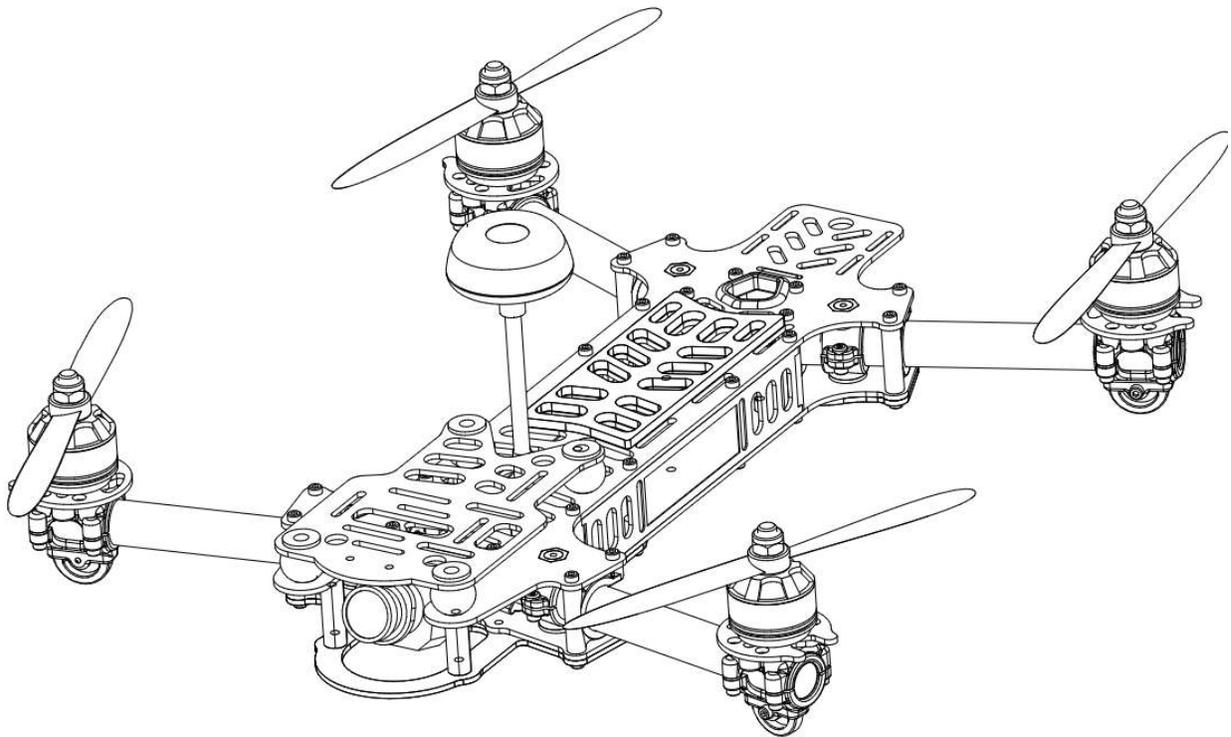# VORTEX

Instruction manual

International edition

Rev 1.0 - May 2015 (Preliminary)
'Living Manual'

ImmersionRC
REAL VIRTUALITY

Table of Contents

Living Manual

Note that this manual is a 'living manual'.

Instead of downloading a static PDF file, the manual is an online document which reflects edits, additions, and corrections as they happen.

The Living Manual also allows readers to add their comments, which editors can use to refine the documentation.

Confused by part of the manual? Wishing for a better explanation for part of the setup? Leave a note and the editors will listen.

Thank You!

The team that designed the Vortex would like to thank you for purchasing this product.

Many hours of development, and testing time went into the Vortex, we truly hope that this is reflected in your experience with the product.

We strived to create one of the first ARF racing quads, with performance in the same class (or better) than some of the custom mini-quad builds that have fueled this rapidly developing segment of the FPV market.

We would love to hear your feedback on the product, whether good or bad, at feedback@immersionrc.com.

⚠️ WARNING

To use dogs as a good analogy, if the DJI Phantom™ is a white fluffy **Poodle**, the Vortex is a **Pitt Bull**, bred for fighting, and ready to bite you at any minute :-)

This is a race quad. It does not come with GPS hold (infact, it has no GPS at all), and it does require a fair amount of skill to pilot it.

Pitt Bulls are a lot of fun, start slowly, get to know your quad before slamming it into a wall at race-speeds.

Read carefully the recommendations in the Getting Started guide, as far as equipment/battery selection, and how to run the Vortex Wizard.

⚠️ REMOVE PROPS

Mini-quad props can do some serious damage when coming in contact with human skin.

Unless you are ready to fly, when you are working on a quad with the battery connected, it is highly recommended to **REMOVE ALL PROPS**.

When setting up mini-quads, there is always a remote chance that a configuration change can spin up motors unexpectedly.

ImmersionRC accepts no responsibility, or liability, for any injury, or damage, to persons or property, caused by the use of the Vortex.

Getting Started, ARF Version

The separate Getting Started guide should be used when setting up your Vortex for the first time. It includes sections on choosing an appropriate battery, and R/C receiver, and also the operation of the setup wizard.

The Anatomy of a Vortex

Connectors and Switches

1) **USB connector**, used to configure the flight controller and upgrade the Vortex firmware.
   Note that to use the USB connector, a battery must be connected also. The Vortex cannot be powered through the USB connector.
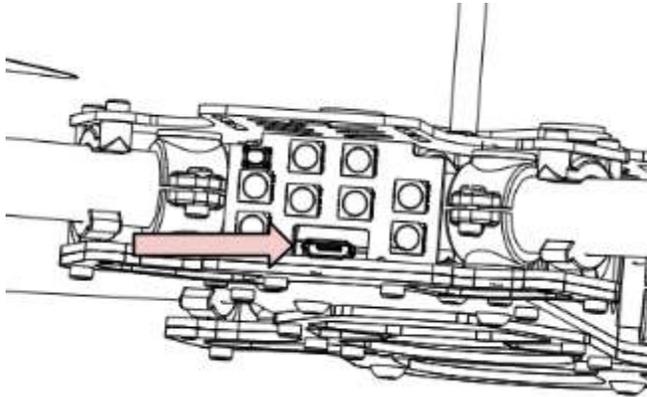
Please be careful not to put too much strain on this connector. It is a lightweight surface-mount part, and if the quad is dragged around by the USB cord it may not survive.

2) **LED board button**, used to change Video Tx band, and also to restart the wizard.
   2 second press and release to change video band. 5 second press and release to restart the wizard.
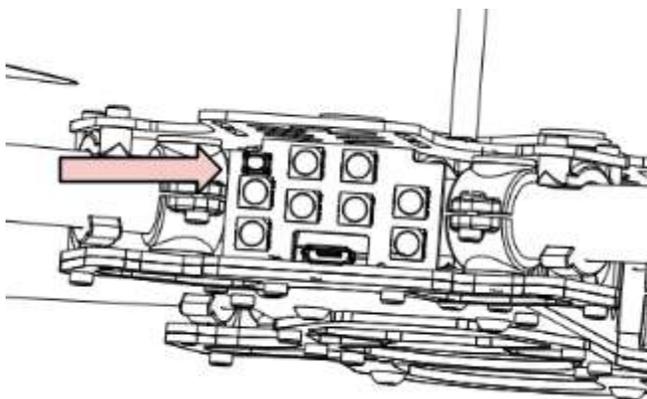
3) **Fusion FC/OSD button**, used to enter firmware update mode.

   See the [Firmware Upgrades](#) chapter for more details.
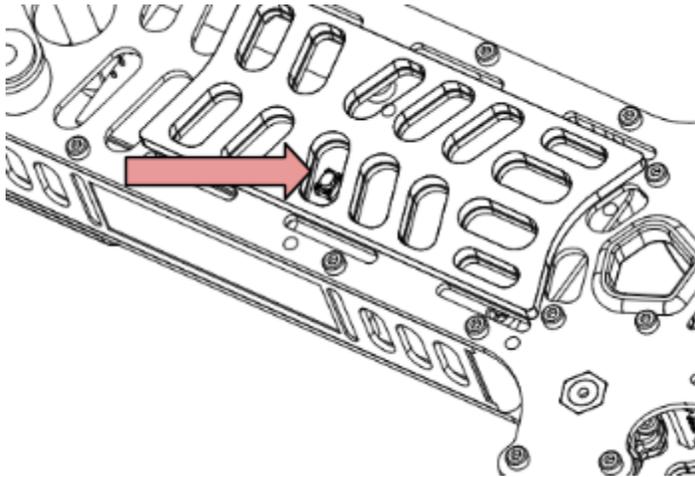
4) **Socketed Video Tx Module**

   A 350mW 5.8GHz Custom NexWaveRF module on the first Vortex shipments.
   25mW version 5.8GHz module to be available summer 2015.
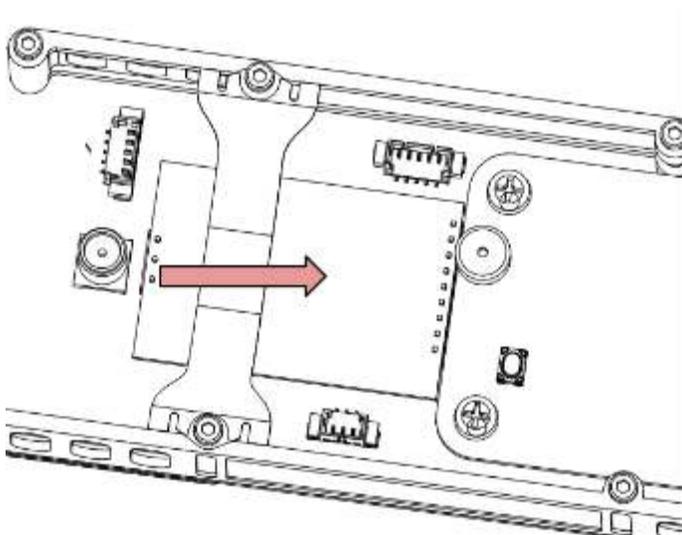
> **Note that the module is restrained using a stainless-steel spring. Take care when removing the two mounting screws on the top plate, since the spring may be ejected from the side of the quad, into awaiting fingers…**
> **Be sure to reinstall the spring when re-assembling the Vortex, to avoid the Tx module from damage in a crash.**

5) Flight Camera Video/Power Connector

The flight camera video and power connector is a 3-pin Picoblade connector located behind the left side plate. Accessing the connector is easiest by just removing the side plate, without the need to remove the top plate.
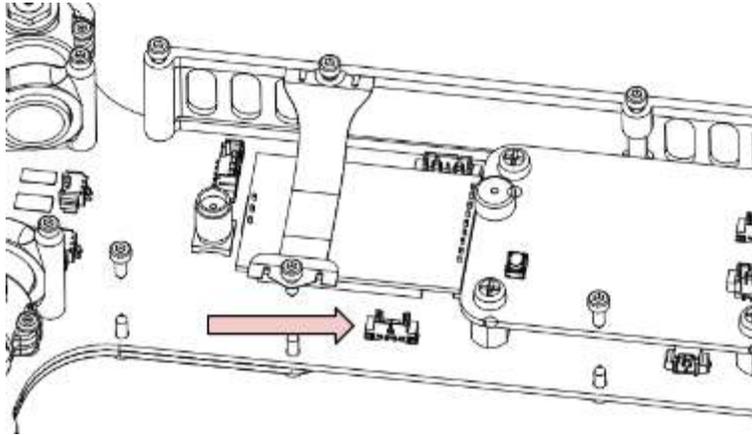
The connector has the following pinout, starting from the front of the quad:

1. Video
2. Gnd
3. +5v

6) GoPro Power Connector

The GoPro power connector is a 2 pin Picoblade, also accessible through the left side plate. It is typically used to power a GoPro with it's battery removed, to remove weight from the front of the quad, and therefore make getting the COG correct easier.
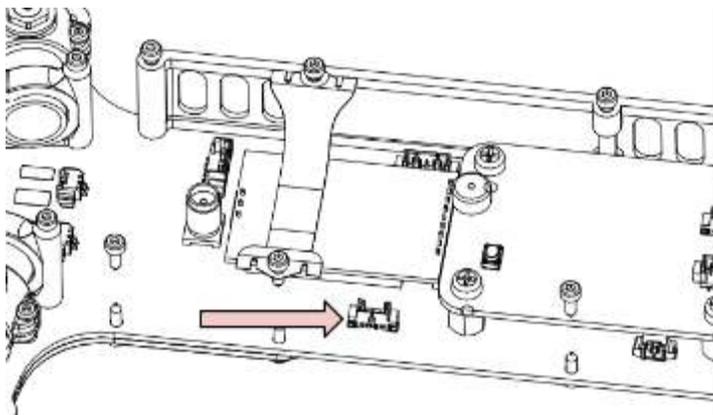
The connector has the following pinout, starting from the front of the quad:

1. +5V   *~1A Maximum Current*
2. Gnd

> **NOTE: Certain GoPro models will not power up without a battery installed, a little research may be required to identify which ones .**

7) Receiver PPM Connector

The receiver PPM connector is a 3-pin JST-PH connector, with the following pinout, looking from right to left in the below image:

1. Gnd
2. +5V   *Power to the receiver*
3. PPM   *3.3v, or 5v logic levels*
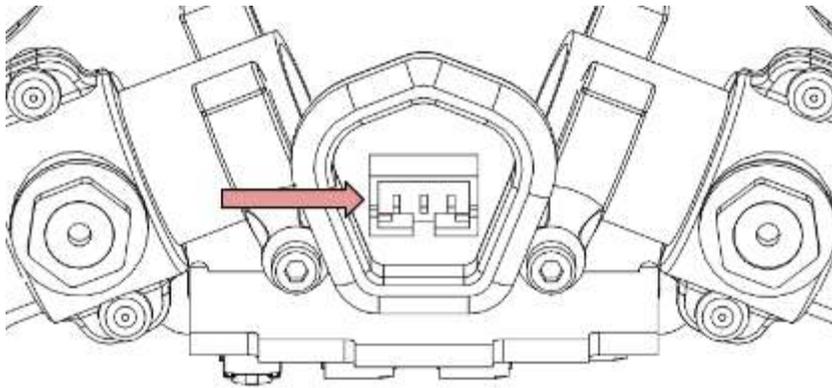
> **Note: To interface to S-Bus, or Spektrum Satellite receivers, an optional cable is required. The Spektrum variant also drops the supply voltage down to 3.3v.**

8) XT-60 Battery Connector

The pre-installed XT-60 connector is compatible with most batteries of the size and capacity in the class required by the Vortex.

> **Note: Pay EXTREME attention to the polarity of batteries connected to this connector, especially those soldered 'DIY'. A reverse-polarity connection, even for a fraction of a second will let out the 'magic smoke' and destroy most of the electronics in the Vortex.**

Also Note: When unplugging the battery, especially one with a new, and rather tight connector, take care to hold the cables, and avoid unnecessary strain on the Vortex PDB. Pulling these cables too hard may pull the traces off of the PCB.

Folding Arm Assembly

The folding arm assembly consists of both injected plastic, and Carbon Fiber parts.
The tiny EzESC is located inside the tube.
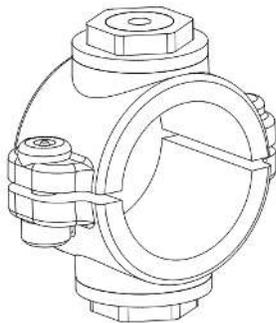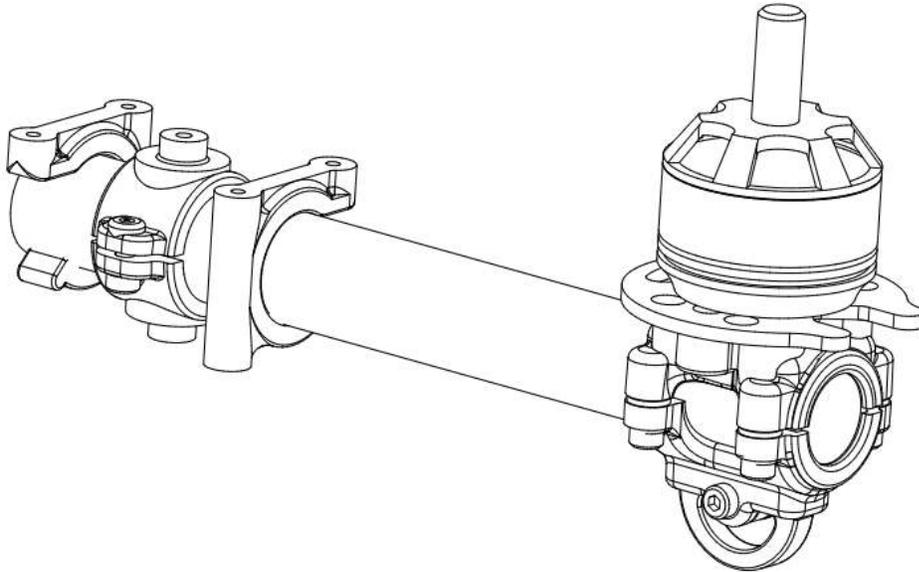
The pivot point is a critical structural element of the Vortex arm. These plastic parts are clamped, and keyed, onto the carbon fiber tube. In a serious crash, this pivot point acts as a 'fuse', and should be checked for damage, and replaced if necessary.

The arm 'C' clip provides the locking mechanism for the arm, and ensures that the arm only bends in the intended direction.

NOTE: When removing and reinstalling the 'C' clips, take care that the correct screws are used. If a screw which is too long is used in the area which rubs against the carbon arm, the surface of the arm can easily be damaged.

When changing the arm, a soldering iron is required, to remove the ESC + and - battery cables.

> **Note: The choice of soldered connections here, instead of the much more convenient connector option may not seem ideal.**
> **Various connectors were tried, but one compact enough, robust enough, and capable of carrying > 20 Amps per motor was not found.**
>
> **A custom connector suitable for this application will be included in a future revision of the Vortex to simplify the in-field replacement of arms.**

Camera Mounting Plate

Flight Camera
The Vortex flight camera is suspended from a dampened carbon fiber plate. This reduces the amount of Jello due to unbalanced (or slightly damaged) props.
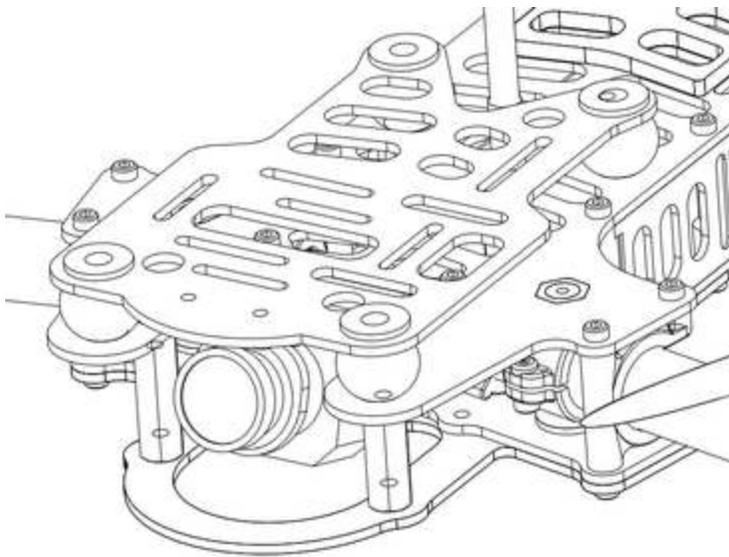
The camera mount itself allows a tilt of up to ~45 degrees, compensating for frame tilt due to high speed racing.

NOTE: The camera pivot point is intentionally tiltable without tools. Because of this, it may move after the occasional 'hard landing', and should be checked before the next launch.

The Vortex frame was designed for the family of FatShark cameras with lightweight plastic cases, from the 600, and 700 TVL CMOS cameras, through to the 900 line CCD.

The Vortex is shipped with the 600 line CMOS installed (certain quads may be shipped with the slightly improved 700 line version).

The plastic pins and circlips installed into each of the dampers are important, and prevent the camera mounting plate from being separated from the frame in a crash.

> **NOTE :It is important that all four of these pins are installed before every flight. Flying with fewer pins installed may result in damage in a crash.**

HD Camera (GoPro/Mobius)

The camera mounting plate also includes slots used to secure either a GoPro, or Mobius camera.

Note that this mounting mechanism doesn't provide support for significantly tilting the camera, which is required to keep the horizon in the center of the image during high-speed flight.

Two optional kits are available from ImmersionRC resellers which achieve this, the **GoPro Recliner** (P/N: **VXUPGGP**) and the **Mobius Incliner** (P/N: **VXUPGMOB**).
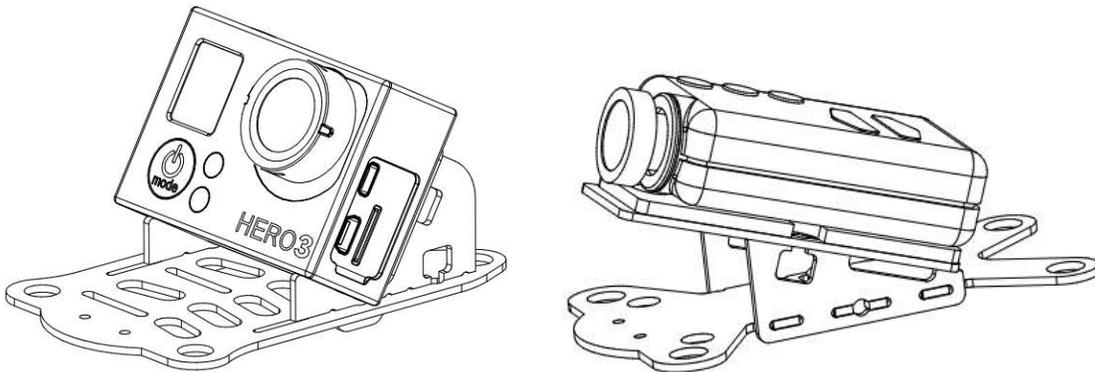
The On Screen Display (OSD)

The Welcome Screen

Each time the Vortex is powered up, and before sticks are moved, the following welcome screen is displayed.

This shows various pieces of status information, including the Flight Controller version number, and Flight Controller API version which is fairly important for OSD compatibility.
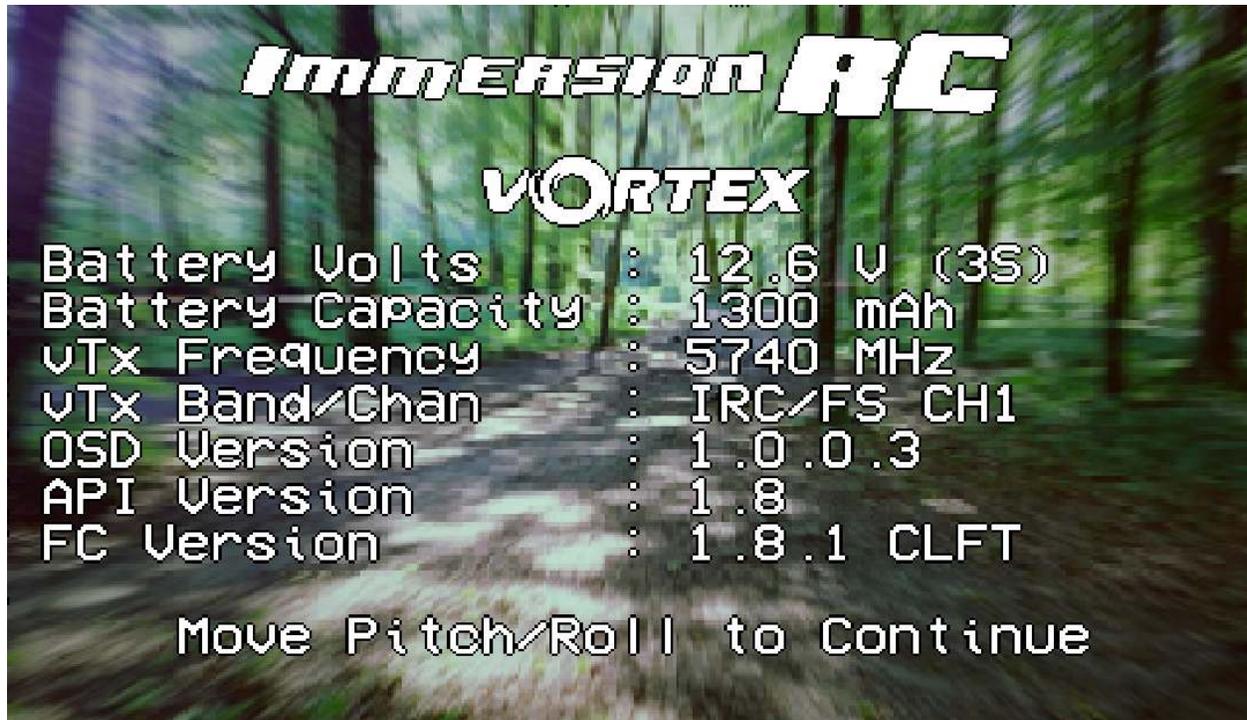
Moving the pitch/roll stick (right stick for mode 2'ers) will dismiss the menu.

The Main Menu

For Mode 2'ers, holding the throttle stick down and to the left will enter the main menu. Note that this stick position needs to be held for a few seconds before the menu appears.

To navigate the menu, use the pitch/roll stick.

The OSD Setup Menu

Various OSD setup parameters are available in this menu.

The **Landscape**, defines the elements that are shown on the main screen in flight, including an EzOSD-type landscape (the default), a clutter-free landscape for hardcore racers, and a gaming mode which is currently in Beta form (documented later in this manual).

The **Pseudo** lets you name your quad. This is useful when several Vortexes are being used in a race, and simplifies Video Tx channel assignments.

The **Pack Capacity** should be set to the capacity of your flight battery. The OSD will track battery consumption, and will warn, with screen-center alarms, if it gets critical.

> **NOTE: It is highly recommended to set this to match the flight pack that you are using to allow the OSD to warn you when the battery is reaching critical levels.**

```
OSD Setup_____1/1
>Landscape          EzOSD              <
 Pseudo             IRCOSD..
 Margins            Normal

 Pack Capacity      1300 mAh
 Beeper Freq.       1800 Hz

 Alarms Setup...
```
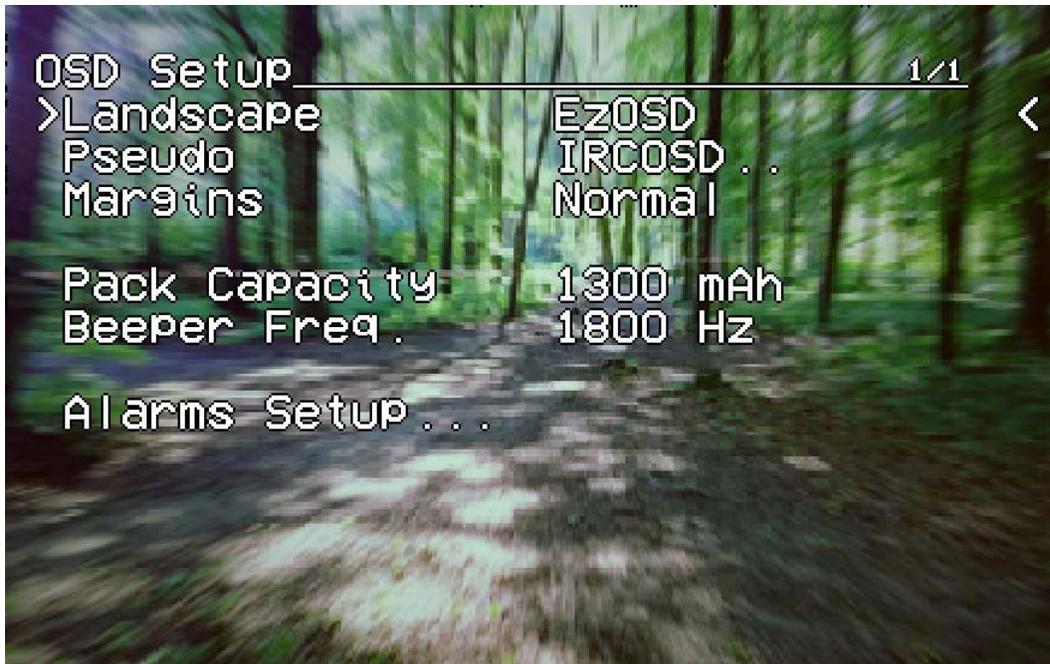
Alarms may be enabled and disabled in the **Alarms Setup** menu.

It is highly recommended to start flying with all alarms enabled, and disable them if required after getting used to the quad.


```
Alarms Setup_____1/1
>Battery mAh        On                 <
 Battery mV         On
 UHF Status         On
 Flight-Time        On
```
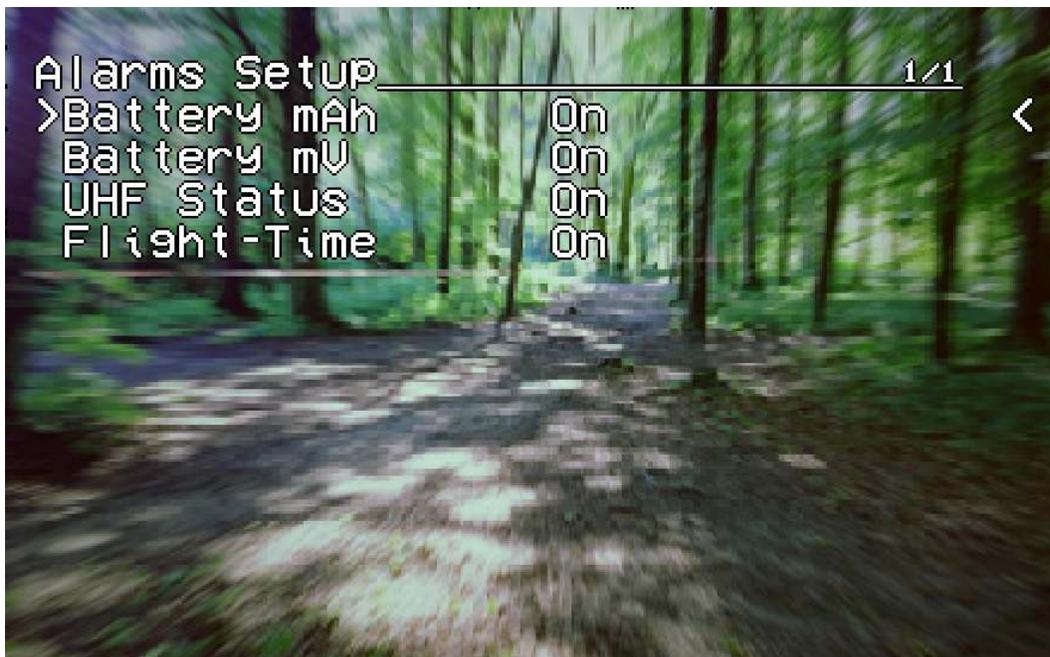
The LED Setup Menu

The RGB LEDs on the rear of the Vortex are fully programmable, with colors, and various patterns.
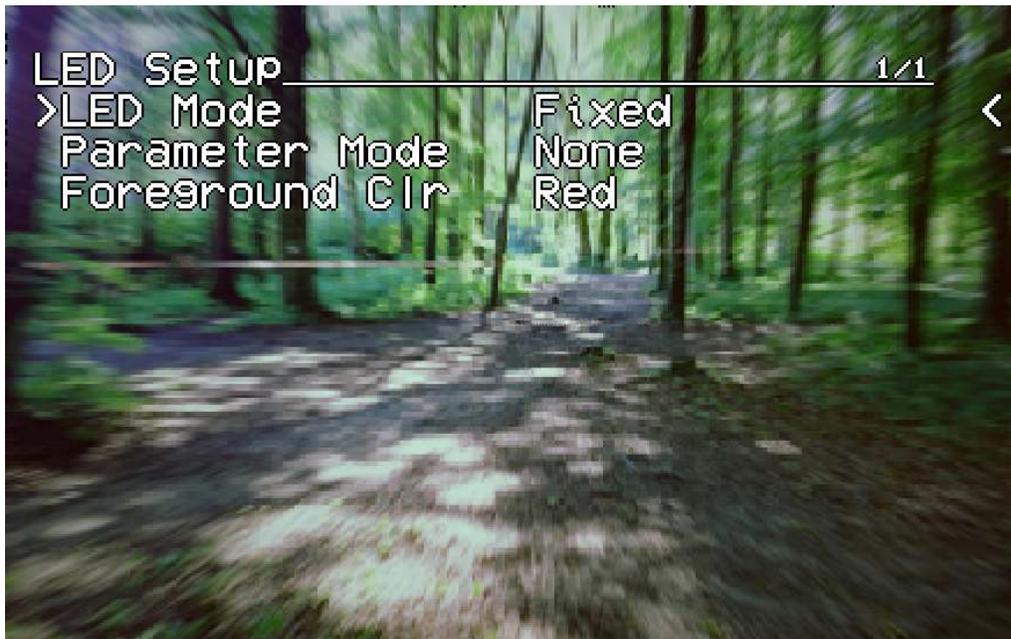
For Parameter Mode = **Intensity**, the intensity of the LEDs will reflect the current throttle position.

For Parameter Mode = **Frequency** the blink rate of the LEDs will reflect the current throttle position.

For Parameter Mode = **Gradient**, the LEDs will shift from the foreground color, to the background color, based upon the current throttle position.

Other modes will be supported in future firmware updates.

The Flight Controller Menus

In-field tweaking of flight-controller menus is possible without a laptop and USB cable.
All of the critical parameters, PIDs, Expos, Loop time, etc. are available.
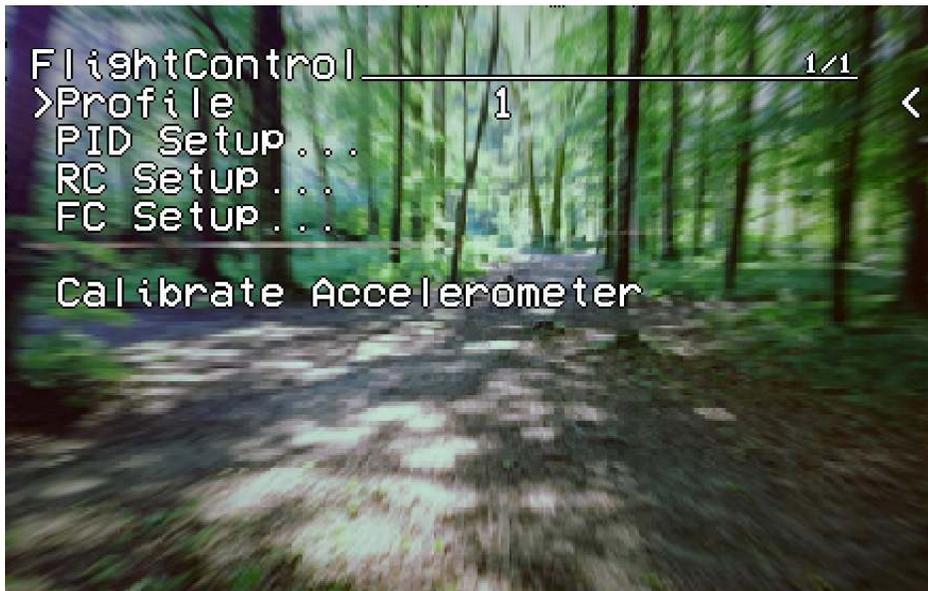
Note that the PID Setup menu is a two page menu, keep moving the caret down to access the second page.

```
PID Setup_____2/2

>ALT      P                    0.0              <
          I                    0.000
          D                        0
 VEL      P                    0.0
          I                    0.000
          D                        0
 LEVEL    P                    0.0
          I                    0.000
          D                        0
```

```
RC Setup_____1/1
>RC rate                0.00                    <
 RC expo                0.00
 RP rate                0.00
 Roll rate              0.00
 Pitch rate             0.00
 Yaw rate               0.00
 TPA                    0.00
 Throttle expo          0.00
```
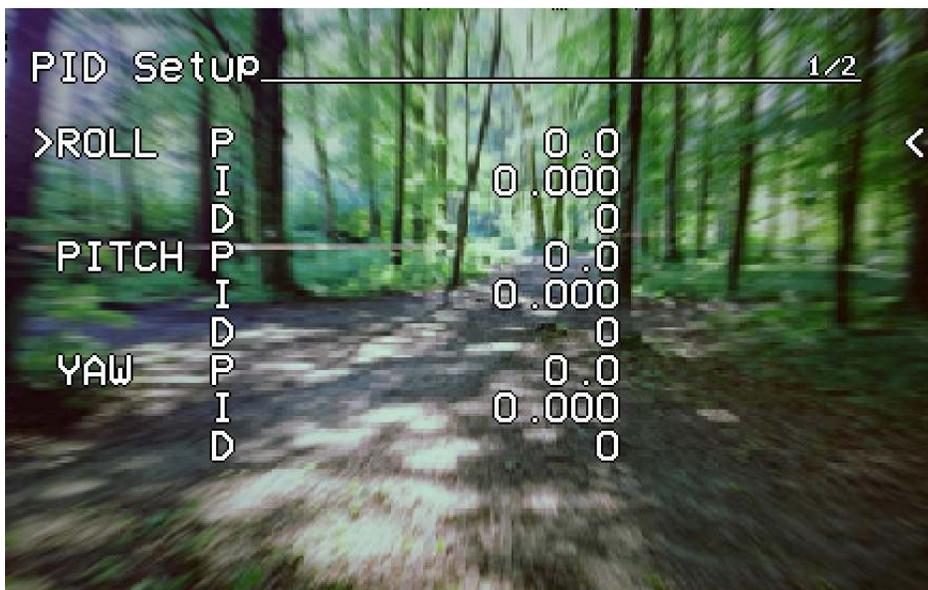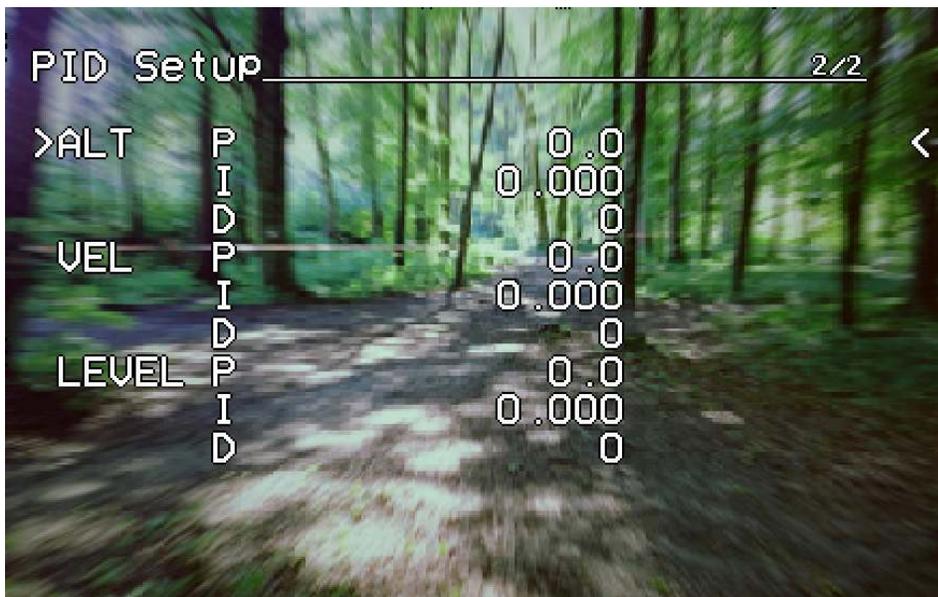
Note that all of the Flight Controller parameters can be preset by loading one of the installed Pro-Tunes.

The Video Tx Menu

The Video Tx menu shows, graphically, the 5.8GHz frequency band, from low (left) through high (right) frequency.

5 bands are supported, covering the standard ImmersionRC/FatShark frequency bands, plus all of the 'Boscam', Team Black Sheep bands, and also the new ImmersionRC 'RaceBand'.

Note the need for RaceBand in this hobby is immediately obvious after looking at this graph!

NOTE: Channel 8 of the IRC/FS set cannot be received by 7 channel ImmersionRC or FatShark receivers. Unlocked Uno/Duo5800 receivers can receive it, as can the new FatShark 4-band RaceBand Dominator module.
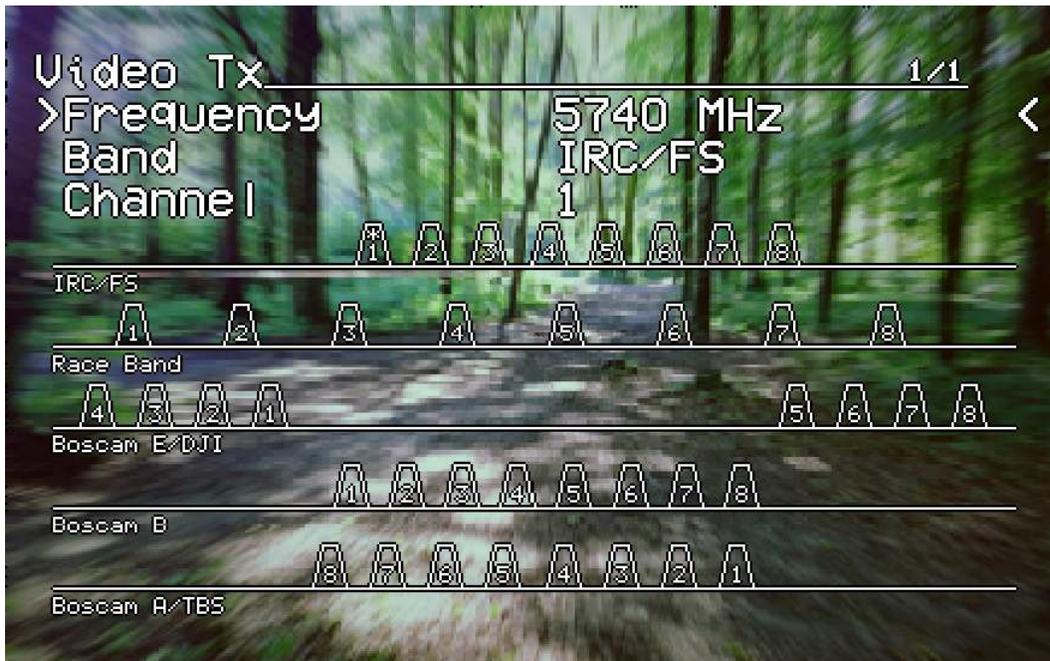
WARNING: Please play attention to the legality of the channels that you are using in your area.

While the authorities have been relatively tolerant of emitted power on 5.8GHz, out of band transmission is a more serious issue.

In the USA, with a Ham license (required to emit more than about 1mW), operation within the 5650MHz to 5925MHz band is allowed. All 8 RaceBand channels fall within this band, but the outer channels of the Boscam E/DJI band are outside the band.

Within Europe, the Ham band is 5650MHz to 5850MHz, which allows the first 6 RaceBand channels.

Flight Controller

R/C Transmitter Control Modes

Mode 1 - *Common in Europe*

Pitch	**Throttle**
Yaw ✥	✥ **Roll**

Mode 2 - *Common in the USA*

Throttle	**Pitch**
Yaw ✥	✥ **Roll**

Mode 3

Pitch	**Throttle**
Roll ✥	✥ **Yaw**

Mode 4

Throttle	**Pitch**
Roll ✥	✥ **Yaw**

Flight Modes

Three flight modes are configured by the Vortex Wizard, and are mapped by default to channel 5 of the R/C Tx.

These modes are as follows:

Acro	This mode is the preferred mode for the more advanced mini-quad pilot. In many ways it is the simplest mode, but also the hardest mode to learn. In Acro mode, the accelerometer part of the IMU is not used, only the Gyro. Because of this, the quad will not self-level, explaining the steep learning curve for this mode. To learn this mode, it is recommended to start flying the quad FPV, in Level mode, get some altitude, and switch into Acro mode. Landings in Acro mode can be a bit challenging for the beginner, so switching to Level mode before landing is a reasonable way to deal with this. Acro mode is the ideal mode to have fun with flips and rolls.
Angle	Angle mode is the easiest to learn. When the sticks are centered, the flight controller is always working to level the quad. The deviation of the Roll/Pitch controls from neutral defines the angle of the quad in flight. Not a great mode for racing, but definitely the mode to use for the maiden flight.
Horiz	Horiz mode is a bit of a hybrid mode. It does auto-level, but also allows flips and rolls.

Cleanflight / Baseflight / Multiwii / Open-Source

The development of the Vortex would not have been possible without the effort of a large team of individuals who invested in the open source flight controller software that running on the Vortex.

The variant of the open source flight controller firmware that we chose to power the Vortex is Cleanflight, mainly due to it's solid support of the OneShot ESC control protocol.

Since the OSD firmware needs an intimate knowledge of the flight controller API, care must be taken when installing updated Cleanflight builds.

The ImmersionRC team may not have support for Beta, and recently released Cleanflight builds the day they are released, but we are committed to keep up with changes.

Check the ImmersionRC Vortex product page for compatibility information.

> **NOTE: Do not install new Cleanflight builds, nor builds of other Flight Controller software, without first verifying that they are supported by the Vortex OSD.**

Cleanflight Configurator Connection

To hook up the Cleanflight Configurator, hook up a Personal Computer via a standard Micro-USB cable, to the connector on the back of the Vortex.

Be aware that making certain changes via the configurator may break compatibility with the Vortex OSD. One example would be changing the channel order, which is set by the wizard.

Re-running the Vortex setup wizard will reset the Cleanflight configuration to defaults.

Flight Controller Stick Commands

Enter Menu/Disarm Flight Controller:

Mode 2:   Throttle stick left, and down (normal flight controller disarm control)
Mode 1:   Yaw left, Throttle stick down

Arm Flight Controller:

Mode 2:   Throttle stick right, and down
Mode 1:   Yaw right, Throttle stick down

Reset vTx Channel:

Mode 2:   Throttle Down, Rudder Left
              + Elevator Up, Aileron Left
Mode 1:   Throttle Down, Rudder Left
              + Elevator Up, Aileron Left

ESCs - The 12/16A Vortex ESC

Overview

The ESCs used in the Vortex are a full-custom design, which uses a potent 32-bit ARM processor.

Their diminutive 9.4mm width allows them to be inserted into the carbon fiber arms of the Vortex, where they are fairly well protected against the elements, and from physical damage from passing tree-branches.

The ESCs come pre-configured for all motors supported by the Vortex, and they have also been used successfully with various after market motors used by our test team.

> **NOTE: The first generation of EzESCs cannot have their firmware upgraded by end-users. Upgrading them requires special equipment, used in the factory, and at ImmersionRC repair centers.**

RotorSENSE

A unique feature of the ESCs used in the Vortex is RotorSense.

This feature puts an end to the decade-old 'wire-swapping' technique used to get brushless motors to spin in the correct direction.

Once props are installed, at power-up before arming the flight controller, a simple spin of a prop will program the rotation sense.

> **NOTE: This procedure may be performed with props in place, or props removed. For safety's sake it is recommended that props are removed.**
> **If they are left installed, it is recommended to use a stick, or other object instead of a finger to flick the prop.**

The full procedure is as follows:

1) Cycle power to the quad to ensure that the flight controller is not armed.
2) Spin the motor in the desired direction. If the ESC recognizes the spin, two short beeps will be generated.
3) Spin the motor again in the desired direction. If the ESC recognises the spin, 5 longer beeps will be generated and the ESC has learned the direction.

Pro-Tuning

During the development of the Vortex, a team of pro-quad pilots spent countless hours, tweaking the tuning (PIDs) of the flight controller, using various 'PID Controllers' supported by the Cleanflight firmware

Each pilot fed back this data to the ImmersionRC team, and we incorporated it into the OSD firmware.

Now, as a user, you can choose your favourite pilot, choice of props, battery, flight style, etc. and all flight controller settings are configured for you, based upon his pro-tune.

Thanks to these pilots, you will spend less time in the field setting up the flight controller (quite an art), and more time racing.

Gaming (Beta)

The Birth of a Gaming Mode - The History

In the Spring of 2015, A bunch of Vortexes (Vortices?), were racing around a field somewhere in Western Switzerland, while an observer watched.

What the observer noticed is that there was no penalty for high altitude in typical quad racing, other than when forced through/under obstacles. Racers gained altitude as they gained speed.

The side-effect of this, is that quad racers don't often 'see' each other during a race, except near the above mentioned obstacles.

So what if racers were rewarded for being in the same Altitude 'plane'.. and penalized for flying too high?

A quick coding session in the Vortex OSD and we had our answer... we had synthesized pure adrenaline, directly injected into a quad racer's veins, with no contact required. The entire dynamics of the race had changed.

How Does It Work?

The concept is simple. Use the altimeter installed in every Vortex to give points for low altitude, and take points away for high altitude. Every meter of altitude underlined below a threshold (of 10 meters by default) doubles the speed of point accumulation. This creates an enormous interest in pilots flying just above ground level, at high speeds.

Yes, not every race track is perfectly flat, but all pilots fly the same course, and therefore this doesn't really matter.

At the end of the race, the time is shown, along with the points accumulated. How to combine these two scores is going to wait until the second firmware release, once we have enough user feedback.

The final score needs to be some fusion of these two scores, in a way that points for low altitude are rewarded, and fast track times are also rewarded.

Enabling Gaming Mode

Enter the OSD menu, and change the **Landscape** to **Gamer**.

Fly a few laps around your course, and get a rough estimate for the lap time. Enter this value into the **Game Setup** menu, along with the number of laps you wish to fly.

Arming the quad will automatically remove the 'Get Ready' prompt, and switch to the gaming landscape:
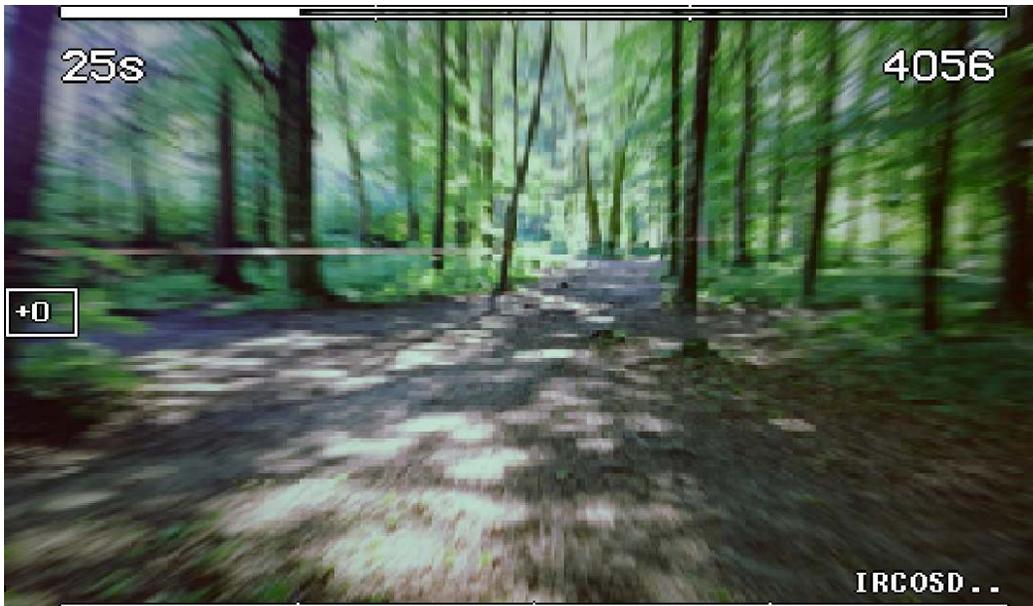
The bar at the top is a very rough idea of where you are in the multi-lap race (NOTE: There is no GPS on the Quad, so this is purely time based, but in testing showed to be useful to know roughly how many laps each pilot had completed).

The bar at the bottom is a 'fuel gauge', full battery on the right, empty on the left.

Disarming the quad at the end of the race shows the time, min and max altitude, and the number of points accumulated.

How the time and points are combined to decide who won is an exercise left to the gamer... for now. Let us know what you think, and we'll continue to develop this feature in future firmware updates.

feedback@immersionrc.com

Idea: for a bit of fun, challenge your fellow internauts to a 'remote race'. Drop two flags in a flat field a fixed distance apart, and record your best lap time, and score.
Publish the results, and lets see who the fastest kid on the (worldwide) block is!

Race Guidelines - Flying with Friends

The current generation of FPV Analog video link brings many advantages. Low-cost, and zero latency being two of the most significant.

They do however suffer from less than ideal 'selectivity', even when using large channel spacing as is the case with RaceBand.

If a few simple rules are followed, quad racing can be a lot of fun.

1) **NEVER land near another pilot.**
   This is an absolutely golden rule. Landing your quad near another pilot, especially one who is at a significant distance, is like screaming in the ear of someone listening to a whisper at the other side of a room.

2) **NEVER walk back to the pilot area with a powered-up quad**
   This is similar to 1), and is the most common cause of issues at the race track. When retrieving a model, unplug the battery before walking back to the pilot area.

3) **POSITION the launch and landing zone as far from the pilot area as possible**
   This ensures that collisions at race start don't affect other pilots.
   A distance of at least 10 meters is recommended, more than this is a bonus.

4) **ALWAYS warn in-air pilots before powering up a quad, even if you KNOW it is on a different channel**
   Warn pilots, and be ready to power down IMMEDIATELY if a pilot is affected, and wait until he lands. Remember that it only takes a second or two, when flying race quads at speed, to crash and damage the quad, and whatever (whoever) it hits.

Firmware Upgrades

Both the OSD, and the Flight Controller, are updated using the USB port on the rear of the Vortex.

OSD Firmware Upgrades

1) Remove all Props!
2) Download the ImmersionRC tools from the ImmersionRC website. Find it on the Vortex product page.
3) Connect a Lipo.
4) Press the button on the Fusion board during 3 seconds (through a hole in the top Carbon Fiber plate)
5) Attach the Vortex to a Windows PC (or a system running parallels, or similar) to the Vortex using a standard Micro-USB cable.
6) Visit the Vortex product page in the ImmersionRC Tools, and select the **Program** page.
7) Wait until the device is detected by Windows, and press the **Update Firmware** button.
8) Point to the update file downloadable from the Vortex product page on the ImmersionRC website, and start the update.
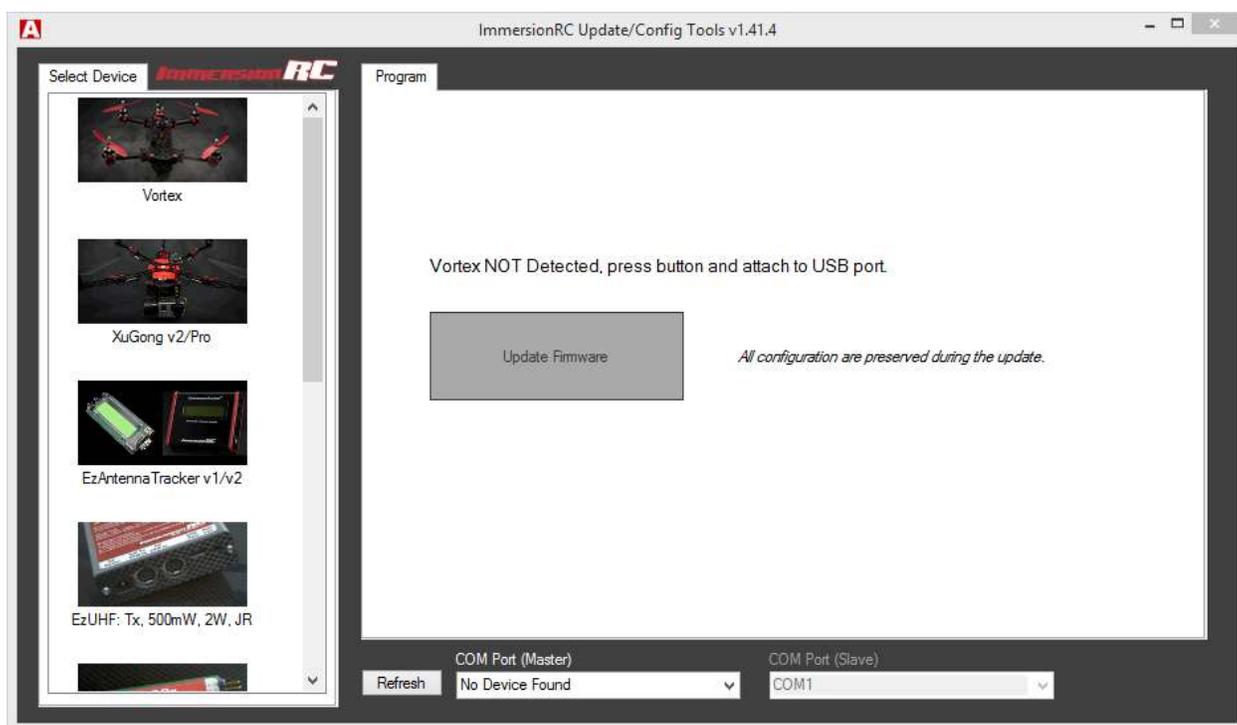
Flight Controller Firmware Upgrades

1) **Remove all Props!**
2) Connect the Vortex to any PC/Mac/Linux machine which supports the Cleanflight Configurator
3) Follow the standard upgrade instructions for Cleanflight.

NOTE: Upgrading Cleanflight to a version not supported by the OSD firmware can easily result in the OSD not functioning. Please refer to the Vortex product page on the ImmersionRC website for compatibility information.

Appendix A: EzUHF Configuration

The single-cable PPM connection between the EzUHF receiver and the Vortex power board requires v1.51 (or later) of firmware to support the uplink status.

The configuration of the EzUHF receiver should be as follows:

1)   10 Channel PPM output

2)   PPM on servo channel 1

3)   UPSTAT on PPM slot 10

Note: To ease programmation of UPSTAT on a receiver equipped with v1.51 of firmware, a new version of the ImmersionRC tools is required, v1.41. This is now available from our website.

Simply click the 'Configure for XuGong v2/Pro' to setup your EzUHF receiver.

Appendix B: The Wizard - What else does it setup?

On startup the wizard will reset Cleanflight configuration to its default state.

Once completed the following features, configurations and mode will be injected in Cleanflight so you can start to enjoy your Vortex straight off the box with zero additional configuration needed:

Flight Controller	
Failsafe	Enabled, Throttle set to 1100
OneShot125	Feature Enabled
Rx Mode	PPM Sum Mode (all channels down a single cable)
Minimum Throttle	1100us
Maximum Throttle	1900us
Minimum Command	1015us
Angle mode on Aux1	1300 - 1700us
Horiz mode on Aux1	900 - 1300us
Acro mode on Aux1	1700 - 2100us
Channel Mapping	According to Wizard prompts
Accelerometer	Calibrated at wizard end
Pro-Tuning	Default ImmersionRC settings (based on UmmaGawd's tune)

NOTE: If you have 'tweaked' any Cleanflight settings outside of the Vortex OSD, please remember to back them up before running the wizard the next time, since it will reset them to default settings.

Appendix C: Video Tx - Staying Legal

Depending upon the Vortex variant purchased, and the Tx module installed, the video transmitter power output level, and available transmit frequencies can vary.

It is highly recommended to understand the rules and regulations in your country before using the Vortex. Transmitting outside a legal band is something frowned upon by the authorities, and may result in a fine, or confiscation of equipment.

As a rule of thumb, the following charts should help understand which frequencies are legal in each of our main markets.

ITU Region 2: Americas, Greenland, eastern Pacific Islands

Assuming that the user has a Ham license, the 5650 - 5925 MHz band may be used.
Note that all 8 channels of ImmersionRC's RaceBand are legal in in this region, with a Ham license.

	1	2	3	4	5	6	7	8	
1	5740	5760	5780	5800	5820	5840	5860	5880	IRC/FS
2	5658	5695	5732	5769	5806	5843	5880	5917	RaceBand
3	5705	5685	5665	5645	5885	5905	5925	5945	Band E
4	5733	5752	5771	5790	5809	5828	5847	5866	Band B
5	5865	5845	5825	5805	5785	5765	5745	5725	Band A

With the FCC power limit for analog transmissions being so low for license-free use, it is not very interesting for race quad use. At present, ImmersionRC does not ship a ~1mW version of the Vortex transmitter module. This may change in the future.

ITU Region 1: Europe, Africa, Middle East, Iraq, Soviet Union

Without a license, only the 25mW Tx module may be used, and then only in the ISM band from 5725 MHz thru 5875 MHz.

	1	2	3	4	5	6	7	8	
1	5740	5760	5780	5800	5820	5840	5860	5880	IRC/FS
2	5658	5695	5732	5769	5806	5843	5880	5917	RaceBand
3	5705	5685	5665	5645	5885	5905	5925	5945	Band E
4	5733	5752	5771	5790	5809	5828	5847	5866	Band B
5	5865	5845	5825	5805	5785	5765	5745	5725	Band A

ITU Region 1: Europe, Africa, Middle East, Iraq, Soviet Union

With a Ham license, the legal band varies widely from country to country, but taking France as an example, Ham users may use the band 5650 through 5850 MHz with more than 25mW.

	1	2	3	4	5	6	7	8	
1	5740	5760	5780	5800	5820	5840	5860	5880	IRC/FS
2	5658	5695	5732	5769	5806	5843	5880	5917	RaceBand
3	5705	5685	5665	5645	5885	5905	5925	5945	Band E
4	5733	5752	5771	5790	5809	5828	5847	5866	Band B
5	5865	5845	5825	5805	5785	5765	5745	5725	Band A

Troubleshooting / Known Issues

Q. When I fly, all I see is the ground

    A. Tilt the flight camera up! (but beware that landing with a heavily tilted flight camera can be more of a challenge)

Q. My quad appears to have unpredictable yaw in tight turns

    A. This can be due to a number of reasons. First thing to check though is that the motors are all aligned correctly (look through the side of the quad and ensure that props are parallel with the top frame).
Another common reason is PID tuning related, try one of the Pro-Tunes.

Q. My Vortex flips instead of taking off

    A. Check that the correct props (CW vs. CCW) are installed in the correct locations.
Also check that the props rotate in the correct direction, and run RotorSENSE on each motor that needs reversing.

Q. My OSD text is not as crisp as it was on my original EzOSD

    A. Yes, we are aware of this, it is not very visible in goggles, but can be on a larger external monitor. A firmware fix is in the works, and will be released shortly.

Looking after your Vortex

Snow and Water

Even though most of the PCBs in the Vortex are coated with a conformal coating, which does offer some protection from water, it **is not recommended** to get the Vortex wet, even if that water comes in the form of snow.

If your Vortex does get wet, immediately remove power, and place it in a sealed container containing uncooked rice, for 24 hours. The rice will absorb some of the water.

If the Vortex falls into salt water, damage may be more serious, and requires rinsing the quad with a bath of distilled water before placing it in the sealed rice container. The Tx module may not survive this ordeal, and may require replacing.

Note that even if the Vortex survives a salt-water bath, long term corrosive effects of the salt on any exposed copper surfaces may result in the product failing at some point in the future.

The Sun

The camera use in the Vortex (or any camera for that matter) does not appreciate being left staring at the sun for long periods of time.

LiPos also have a habit of living short lives when exposed to extreme heat.

It is highly recommended to store the Vortex in the shade between flights.

Dirt

The typical mini-quad tends to live a life coated in a thick layer of grass, dirt, and other materials which happen to be in the way during landings, whether intentional, or otherwise.

It is highly recommended to keep the Vortex clean of foreign materials, especially those which tend to conduct electricity when wet.

Jealous Friends

The Vortex does appear to have a kind of magnetic personality which could result in your Vortex ending up in the bottom of your best mates rucksack.

This is probably the most serious of the issues listed above, take care!

Specifications

Flight Controller	
IMU	Invensense 6050, 3 axis Gyro, 3 axis Accelerometer
Altimeter	Bosch BMP180
CPU	STM32F103 32-bit ARM processor
Firmware	Cleanflight compatible *(with API version matching that of the OSD)*
OSD	
CPU	STM32F373 32-bit ARM processor
Resolution	440H x 280V
Style	White, with black surround around all pixels
Output	Programmable Black/White levels
Video Tx Features	
Transmitter Module	Socketed, Custom NexWaveRF 5.8GHz module
Channels	40 Initially, programmed via OSD
Bands	5, including the ImmersionRC/FatShark bands, and RaceBand
Frequency, IRC/FS	5740, 5760, 5780, 5800, 5820, 5840, 5860, 5880 MHz
Frequency, RaceBand, CH1..8	5658, 5695, 5732, 5769, 5806, 5843, 5880, 5917 MHz
Frequency, 'A' Band, CH1..8	5865, 5845, 5825, 5805, 5785, 5765, 5745, 5725 MHz
Frequency, 'B' Band, CH1..8	5733, 5752, 5771, 5790, 5809, 5828, 5847, 5866 MHz
Frequency, 'E' Band, CH1..8	5705, 5685, 5665, 5645, 5885, 5905, 5925, 5945 MHz
Power Output	350mW +/- 1dB (25mW module available after launch)
Audio	Stereo, Right channel used for Telemetry, Left channel unused
Recommended Antenna	Supplied SpiroNET Omni, Skew Planar, 4 leaf
External vTx Support	5-pin PicoBlade connector, usable only when the RF module is removed.
	Note: Using an external vTx does not allow OSD channel switching.
Power Train	
Standard Prop	Gemfan 5030
Upgrade Prop	HQ 5040
Maximum Prop Size	6"
Race Motors	OEM T-Motor 1806-2300kV
Recommended Battery	1300mAh 3S 45~90C, or 1300mAh 4S 45~90C

ESC	
Type	ImmersionRC EzESC
Rating	12A continuous, 16A peak
Features	OneShot125, and Motor Braking
Processor	32-bit ARM
R/C Receiver	
Channels Required	Absolute minimum four. Five recommended to support mode switch.
Interface Standard	3.3v-5v PPM Sum (all channels in one PPM stream)
Receiver Power	+5v @ 200mA max. (3.3v supplied using the optional Spektrum Rx cable)
Flight Characteristics	
Flight Time	Depends upon battery, and flight style
Maximum Range	Highly dependent on battery, and flying style
Maximum Speed	TBD
Blackbox Support	
Compatibility	Supported via the GPS port on the Vortex PDB, Instructions to follow
Camera Support	
Onboard GoPro Supply	+5v at 1A
Video Standard	Composite, PAL or NTSC, switchable using a camera-mounted jumper
Weight and Size	
Weight, as Shipped, ARF	~350g
Weight, Typical RTF	497g w/1300mAh 45C 4s pack
Size	283mm between diagonal motors
Folded Size	300 X 110mm

Spare parts and Upgrades

Several crash kits, and upgrades, are available for the Vortex, including the following:

Part Numbers	
VX4CK1	Crash Kit #1, Plastic Parts
VX4CK2	Crash Kit #2, Carbon Parts
VX4CK3	Crash Kit #3, Arm/ESC/Motor assembly
VXGF5030RL	Gemfan 5030 Props, 4x CW, 4 x CCW
VXHQ5040BNRL	HQ 5040A Props, 4x CW, 4 x CCW
VXTM180623	OEM T-Motor 1806 2300kV
EZESC12	EzESC 12A (16A peak), with soldered cables
VXFUSION	Vortex Fusion Flight Controller/OSD with cables
VX4PDB	Vortex Power Distribution Board
VXAVTX350	350mW 5.8GHz Tx module, Vortex-only
VXAVTX25	25mW 5.8GHz Tx module, Vortex-only (EU-Legal)
VX4UPGMTL	Vortex Metal Upgrade Kit (non-folding, aluminium arm mounts)
VXUPGMOB	Mobius Incliner Set
VXUPGGP	GoPro Recliner Set (including power cable for battery-free use)

Please contact your reseller for any spare parts required.

Support

First line of support is handled by the reseller. If you encounter any problems with your ImmersionRC product please contact them first.

For support on issues involving equipment from other brands and also general support for ImmersionRC products, the best place to go is the ImmersionRC section of FPVlab.com.

We actively monitor this forum and provide support here.

Regulatory notice

The use of this product may be prohibited in your country/region/state, please verify that the RF output power and frequencies used by this transmitter comply with local rules and regulations, this product may require a license to operate.

Directions on safety

ImmersionRC advocates the safe use of their products, always make sure you equipment is in proper working order, is checked prior to every flight and that your are familiar with and respect the equipment's capabilities and limitations. Do NOT fly recklessly, do NOT fly near airports, freeways, towns, people, etc, basically anywhere where a equipment failure or pilot error can result in injury or damage to people and/or property.

Warranty

For warranty claims or repair requests please consult the retailer that you purchased this product from, they will be able to help you with your warranty claim or repair request.

Social Networks

Like Us 👍

We would like thank you for purchasing this ImmersionRC product.

Like ImmersionRC's Facebook page and be kept up-to-date with news, product releases, firmware updates, tips and tricks, and other information relevant to the FPV hobbyist.

http://www.facebook.com/ImmersionRC

You can also follow us on Google Plus

google.com/+immersionrc

We have even been known to Tweet on occasion

https://twitter.com/@immersionrc