

WARNINGS Read this user manual before use.

- Thank you for purchasing this RUSH product! We strongly recommend reading through this user manual before use. Because we have no control over the use, installation, or maintenance of this product, no liability may be assumed for any damage or losses resulting from the use of the product.
- When you need to perform welding operations, please ensure that you have the relevant skills to ensure reliable welding. If there is a short circuit or damage to the original electronic components during the installation and welding process, we will not bear the warranty and compensation responsibility.
- The open source flight Controller can only be flashed with the RUSH BLADE corresponding firmware when flashing or upgrading firmware, otherwise it may cause the FC to stop working or even damage the chip inside.
- This user manual is based on the operation manual for Betaflight and only for reference. For more detailed information, please refer to the original Betaflight website. Due to firmware update or other reasons, the descriptions for functions may differ, so please always take the official Betaflight manual as standard.

Features

- High-performance STM32 F722 MCU with speeds up to 216MHz.
- ICM42688P gyroscope, independent low-noise power supply.
- Built-in analog video OSD, 16M black box, 5 UART ports, 8 PWM output ports, 2 ADC ports, 1 I2C port, 1 camera control port.
- High power synchronous rectifier BEC, supports up to 36V input and provides stable 5V 3A output.
- Modular cable design, with reliable locking structure, can be installed quickly, while retaining full-featured pads on the back, providing more expansion support.
- Single-side layout, lower mounting height, 6-layer PCB, isolated ESC interference.
- PC case is impact resistant and easy to disassemble, isolated from dust and grass clippings.

Specification

MCU	STM32F722RET6
GYRO	ICM42688P
BEC	INPUT 7-36V / 3-6S LIPO
	OUTPUT 5V 3A
OSD	AT7456E CVBS OSD
BLACKBOX	16MB FLASH
TARGET	RUSH_BLADE_F7

PORT	8×PWM 5×UART 1×I2C
ADC	V-BATT / CURR-ESC
BARO	BMP280
LED	WS2812 LED STRIP
MOUNTING HOLES	30.5*30.5mm
SIZE	36.5mm*37mm*5.2mm
WEIGHT	11g(without cable)

Configure flight control

- Please select the betafight configurator that suits your operating system, download and install it.
<https://github.com/betaflight/betaflight-configurator>
- If your PC is connected to the FC for the first time, please install the STM32 VCP driver first.
- After connecting the flight controller via USB, the port configuration and parameter adjustment of the flight controller can be performed. Please refer to <https://github.com/betaflight/betaflight/wiki>
- RUSH BLADE FC supports PPM, S-BUS, CRSF, F-PORT and other mainstream receiver protocols. Please connect the module cable according to the receiver manual.

Firmware upgrade

- For a better flight experience, please check whether the flight controller is the latest version before use.

- The flight controller needs to work in DFU mode for firmware upgrade. Use the Zadig tool to switch the working mode. (Download at <http://zadig.akeo.ie>)

- Please short the BOOT pad of FC for first time use and connect FC to PC.

Open zadig, click <options>, select <list all devives>.

Select <STM32 BOOTLOADER> from the device list, select <winUSB> in the <DRIVER> option, and click <REINSTALL DRIVER>.



- Open the betafight configurator, the connection option has changed to DFU mode at this time, and the firmware upgrade operation can be carried out after connection.

- To upgrade the firmware again, connect the betafight configurator and in the <setup> menu, select the <activate boot loader / DUF >option and the FC reboots into DFU mode.

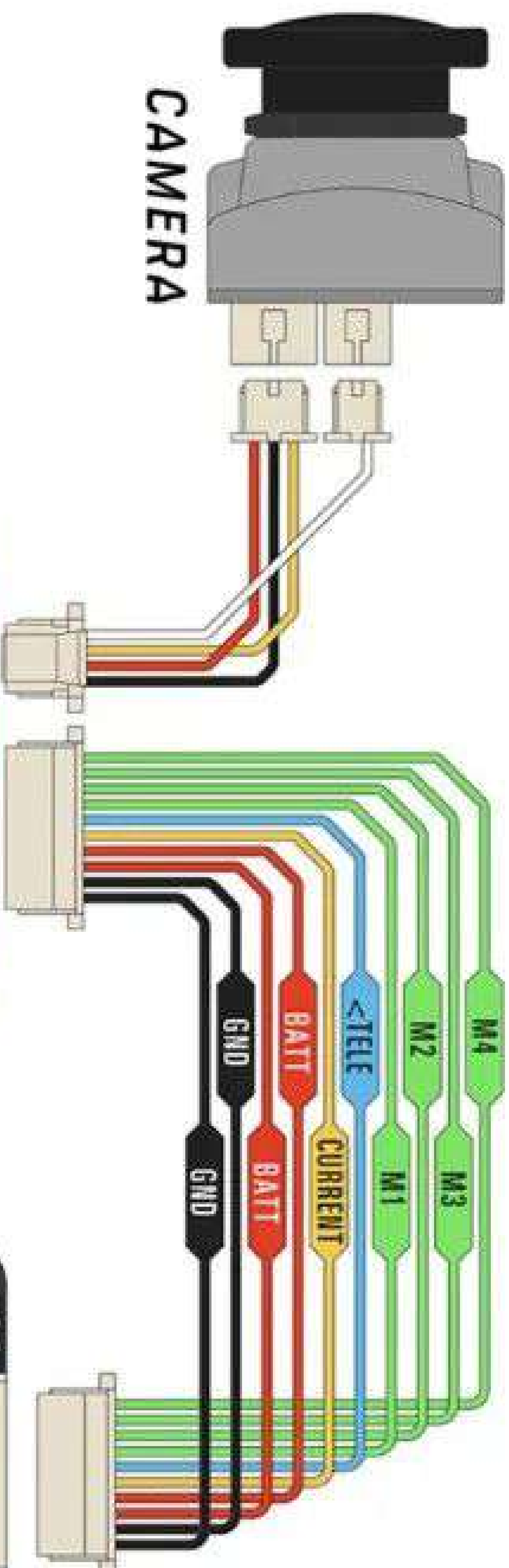
- The Betaflight firmware target is RUSH_BLADE_F7 , and the unified target is STM32F7X2. Please visit <http://github.com/betaflight/betaflight/releases> for the latest firmware.



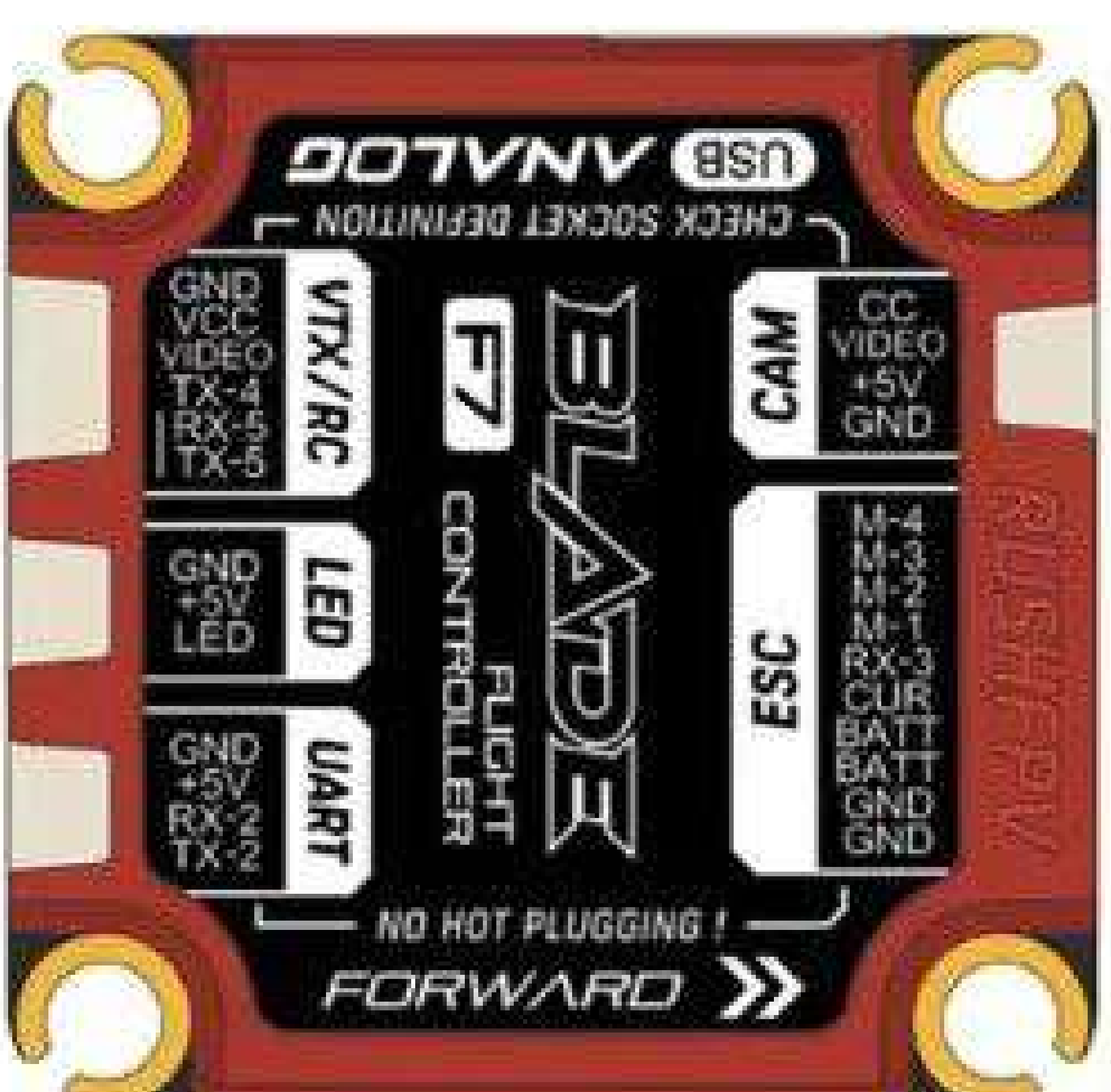
VTX



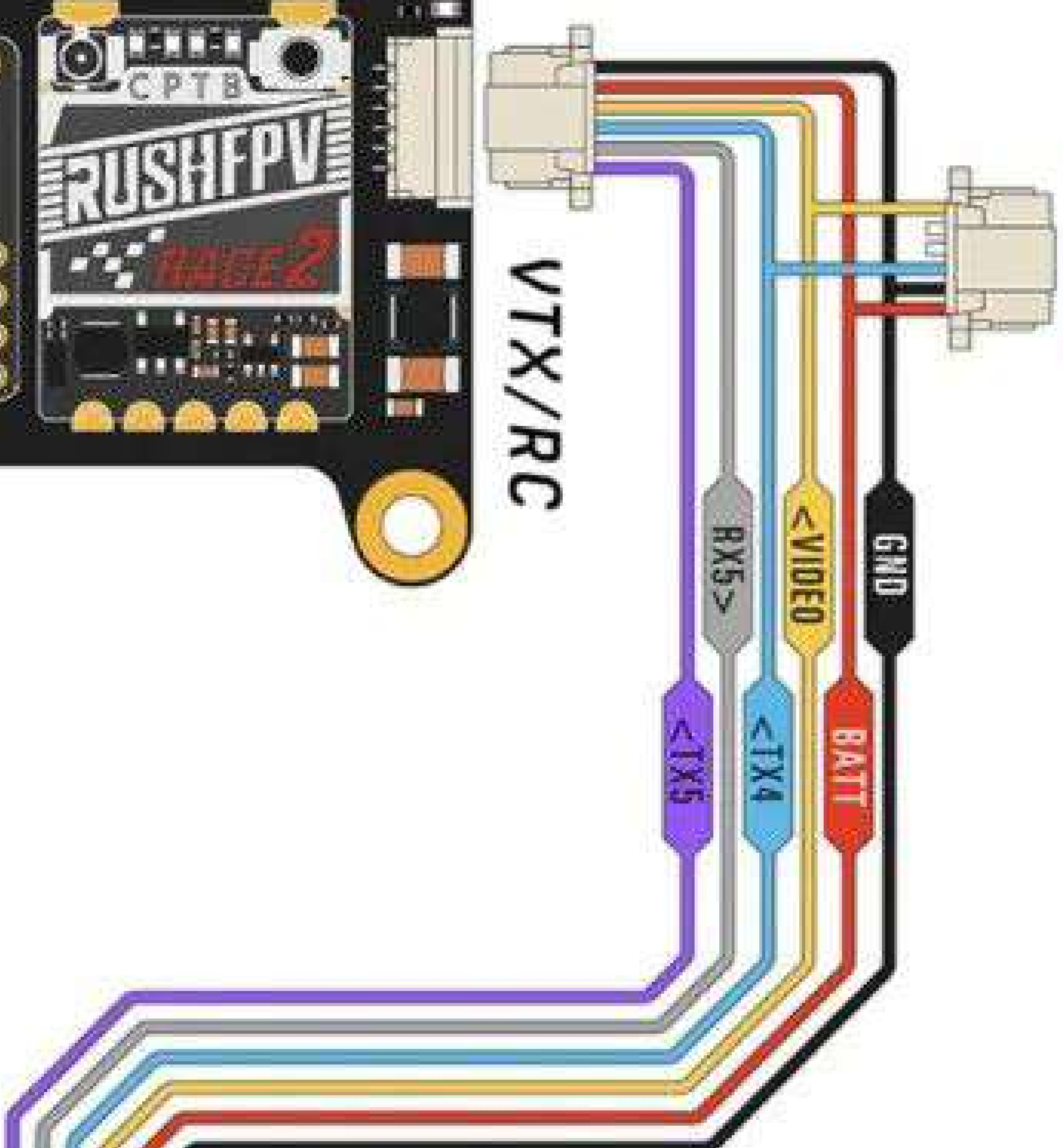
CAMERA



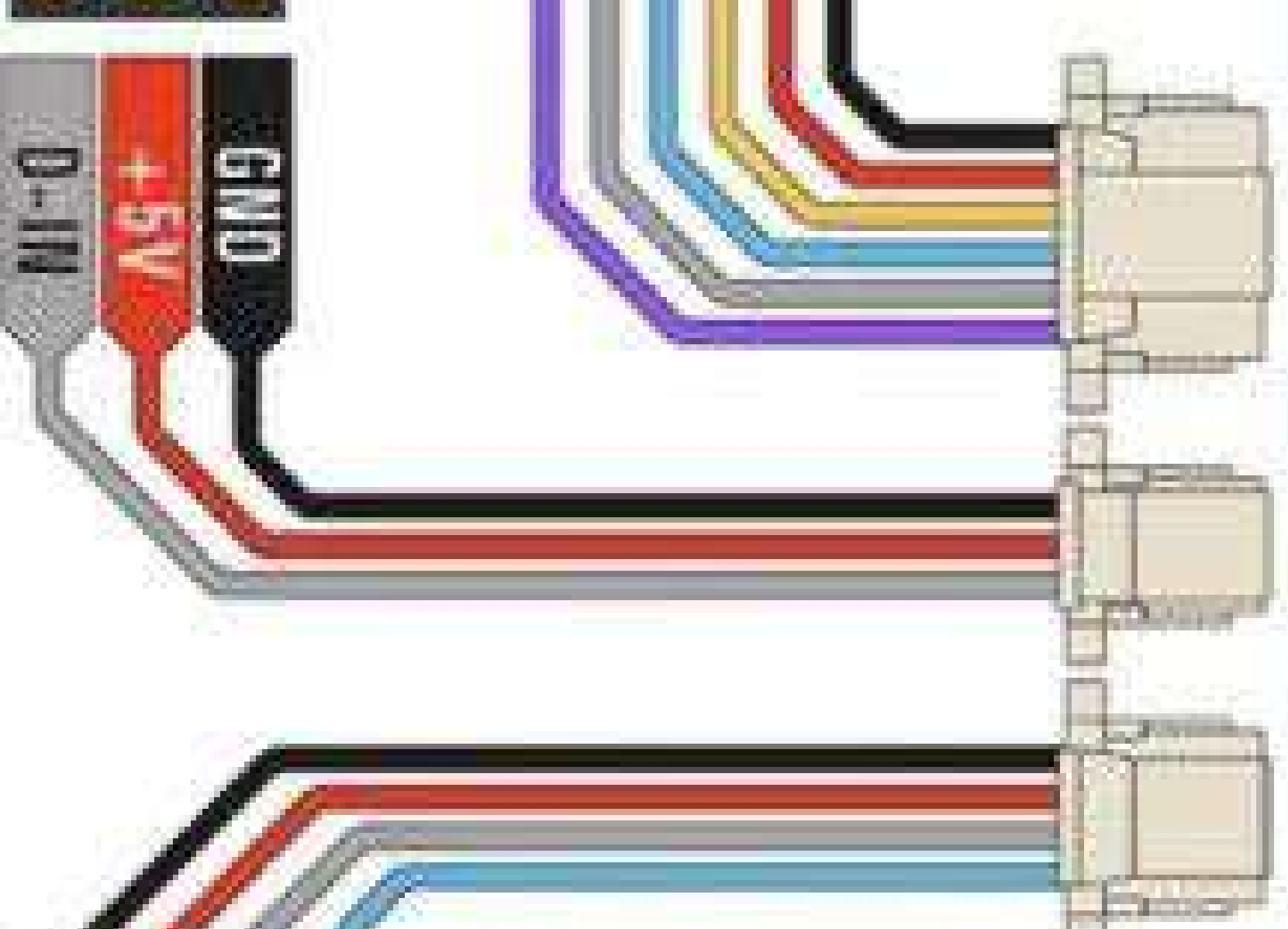
ESC



VTX/RC



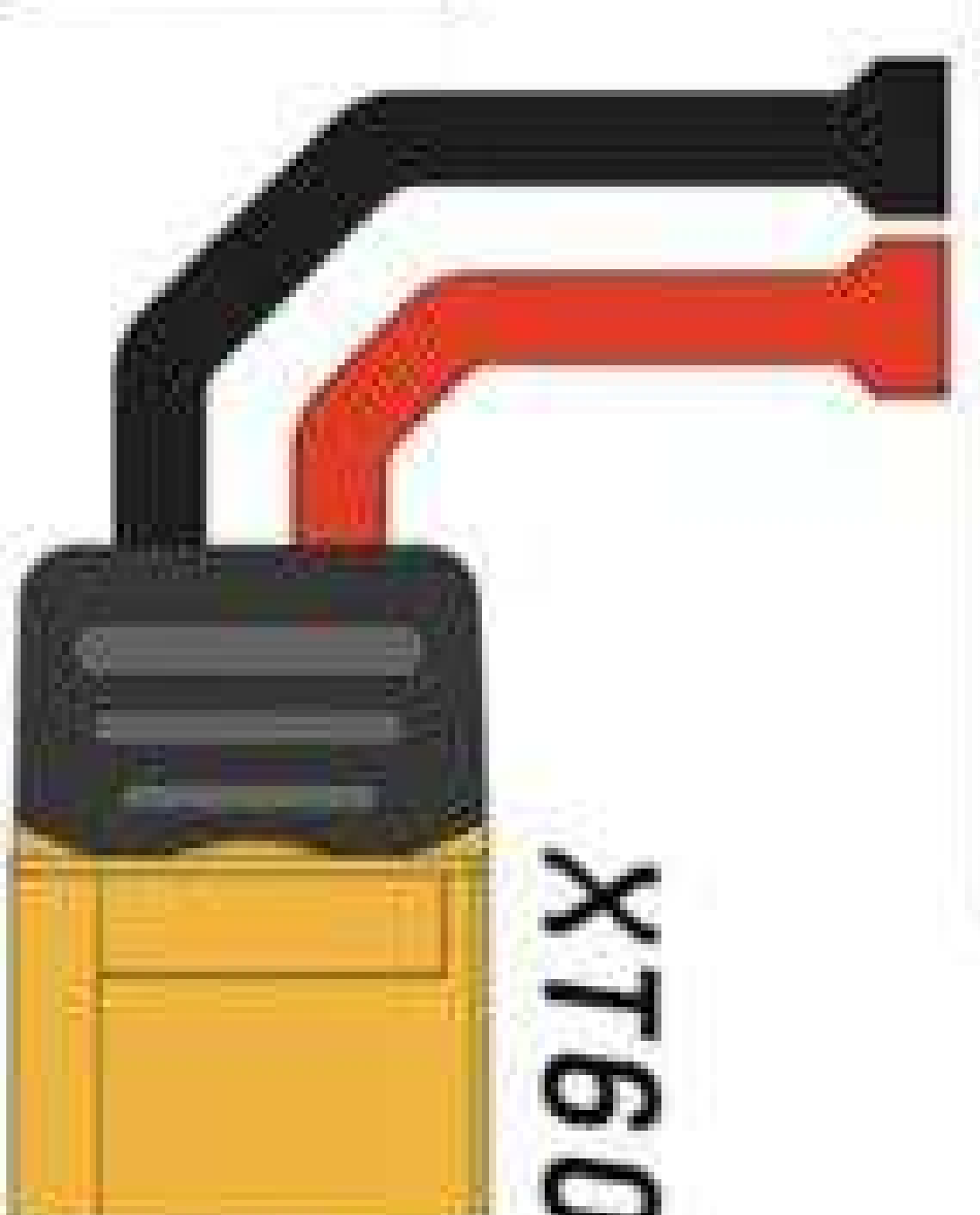
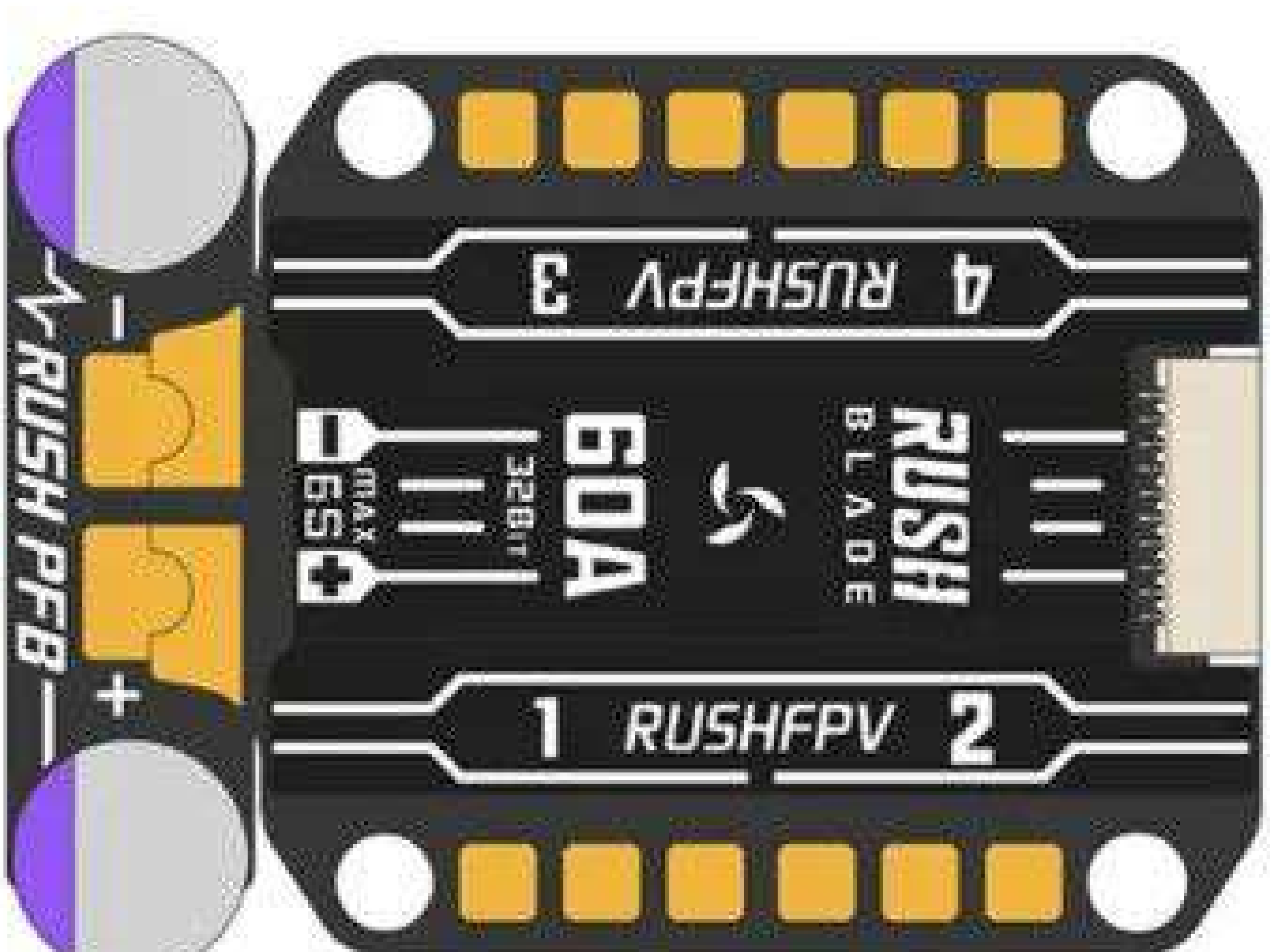
WS2812 LED-STRIP



RECEIVER



XT60

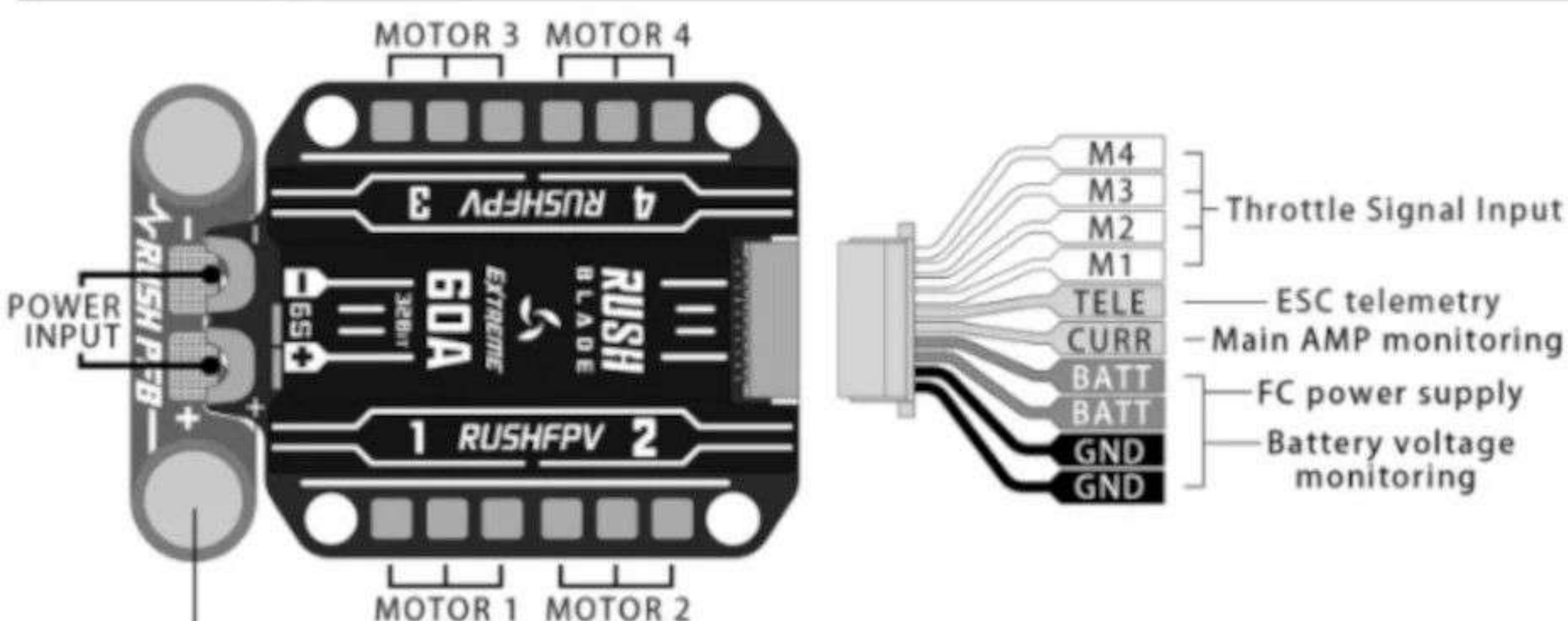


Specification

MODEL	<i>SPORT 50A</i>	<i>SUPER 60A</i>	<i>EXTREME 60A</i>
TYP. APMS	50A	60A	60A
PEAK.AMPS	60A	80A	80A
BATTERY	3-6S	3-6S	3-6S
PROCESSOR	F0 @48MHz	F3 @168MHz	F4 @200MHz
PWM FREQ	24-48K	24-96K	24-128K
LED COLOR	BLUE	PINK	ORANGE
WEIGHT	16g	16.5g	16.5g
SIZE	45×36.5×7.5mm	45×36.5×7.5mm	45×36.5×7.5mm
BL32 FW	RUSH_BLADE_SPORT	RUSH_BLADE_SUPER	RUSH_BLADE_EXTREME

WIRING DIAGRAM

All RUSH BLADE 30*30mm ESCs use the same wiring diagram. Use the attached 10pin connector to connect the RUSH BLADE flight controller.



Please connect the XT60 cable to the bat+- pad and select wires thicker than 14AWG to avoid current limit. It is recommended to install a RUSH PFB here or connect a Low ESR capacitor above 35V 470uf in parallel to filter voltage disturbances.

Start-up/Throttle Calibration

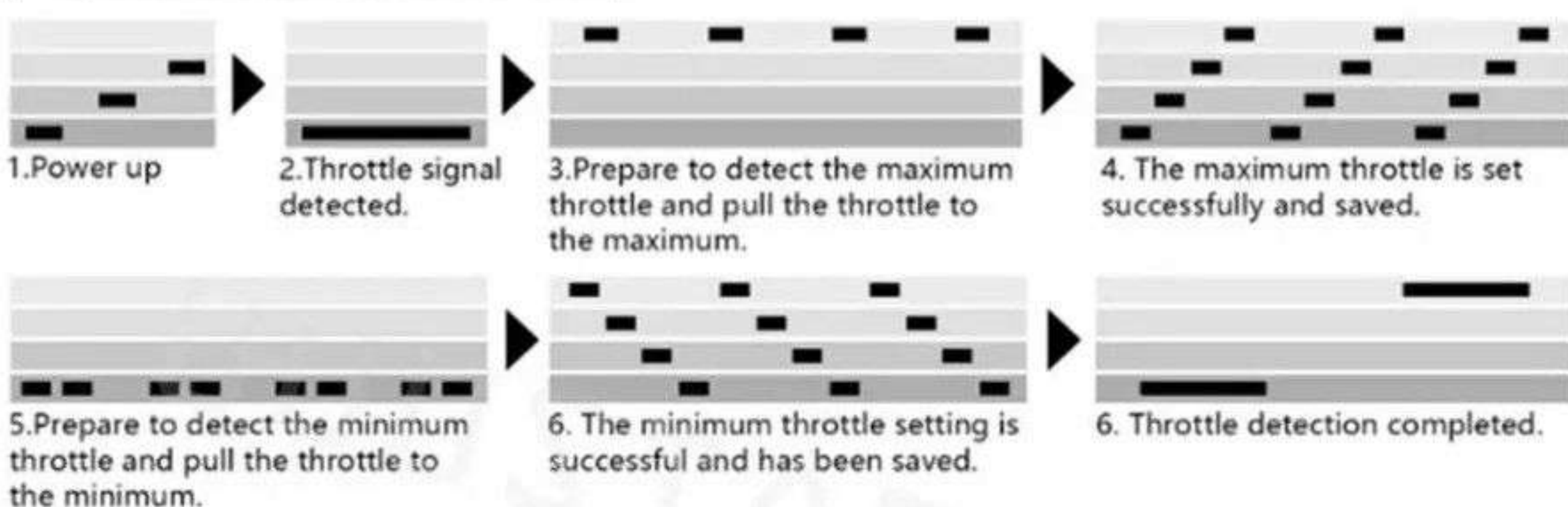


- Improper operation can cause serious injury. For your safety, we recommend you to always remove the propellers when working on the drone.
- No need to calibrate the throttle when using DSHOT signal.

NORMAL START-UP PROCESS



ESC THROTTLE CALIBRATION



Programming parameter

- 1. Rampup Power:** Rampup power can be set to relative values from 3% to 150%. This is the maximum power that is allowed when ramping up at low RPMs and during start-up. For low RPMs, the maximum power to the motor is limited, in order to facilitate detection of low BEMF voltages. Rampup power also affects bidirectional operation, as the parameter is used to limit the power applied during direction reversal. During startup, the actual applied power depends on throttle input, and can be lower than the maximum level set by the rampup power parameter, but the minimum level is a quarter of the maximum level.
- 2. Temperature Protection:** Temperature protection can be enabled or disabled, and the temperature threshold can be programmed. The programmable threshold is primarily meant as a support for hardware manufacturers to use, as different hardware can have different tolerances on the max temperatures of the various components used.
- 3. Low RPM Power Protection:** Power spacing for low RPMs can be enabled or disabled. Disabling it can be necessary in order to achieve full power on some low KV motors running on a low supply voltage. However, disabling it increases the risk of sync loss, with the possibility of damaging the motor or ESC.
- 4. Low Voltage Protection:** Low voltage protection can be set between 2.5V and 4.0V per LiPo cell. It can also be disabled. When enabled, it will limit power applied to the motor if the battery voltage drops below the programmed threshold. This feature is primarily intended for fixed wing crafts.
- 5. Motor Direction:** Motor direction can be set to fwd / rev / bidirectional / bidirectional rev. In bidirectional mode, center throttle is zero and above is fwd rotation and below is reverse rotation. When bidirectional operation is selected, throttle calibration is disabled.
- 6. Demag Compensation:** Demag compensation is a feature to protect from motor stalls caused by long winding demagnetization time after commutation. The typical symptom is motor stop or stutter upon quick throttle increase, particularly when running at a low RPM. As mentioned above, setting high commutation timing normally helps, but at the cost of efficiency. Demag compensation is an alternative way of combating the issue. First of all, it detects when a demag situation occurs. -In this situation, there is no info on motor timing, and commutation proceeds blindly with a predicted timing. -In addition to this, motor power is cut off some time before the next commutation. A metric is calculated that indicates how severe the demag situation is. The more severe the situation, the more power is cut off. When demag compensation is set to off, power is never cut. When setting it to low or high, power is cut. For a high setting, power is cut more aggressively. Generally, a higher value of the compensation parameter gives better protection. If demag compensation is set too high, maximum power can be somewhat reduced for some motors.
- 7. Motor Timing:** Motor timing can be set between approximately 10 and approximately 310 in approximately 10 increments (actual accurate values here are 15/16ths of a degree). Typically a medium setting will work fine, but if the motor stutters it can be beneficial to increase timing. Some motors with high inductance can have a very long commutation demagnetization time. This can result in motor stop or stutter upon quick throttle increase, particularly when running at a low RPM. Setting timing higher will allow more time for demagnetization, and often helps. This parameter can also be set to auto. In this case the code monitors demagnetization time, and keeps timing as low as possible without having issues with demag. On well behaved motors, timing can be low in the entire power range, and thereby max power can be reduced. On not so well behaved motors, timing is increased as needed, and thereby improves margins against sync loss.
- 8. Maximum Acceleration:** Maximum acceleration can be set between 0.1%/ms and 25.5%/ms. It can also be set to maximum, in which case acceleration is not limited. Limiting acceleration is primarily intended as a backup parameter that can be used in cases where too hard acceleration gives desyncs. When setting to eg 10%/ms, it means that the power applied to the motor is not allowed to increase by more than 10% per millisecond.
- 9. Throttle Cal Enable:** If disabled, throttle calibration is disabled.
- 10. Minimum Throttle, Maximum Throttle and Center Throttle:** These settings set the throttle range of the ESC. Center throttle is only used for bidirectional operation. The values given for these settings are for a normal 1000us to 2000us input signal, and for the other input signals, the values must be scaled. For Dshot input signal, these settings have no effect.
- 11. Brake On Stop:** Brake on stop can be set between 1% and 100%, or disabled. When enabled instead, the given brake force will be applied when throttle is zero. For nonzero throttle, this setting has no effect. This feature is primarily intended for fixed wing crafts with folding props. On some ESCs this setting is not linearly programmable. It will just be enabled (at 100% force for any setting 1%-100%) or disabled (this applies to ESCs that have "EN/PWM" style fet drivers).
- 12. Beep Strength:** Sets the strength of beeps under normal operation.
- 13. Beacon Strength:** Sets the strength of beeps when beeping beacon beeps. The ESC will start beeping beacon beeps if the throttle signal has been zero for a given time. Note that setting a high beacon strength can cause hot motors or ESCs!
- 14. Beacon Delay:** Beacon delay sets the delay before beacon beeping starts.
- 15. PWM frequency:** Motor PWM frequency can be programmed between 16kHz and 96kHz. Higher PWM frequency can run motors smoother. Programmable frequency also allows for moving of small but potentially disturbing bumps in the throttle response. All ESCs have these bumps, with BLHeli_32 they can be moved in the RPM range, to a place where the system has low sensitivity to them.