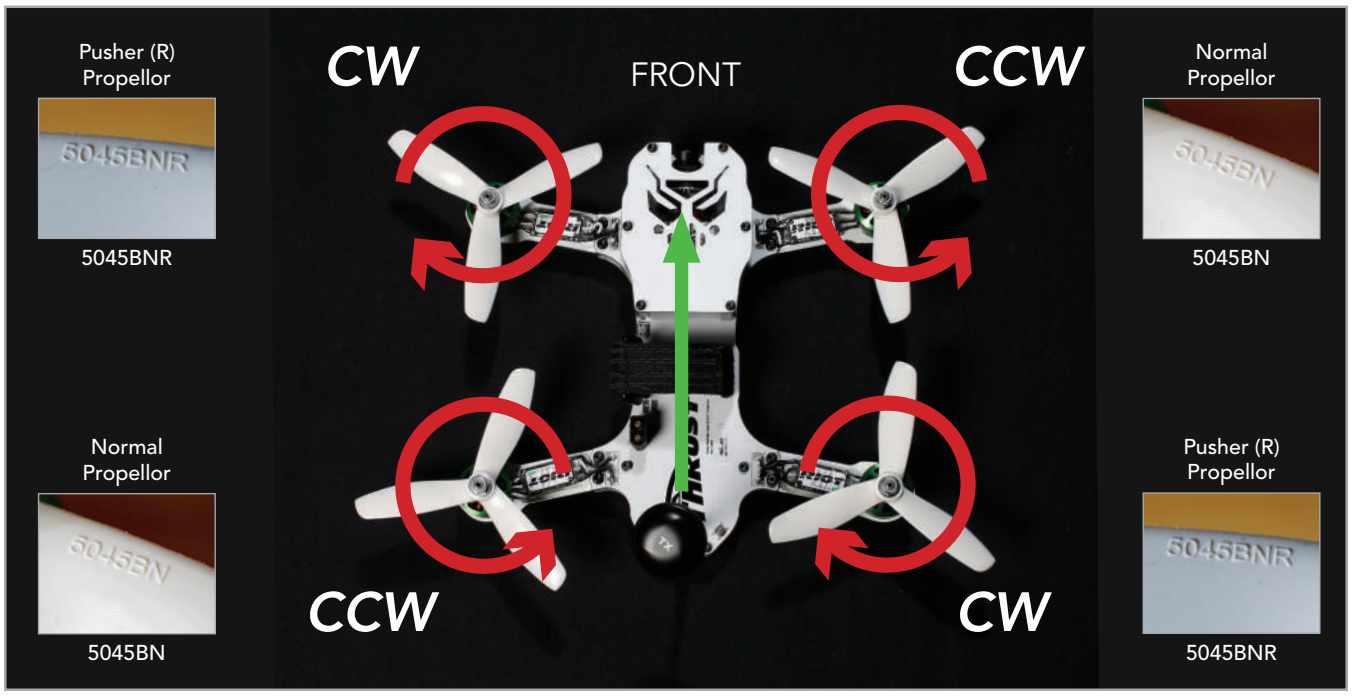
5 Set up the video channel

The Riot is set to the default channel of 5740 (Fatshark 1). Each type of FPV goggles operates differently. Refer to your FPV goggle and module instructions to connect to the correct video channel.

6 Install the propellers

Attach propellers (props) to the top of each motor. Thread nuts on top and tighten with a wrench. The fit should be snug.

Check for correct prop orientation before taking off. Incorrect orientation causes drones to flip over or fly out of control.



7 Calibrate the sensors

WARNING! Set the drone on a flat surface before connecting the battery to accurately calibrate the sensors. Poorly calibrated sensors cause drones to fly erratically.

The sensors calibrate automatically each time the battery is plugged in. When the noises go quiet, the calibration is complete and the Riot is ready to fly. Brand new LiPo batteries typically come at storage voltage (3.85V per cell), so be sure to fully charge the LiPo before flying.

One way of troubleshooting erratic flight is to land the drone and recalibrate the sensors using stick commands. Throttle down and left while pitching back to calibrate the gyro sensor.

Throttle up and left while pitching back to calibrate the accelerometer.

CONFIGURATION

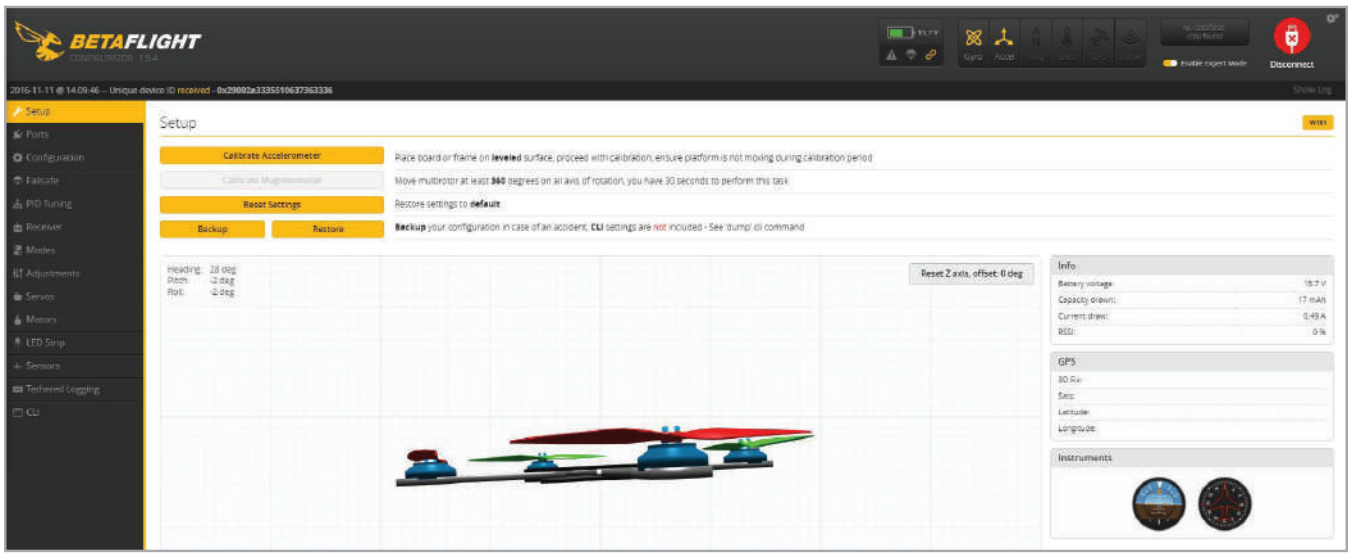
1 Download Betaflight

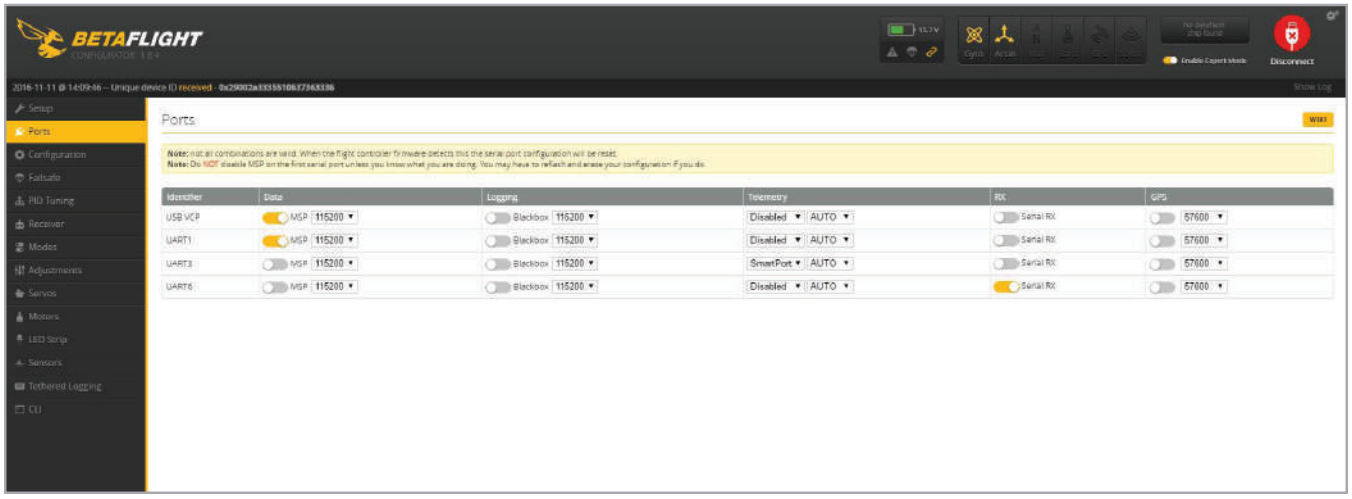
The Riot comes fully loaded with a default configuration. These settings can be customized in Betaflight - Configurator, an open source flight controller software available for free from the Google Chrome Store.

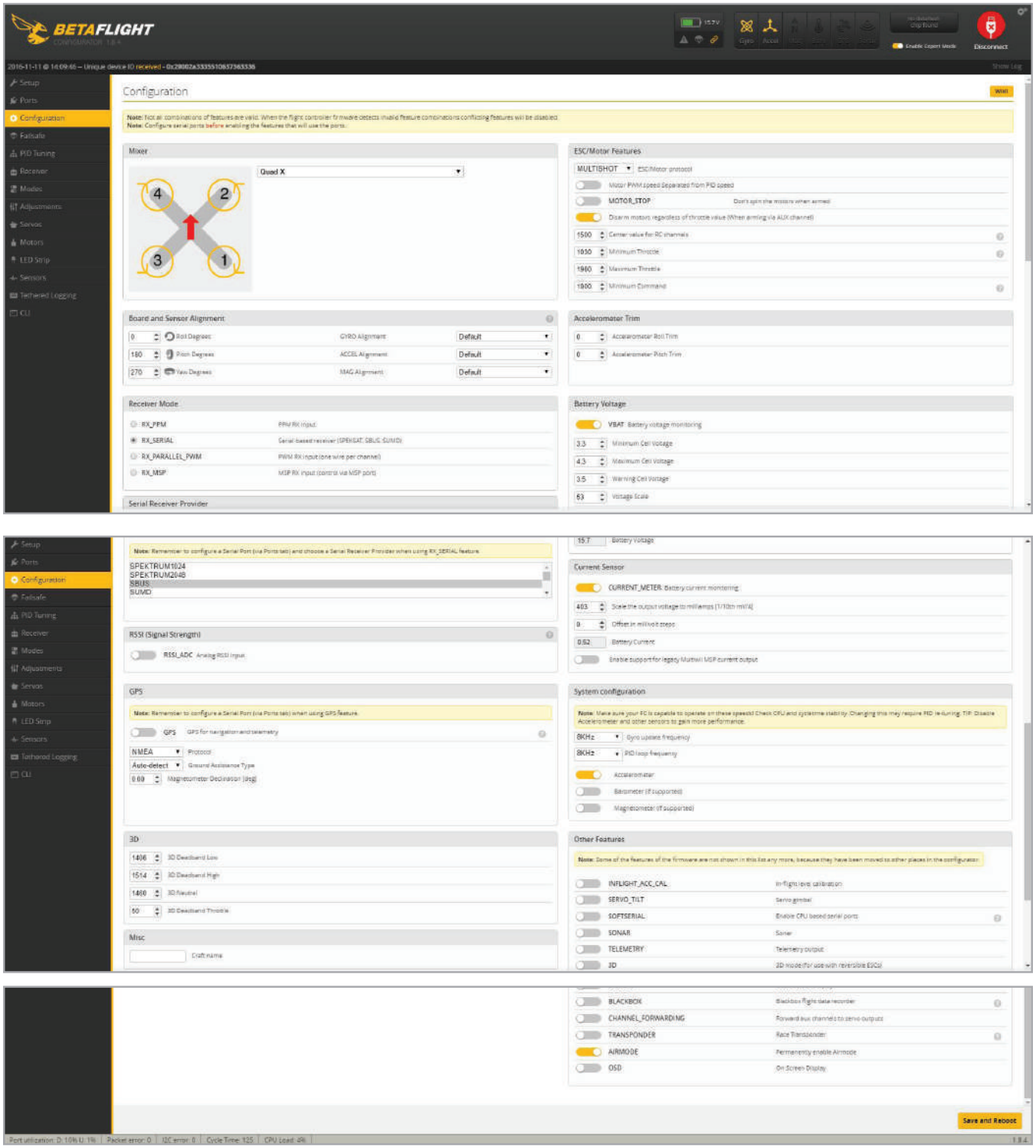
- Launch the app and connect the Riot to your computer via micro USB.
- Press the Connect button in the top right corner and open the Configuration tab.

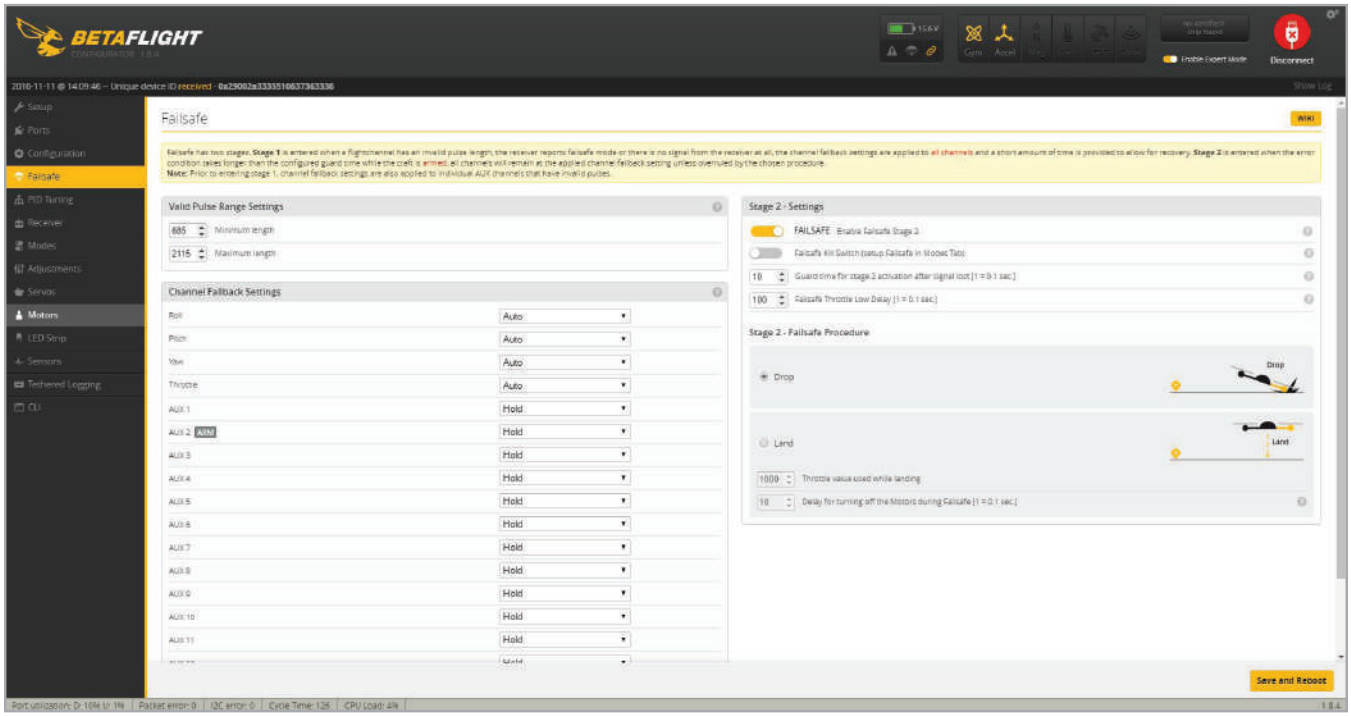
2 Reset the Default Configuration

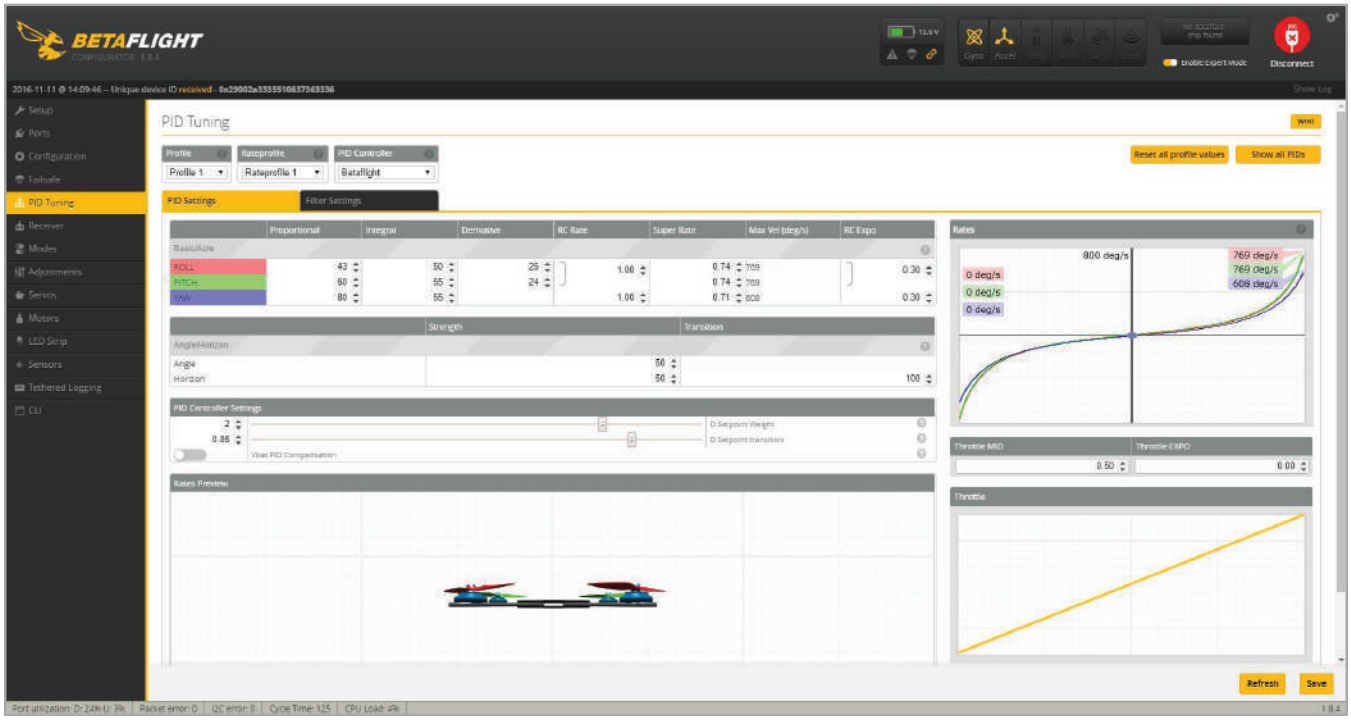
From the Setup page in Betaflight, click Reset Settings at any point to return to the default settings shown below. See Riot Set Up for details on configuring the receiver.

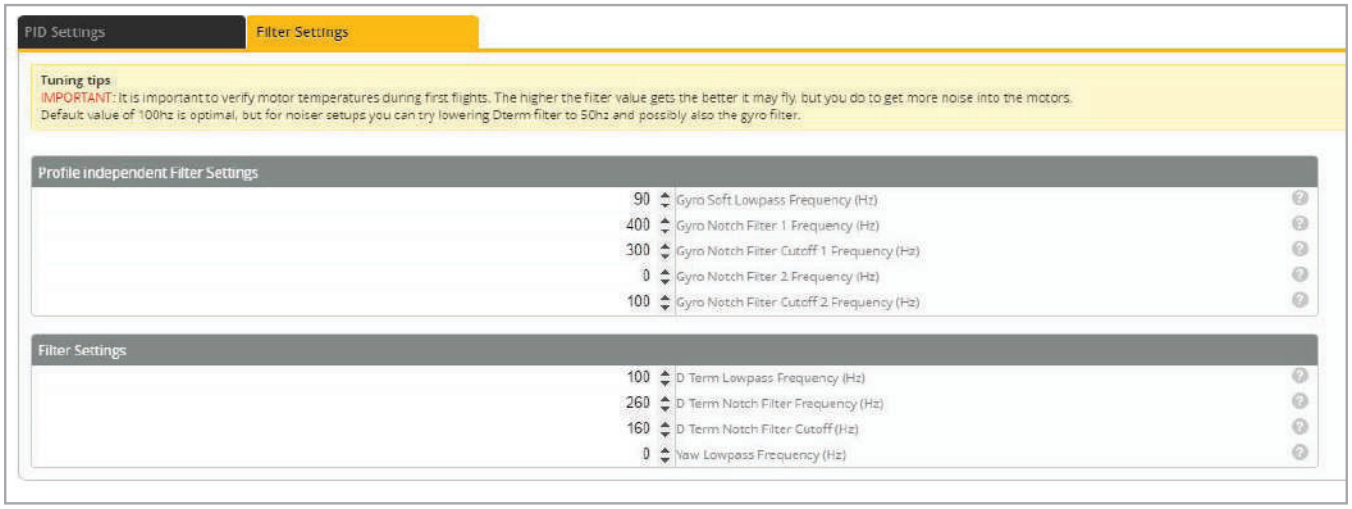


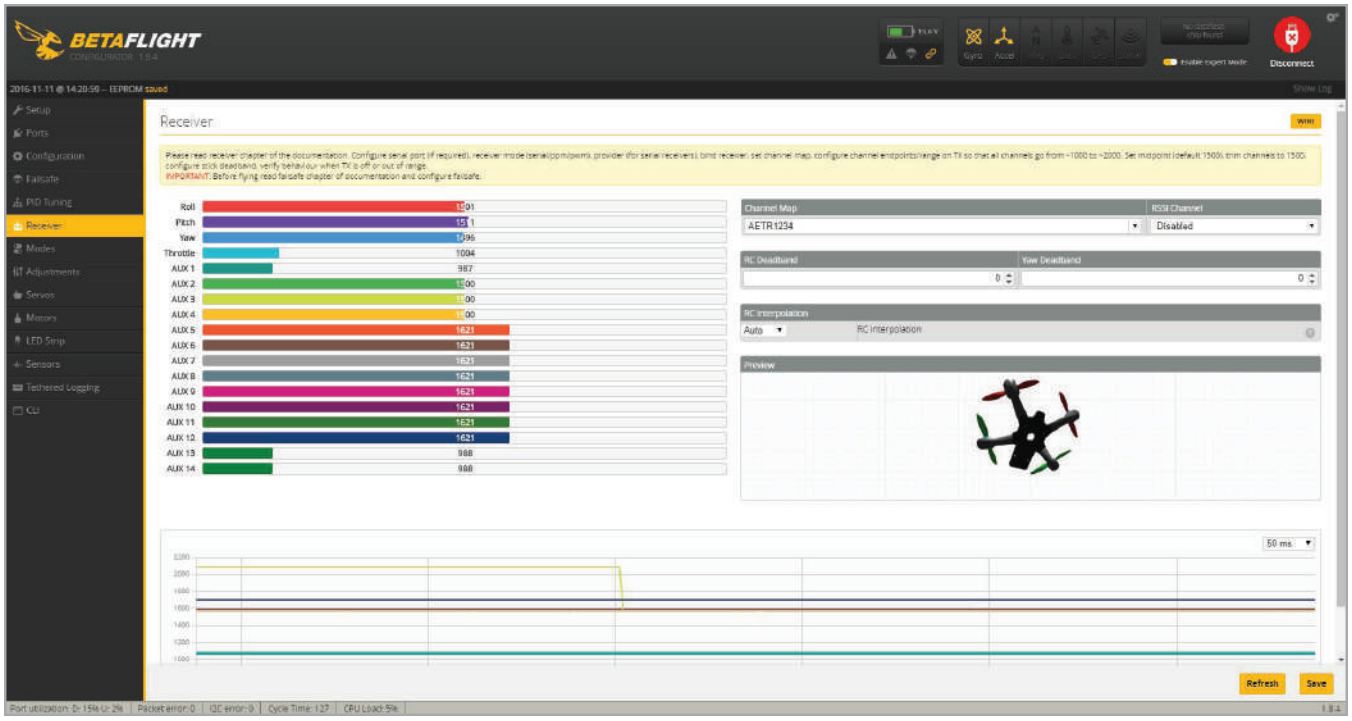


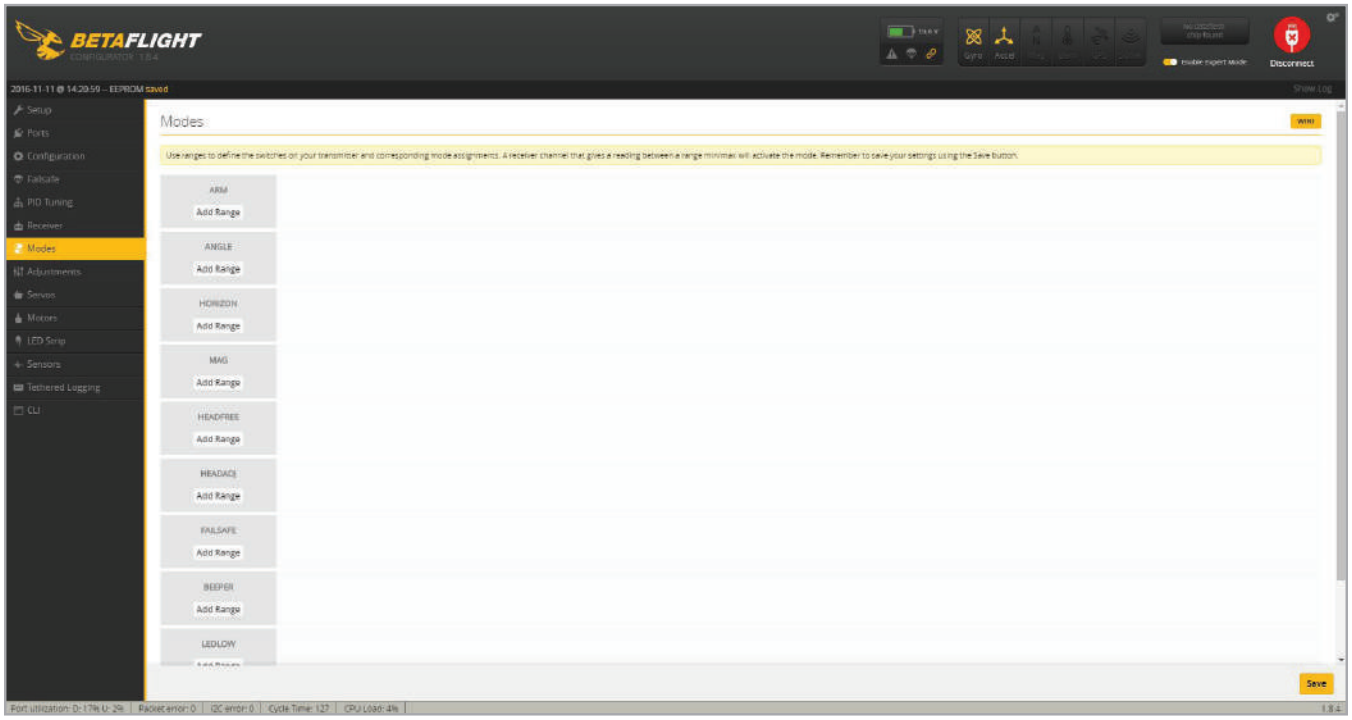

BETAFLIGHT
Configuration
Setup
Ports
Configuration
Failsafe
PID Tuning
Receiver
Modes
Adjustments
Servos
Motors
LED Strip
Sensors
Tethered Logging
CLI
Mixer
Quad X
ESC/Motor Features
Board and Sensor Alignment
Accelerometer Trim
Receiver Mode
Battery Voltage
Serial Receiver Provider
SPEKTRUM1024
SPEKTRUM2048
SBUS
SUMD
RSSI (Signal Strength)
Current Sensor
GPS
System configuration
3D
Other Features
Misc
BLACKBOX
CHANNEL_FORWARDING
TRANSPONDER
AIRMODE
OSD
Save and Reboot


BETAFLIGHT
Failsafe
Valid Pulse Range Settings
Channel Failback Settings
Stage 2 - Settings
Stage 2 - Failsafe Procedure
Drop
Land
Save and Reboot

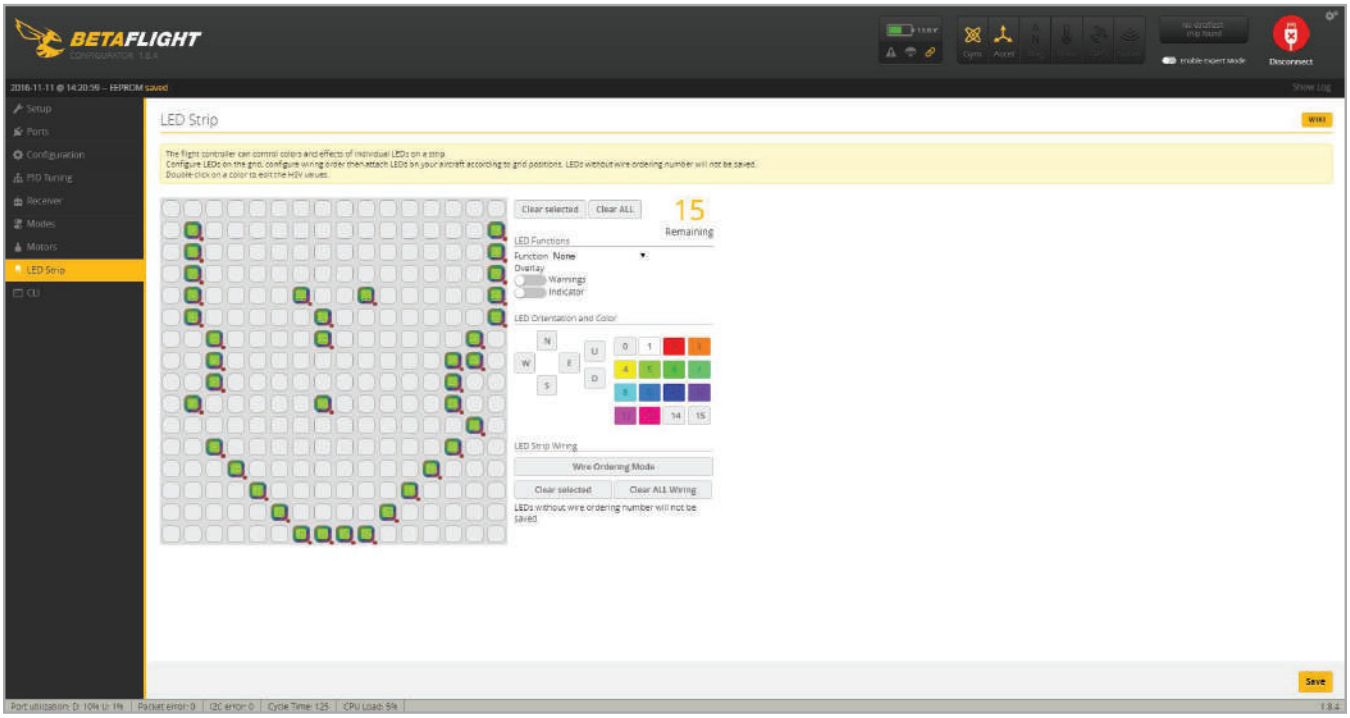

BETAFLIGHT
PID Tuning
Reset all profile values
Show all PIDs
PID Settings
Filter Settings
Rates
Refresh
Save


PID Settings
Filter Settings
Tuning tips
IMPORTANT: It is important to verify motor temperatures during first flights. The higher the filter value gets the better it may fly, but you do to get more noise into the motors.
Default value of 100hz is optimal, but for noiser setups you can try lowering Dterm filter to 50hz and possibly also the gyro filter.
Profile independent Filter Settings
90 Gyro Soft Lowpass Frequency (Hz)
400 Gyro Notch Filter 1 Frequency (Hz)
300 Gyro Notch Filter Cutoff 1 Frequency (Hz)
0 Gyro Notch Filter 2 Frequency (Hz)
100 Gyro Notch Filter Cutoff 2 Frequency (Hz)
Filter Settings
100 D Term Lowpass Frequency (Hz)
260 D Term Notch Filter Frequency (Hz)
160 D Term Notch Filter Cutoff (Hz)
0 Yaw Lowpass Frequency (Hz)


BETAFLIGHT
Disconnect
Receiver
Setup
Ports
Configuration
Failsafe
PID Tuning
Receiver
Modes
Adjustments
Servos
Motors
LED Strip
Sensors
Tethered Logging
CLI
Roll
Pitch
Yaw
Throttle
AUX 1
AUX 2
AUX 3
AUX 4
AUX 5
AUX 6
AUX 7
AUX 8
AUX 9
AUX 10
AUX 11
AUX 12
AUX 13
AUX 14
Channel Map
AETR1234
RSSI Channel
Disabled
RC Deadband
Yaw Deadband
RC Interpolation
Auto
Preview
Refresh
Save


BETAFLIGHT
Modes
Setup
Ports
Configuration
Failsafe
PID Tuning
Receiver
Modes
Adjustments
Servos
Motors
LED Strip
Sensors
Tethered Logging
CLI
ARM
ANGLE
HORIZON
MAG
HEADFREE
HEADADJ
FAILSAFE
BEEPER
LEDLOW
Add Range
Save
Disconnect

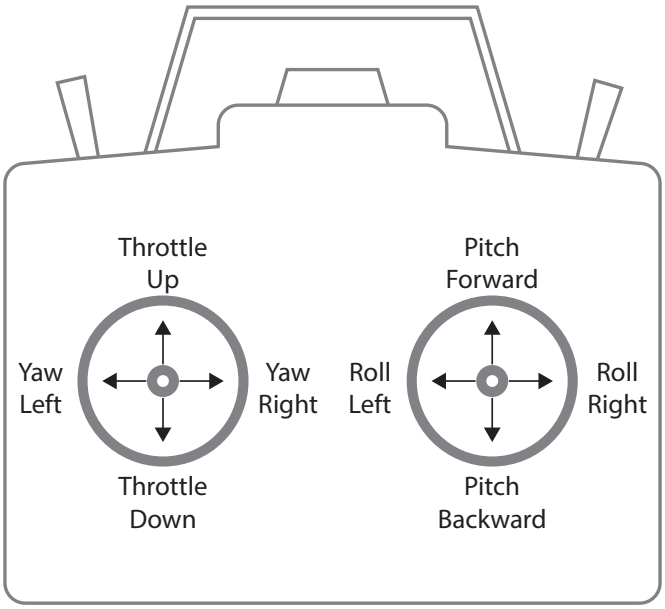

BETAFLIGHT
Motors
Setup
Ports
Configuration
PID Tuning
Receiver
Modes
Motors
LED Strip
CLI
Accelerometer - [Reset]
Refresh:
Scale:
Motors
Servos
Master
Disconnect



3 Program Radio Controls

By default, the controls are set to mode 2, which is the most common configuration in the United States.

Mode 2 Stick Functions

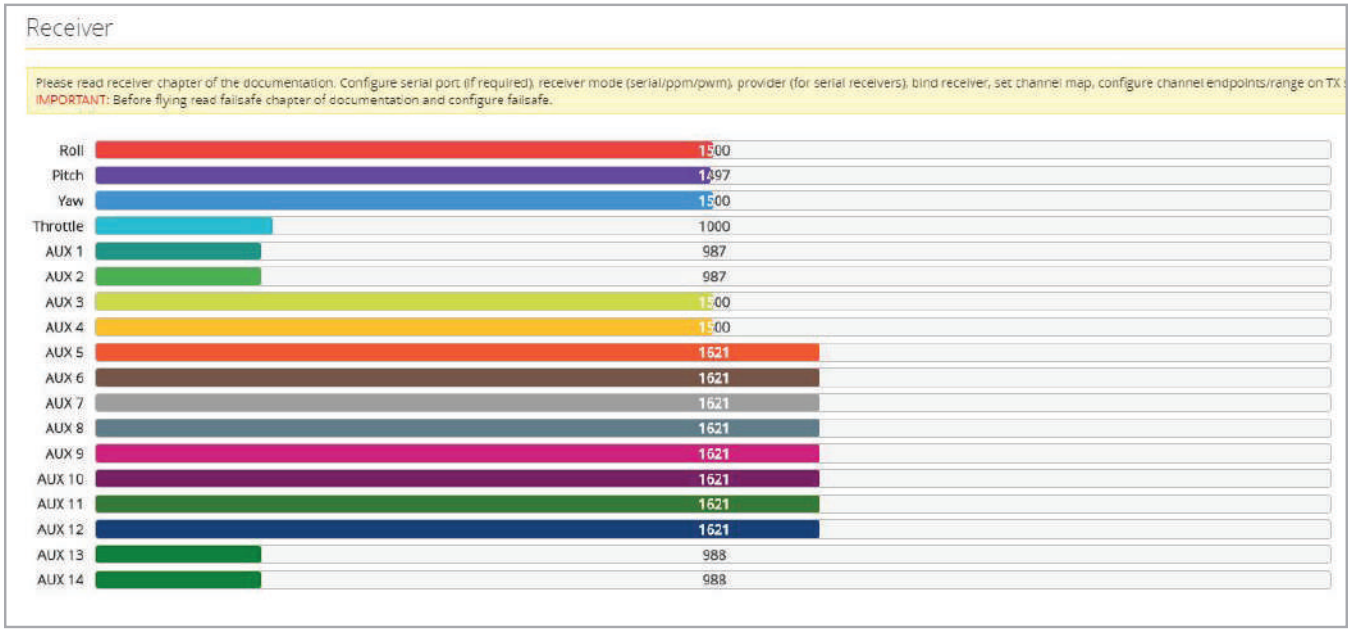


The arm and disarm commands can also be set to switches on the radio. All radios operate differently, so refer to your TX (radio) manual for direction on how to program the aux switches on your radio. Typically a 2 position aux switch is set up for arm/disarm.

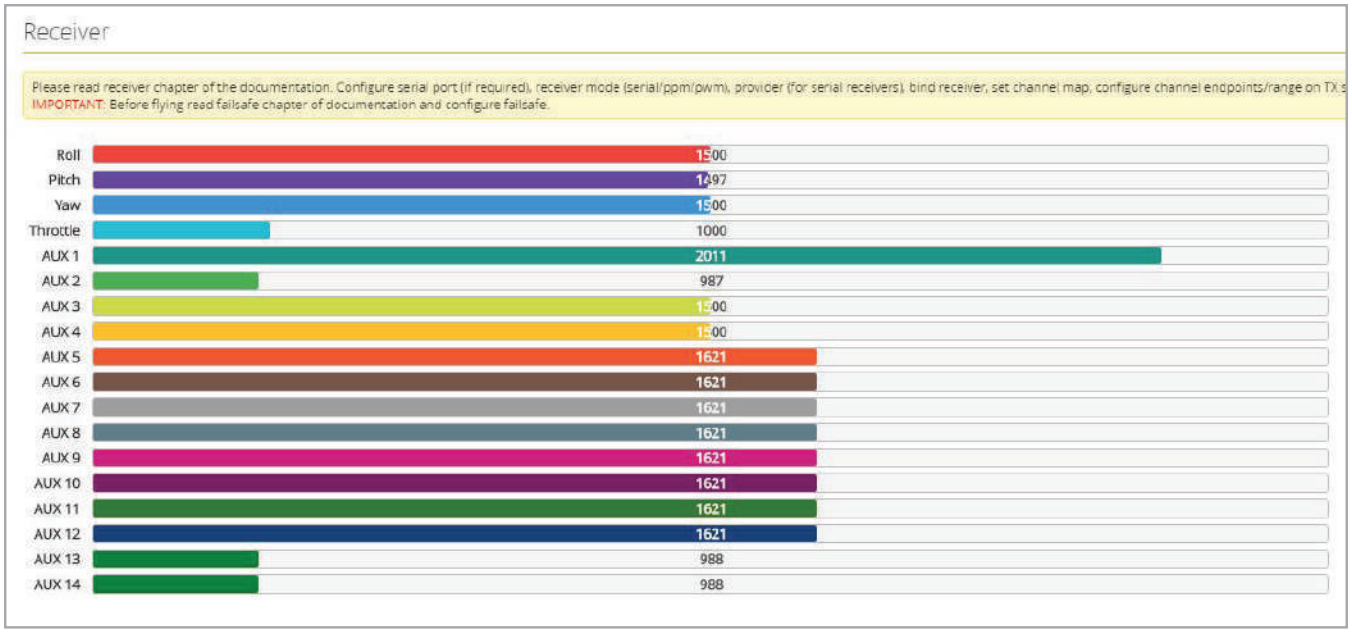
After programming the aux switches, verify in the Betaflight.

WARNING! Be sure props are removed before switch verification.

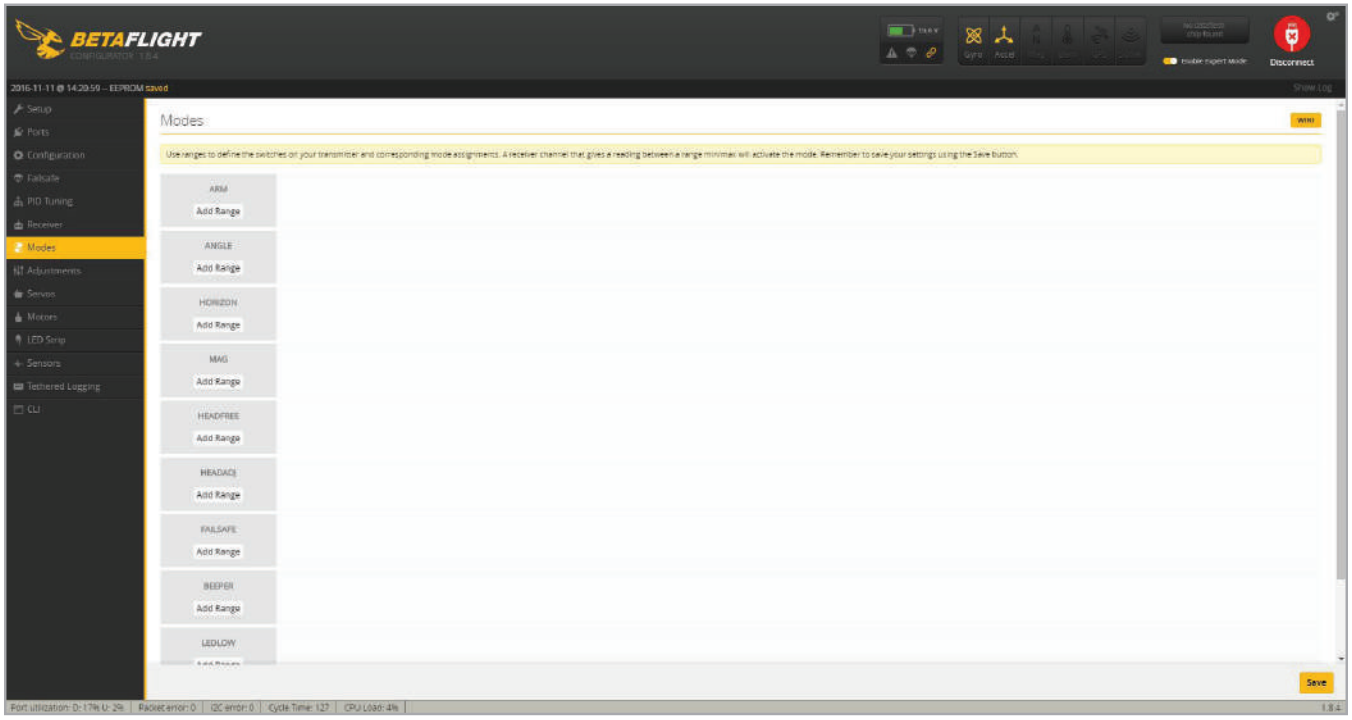
Start in the Receiver tab.



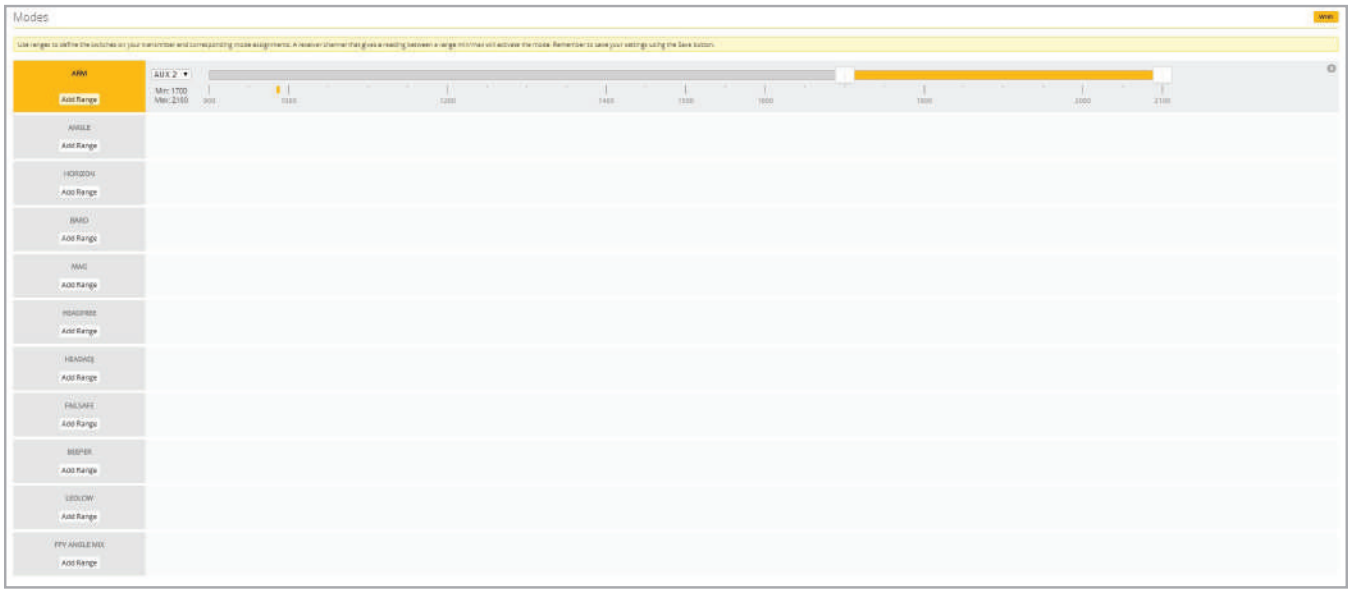
Flip the switch to see which AUX bar moves. Here, a two position switch was set up to channel 5, which shows up as AUX 1 in Betaflight.



Move to the Modes tab to set up what function the switch activates.



To set the arm switch, click the Add Range button below ARM. Set the AUX drop down to the AUX number from the Receiver page. If it was the AUX 1 bar that moved, leave the dropdown set to AUX 1. Drag the slider to the position that you want to be the arm state. The orange indicator below the slider shows the current switch position, so you can decide whether you want a forward or backward switch position to arm the drone.



Click save in the lower right corner of Betaflight to set the arm switch.

4 Configure Multiple Flight Modes

The Riot comes configured to Rate Mode. Rate Mode gives pilots full control of the drone. This is the recommended setting for aspiring drone racers. For new or beginner pilots we also recommend practicing with a flight simulator, or configuring a switch to the Angle Mode. The Riot can be configured for multiple flight modes in Betaflight.

Common flight modes

ANGLE MODE: Angle mode is a stabilized mode that will not allow your quad to spin in any direction past a set angle (50 degrees). This means that with your hands off the controls, it will use the accelerometer and the gyroscope to keep the quad level. This is the default flight mode.

HORIZON MODE: Horizon mode is a mix between Angle and Air mode, offering stabilization while the pitch/roll stick is near center, but using rate mode settings when sticks are at their endpoints. This allows a pilot to fly in a stabilized manner, but still perform rolls and flips when really pushing on the pitch/roll stick.

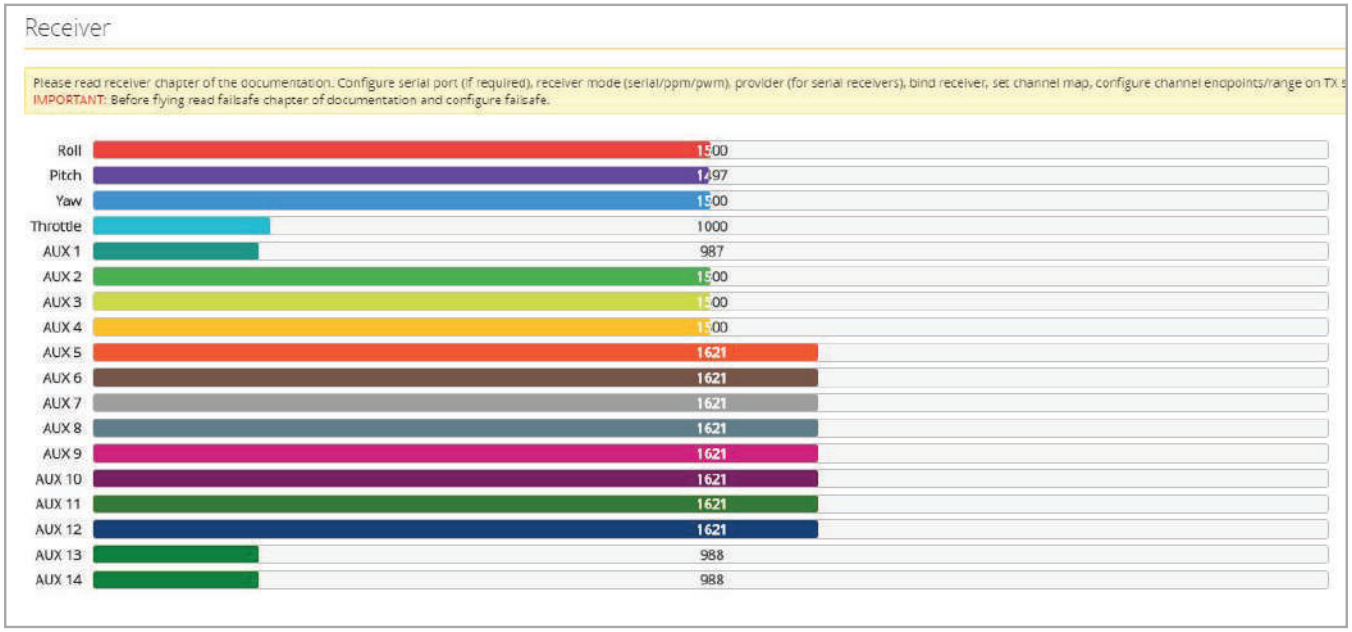
RATE MODE: This is the most difficult mode for flying but also the most responsive. Air mode uses the gyro sensor which takes the pitch/roll stick inputs speed and angle and translates it into the rate at which the craft rotates on that particular axis. Once you have become a skilled pilot, the reason you may want to fly in air mode is so that you won't have the stabilization provided by the other modes, which can with skilled piloting lead to smoother flying and better video capture. It will also let you perform banked turns and make small adjustments to get through small gaps much more easily than a stabilized mode.

Like arm and disarm, flight modes can also be set to switches on the radio. Since all radios have their own procedure, refer to your TX (radio) manual for directions on how to program the aux switches on your radio. Typically a 3 position switch is set up for arm/disarm.

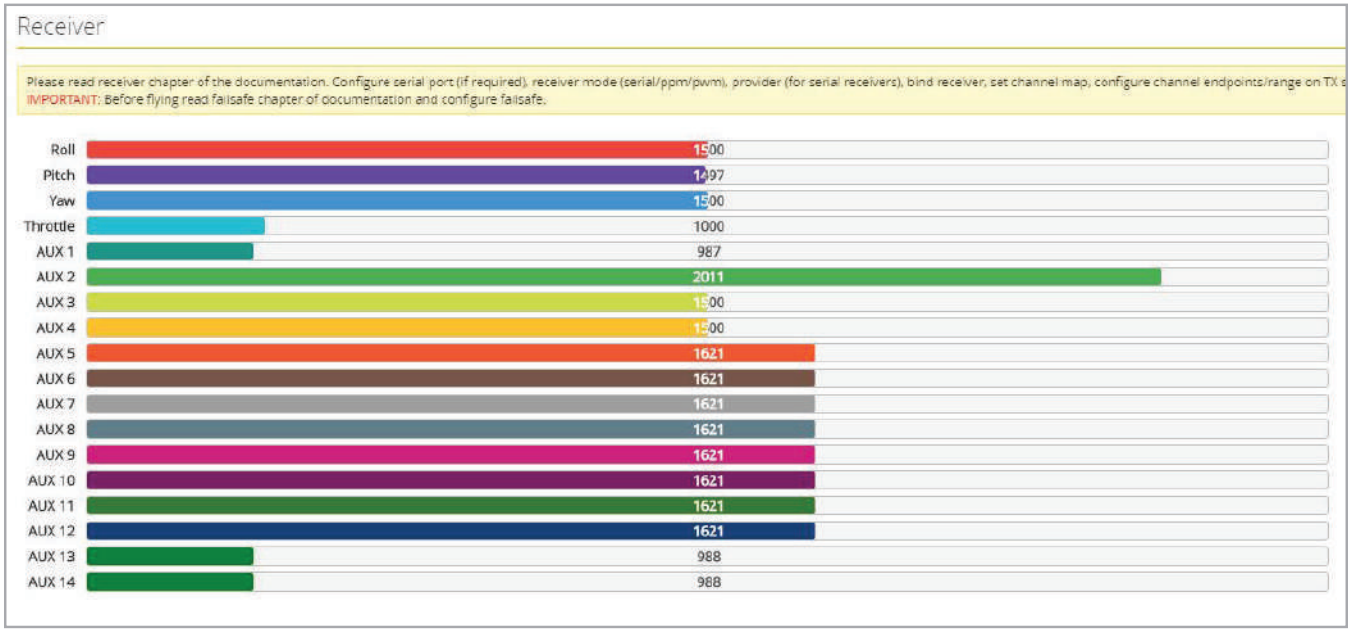
After setting up the aux switch for flight modes, verify in Betalight.

WARNING! Be sure props are removed before switch verification.

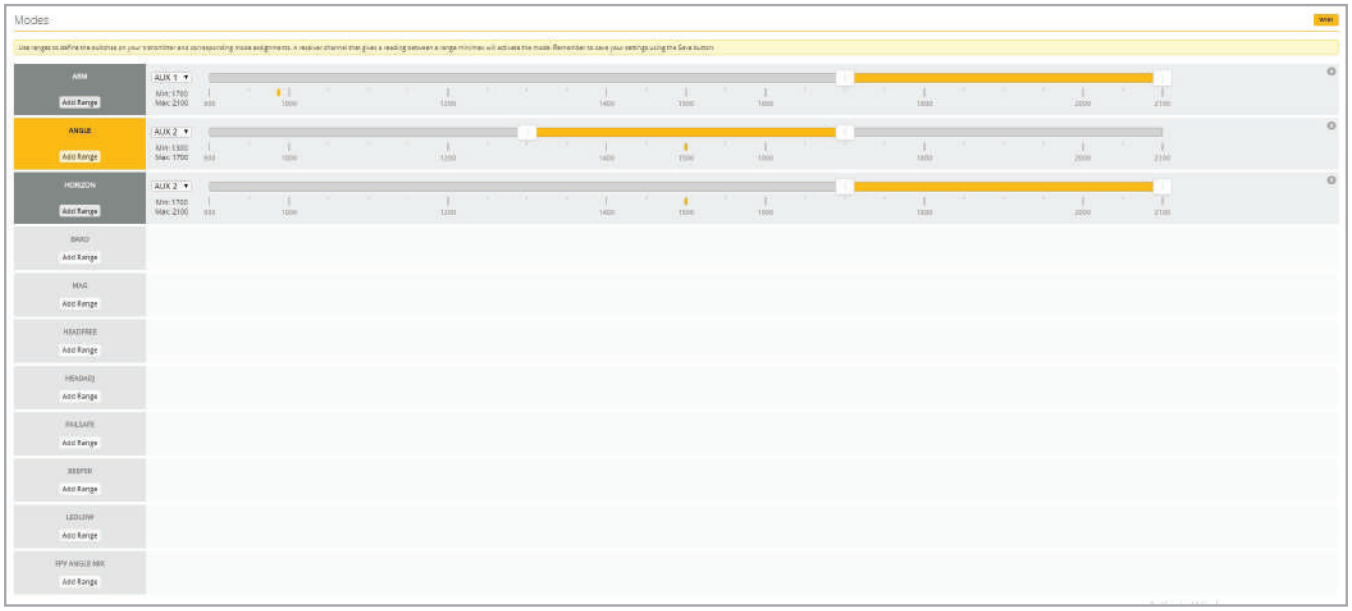
Start in the Receiver tab.

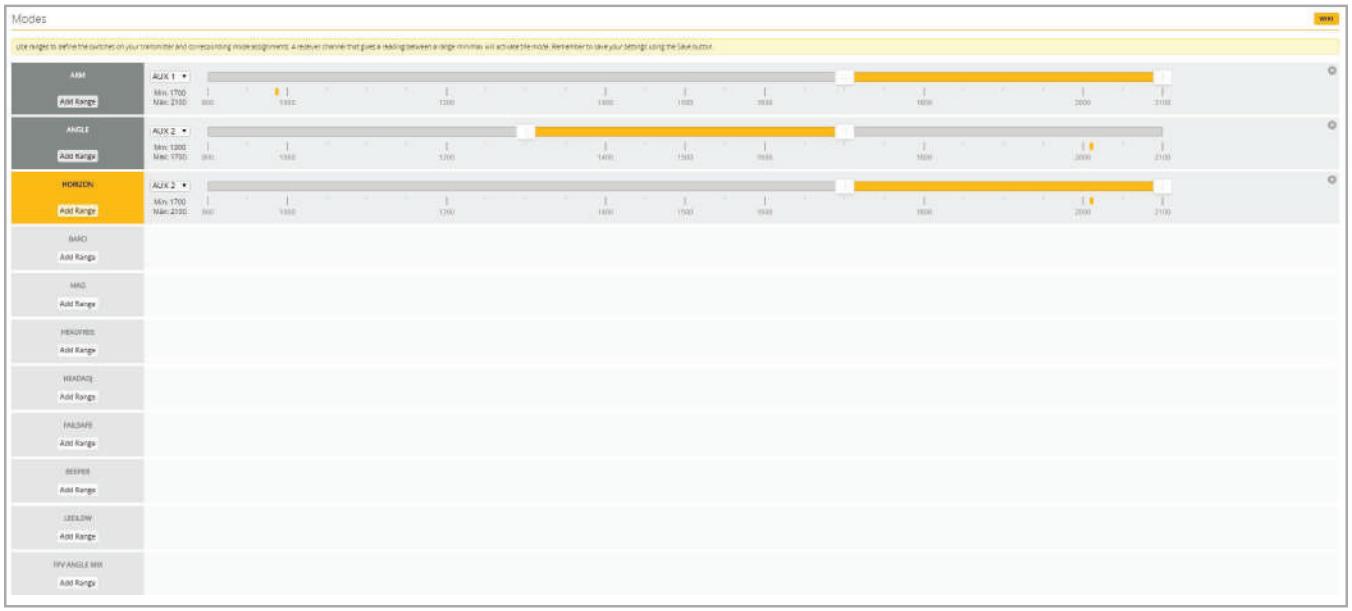


Flip the switch to see which AUX bar moves. Here, a three position switch was set up to channel 6, which shows up as AUX 2 in Betaflight.



Move to the Modes tab to set up what each switch activates. To set up a new flight mode, click the Add Range button below ANGLE or HORIZON. Set the AUX drop down to the AUX number from the Receiver page. Drag the slider to the position that you want to be the arm state. The orange indicator below the slider shows the current switch position. Switches turn yellow when successful activated on the radio.





Click save in the lower right corner of Betaflight to set the new modes.

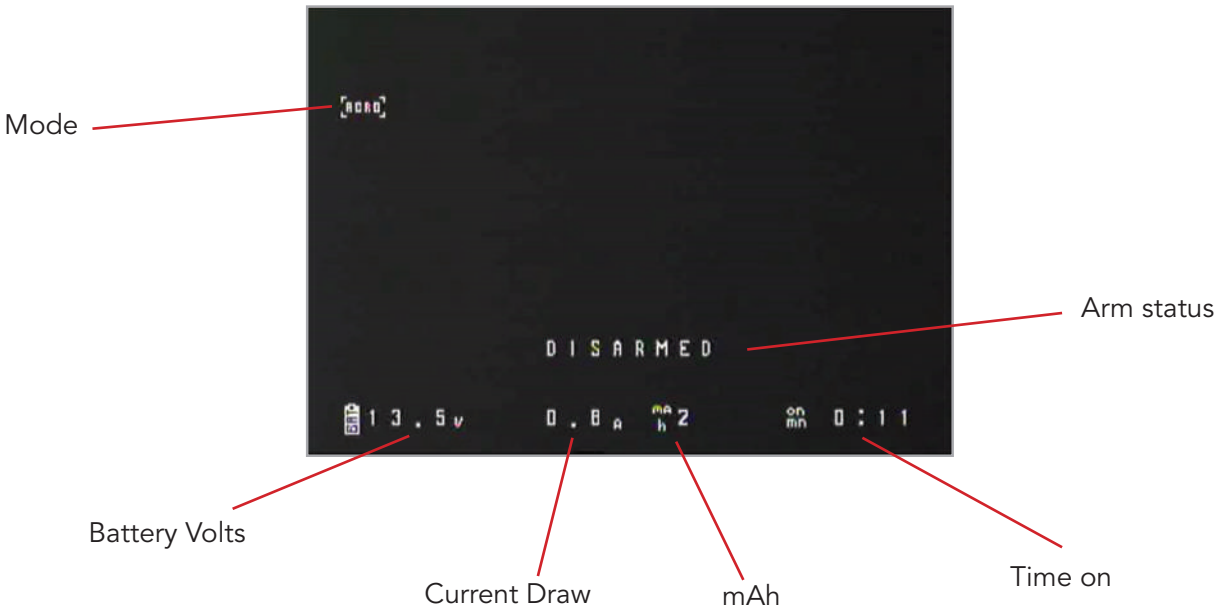
OSD (ON-SCREEN DISPLAY)

1 Open the Main Menu

The OSD Open Screen shows in any 5.8 GHz FPV goggles when the Riot's flight controller is turned on.

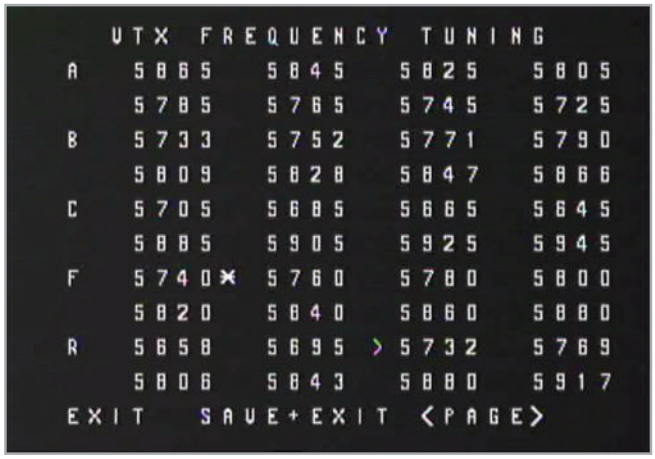
Yaw right and pitch forward to open the main menu.

The main screen shows the display that's broadcast during flight.

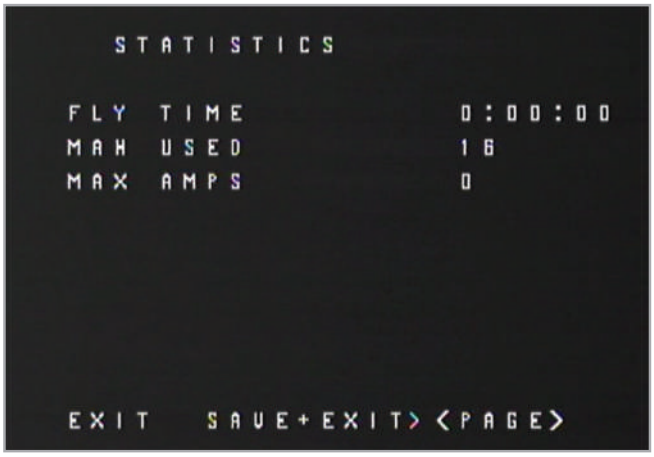


2 Adjust OSD Settings

From the main menu, yaw right and pitch forward again to move through the setting control screens.



The first screen shows Frequency Selection. Move the > up and down with the right stick. Yaw right to select.



The second screen shows Statistics, which automatically pop up after each flight.

Advanced user also have the option to explore the screens on PID Config, Voltage, RC Tuning, RSSI, Current, Advanced and Advanced Tuning.

The final Display screen controls what shows on the main screen:

Horizon: a line parallel to the ground to help maintain orientation.

Side Bars: vertical HUD sidebars

Scrolling Bars: sidebars that move in direction of change for altitude and speed

Throttle: amount of throttle.

GPS Coords: the GPS coordinates if external GPS sensor has connected to the Riot.

Sensors: output from any external sensors connected to the Riot

The OSD can also be configured from a laptop or desktop computer. Download MWOSD GUI from www.thrust-uav.com/support. Connect the flight controller to the computer with a FTDI adaptor, FTDI and serial-to-JST SH 6 pin cable.

PRE-FLIGHT CHECK

The FAA recommends a thorough pre-flight check of your drone and operating environment before flying. Here's a short list:

Are you clear to fly?

- Do you have enough daylight and fair weather?
- Have you notified an airport if flying within 5 miles?
- Are you away from people not involved in the flight operations as well as any sensitive property?
- Are you fully aware of and compliant with all federal and local flight regulations?
- If you're flying FPV, do you have a spotter?

Is everyone involved in the drone operation aware of:

- Emergency and contingency procedures?
- Each person's roles and responsibilities?
- Any potential hazards in the area?

Is your drone ready to fly?

- Is the drone linked to the radio and goggles? If not, see the Troubleshooting section.
- Does the battery have enough power for your intended flight?
- Are the sensors accurately calibrated?
- Are all components securely attached?
- Is the drone's registration clearly visible?

TROUBLESHOOTING

1. The drone is not responding to radio controls.

- Check receiver wiring.
- Verify configuration in Betaflight.
- Consult your receiver user manual: FrSky XSR, FrSky X4R or Spektrum
- Refer to your radio user manual.

2. The drone crashed and needs new parts.

- Replacement parts can be purchased directly from the Thrust UAV website, including:
  - Motors
  - Speed controllers
  - Arms or frame
  - Skirts
  - Flight controller
  - Camera
  - Antenna
  - Missing screws or nuts

3. The goggles are not receiving video feed.

- Check the channel on the goggles. The default is set to 5740.
- Make sure the camera is plugged in.
- Check the battery percent power and charge if needed.
- Refer to your FPV goggle instruction manual.

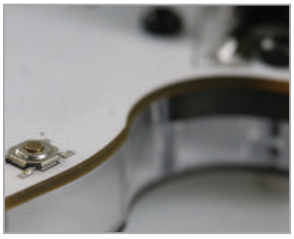
4. The drone flies erratically.

- Check all screws and make sure the hardware is tight on each arm.
- Verify the sensor calibration.
- Inspect the ESC's for prop marks or severed wires. ESC's can be replaced if damaged.
- Inspect the motors. They should spin smoothly and can be replaced if damaged.
- Check the prop orientation.

5. The motors aren't configured correctly.

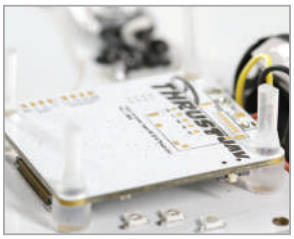
The ESC's can be reconfigured using Betafight and BLHeliSuite. A great tutorial is at https://oscarliang.com/flash-esc-via-cleanflight-fc/

DRONE ANATOMY



Frame: The frame is the backbone of the drone.

The Riot comes with a 250-sized H frame, meaning it measures 250mm zdiagonally between two motors while in the shape of a letter H. White gel-coated carbon fiber provides lightweight strength. Quick swap arms make it easy to repair and customize the Riot yourself. Clear polycarbonate risers are nearly indestructible and diffuse light from the LED's for improved visibility.



Flight controller: The flight controller is the brain of the drone, the place where programs from Betaflight or Raceflight are stored and executed

Currently the fastest processor on the market for top racing performance, the Riot's STMF4 flight controller contains a built-in gyroscope and accelerometer.

Motors: Motors spin the props.

The Riot flies with high quality DYS SE2205 2550kv motors utilizing new N52 magnets to ensure top racing performance. Depending on the props, the Riot has a max flight time of 2-5 minutes.

Electronic speed control (ESC): The ESC's control the speed of the motors by regulating how quickly they turn the motors on and off.

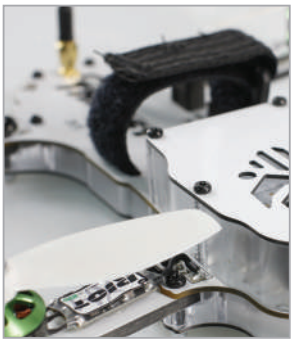
The Riot is equipped with four DYS XM20's, which are built with a F396 processor designed for high kv motors.

Camera: The camera captures video feed.

The Riot's Runcam Swift CCD (charge-coupled device, a common sensor for improved resolution in digital cameras) offers wider dynamic range for FPV racing.

Video antenna: The video antenna sends video to the goggles via RF (radio frequency) transmission.

Durable and easy to install and remove, the Riot's RHCP (right hand circular polarized) omni antenna provides 360 degree coverage. See Riot Set Up for antenna installation details.



Video transmitter (VTX): The VTX takes the analog signal from the camera and converts it to RF (radio frequency) to send from the antenna to the FPV goggles.

The Riot's VTX is fully integrated into the PDB for seamless telemetry.

Power distribution board (PDB): This is like the motherboard of a computer, the place where all the drone's electrical components connect to draw power from the battery.

Designed and engineered by Thrust UAV, the Riot's fully integrated PDB includes 52 addressable LED's.

Propellers (Props): Props provide lift for the drone.

For the best of all worlds, the Riot comes equipped with hybrid bullnose 5045x3 Gemfam props. Moderately efficient, these provide a powerful 1200+ g of thrust. See Riot Set Up for prop installation details.

ADDITIONAL COMPONENTS

To start racing, all you need is:

Radio: PPM, SBUS or DSMX compatible, FrSky Taranis recommended

Receiver: PPM, SBUS or DSMX compatible, FrSky XSR recommended

FPV Goggles and Compatible Module: Any, Fatshark Dominator V3 recommended

Battery: Any 3-4S 45C+ LiPo, 1300 size recommended, unless flying with an HD recording camera. Beginners typically prefer starting with a 3S (11.1V) battery. A 4s (14.8V) battery is best for pros looking for aggressive, top-speed performance.

Li-Po Compatible Balance charger: Any

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