



Thank you for purchasing our product . Any Improper operation may cause personal injury damage to the product and related equipments. This high power system for RC model can be dangerous, we strongly recommend reading the user manual carefully and completely. We will not assume any responsibility for any losses caused by unauthorized modifications to our product. We have the right to change the design, appearance, performance and usage requirements of the product without notice.

01 Main features

- Using C8051F390 MCU ,pipelined 8-bit C8051 core with 50 MHz maximum operating frequency.
- Using dedicated 3in1 drivers, faster response, small size&lighter in weight. ESC maximum speed is limited to 400k eRPM.
- Two layers tower structure between the 4in1 ESC and FC with quick pin connection. The interference caused by the signal transmission is reduced to the maximum extent, and the flight is more stable, make the whole weight lighter, and the installation is faster and more convenient;
- Standard F3 flight controller, Supports PPM, PWM and SBUS remote control / receiving mode
- FC integrated OSD, also integrated 5V, 12V, and battery voltage (VBAT), Easy power supply to Image transmitter, camera, buzzer, LED and other peripheral ; provided all kind of cables for connectors on FC , to give you an unprecedented experience of installation;
- Connect computer via USB on the flight controller, then can upgrade ESC software directly or adjusted the ESC settings directly ;
- Use BLHeli open-source firmware, can update the firmware or write setup via signal cable; Using "Damped light" mode , it improves the throttle response, when reducing the throttle amount, the Motors slow down rapidly. It strengthens the stability and flexibility of multi-rotors, quite suitable for QAVs.
- There are tuneable parameters that can make the code run well even in the most demanding situations, although default settings will work excellently in normal operating environments.
- Supports regular 1-2ms pulse width input, as well as Oneshot125 (125-250us), Oneshot42 (41.7-83.3us) and Multishot (5-25us). The input signal is automatically detected by the ESC upon power up.



*All pictures are for reference only

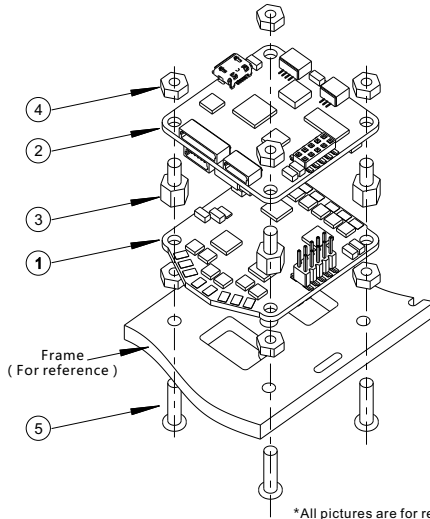
02 Specification

Model	Manufacture Model	Con. Current	Burst Current (10S)	BEC	LiPo cells	Weight	Size (For reference)	Typical Application (For reference)
Raptor390 Tower-20A	W4-FW020004-BX	20A	30A	No	2-4S	19.5g	41.5x36x15.1mm	130-330 Multi
Raptor390 Tower-30A	W4-FW030004-BX	30A	40A	No	2-4S	19.5g	41.5x36x15.1mm	170-450Multi

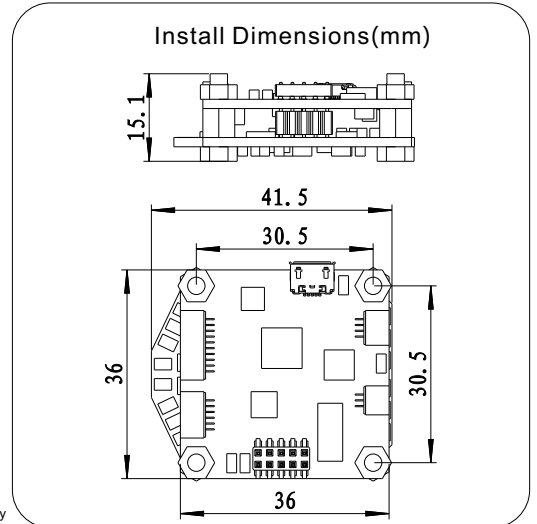
03 Part list / Install Dimensions

Item	Description	Qty.
1	Raptor390 4in1 ESC	1
2	Flight controller	1
3	Nylon spacer M3*5+6	4
4	Nylon Nut M3	8
5	Nylon screw M3*12	4

The flight controller additional provide :
 One 10p cable (10-pin SH1.0 terminal) for PWM connector;
 One 3p cable (10-pin SH1.0 terminal)for PPM connector;
 One 3p cable (4-pin SH1.0 terminal)for SBUS connector;
 One 4p cable (4-pin SH1.0 terminal)for Image transmitter;
 One 3p cable (3-pin SH1.0 terminal)for Camera;
 One 6p cable (6-pin SH1.0 terminal)for LED and Buzzer.

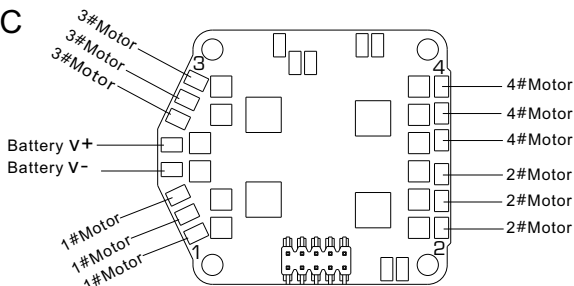


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04 Wiring diagram of ESC and FC receiving mode

ESC



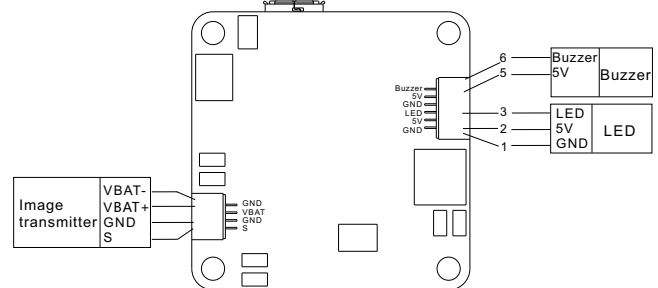
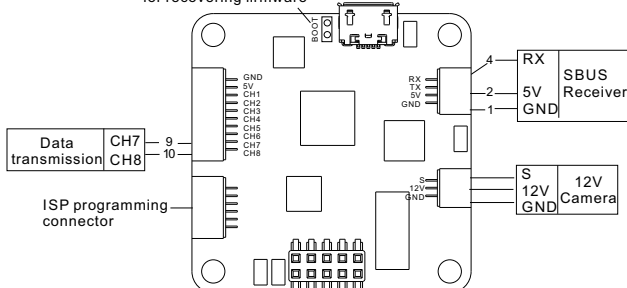
- All welding requires good welding technology, short circuit between the element or the wire should be avoided at any time.
- Please ensure all solder joints are insulated with heat shrink where necessary.
- Please double-check the polarity is correct before power up.

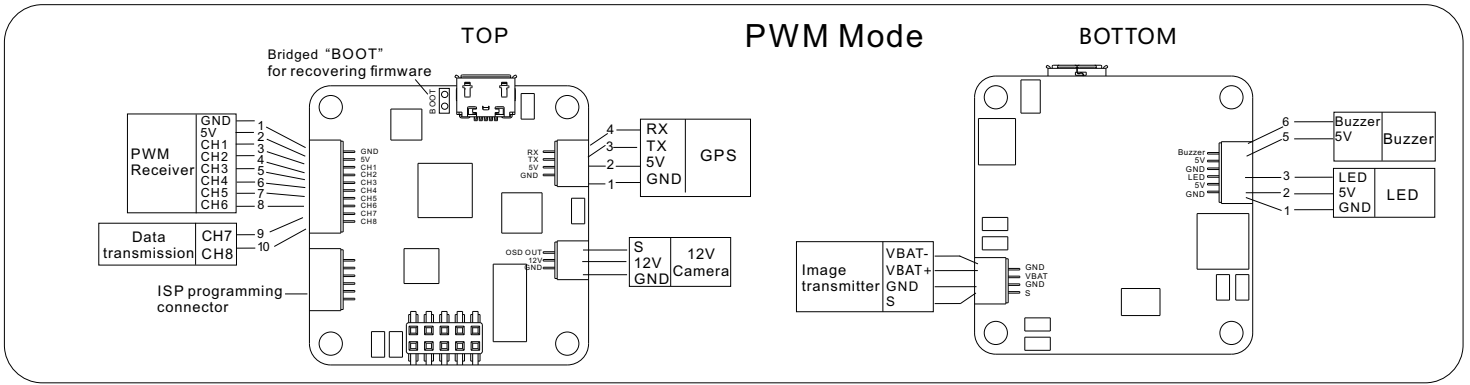
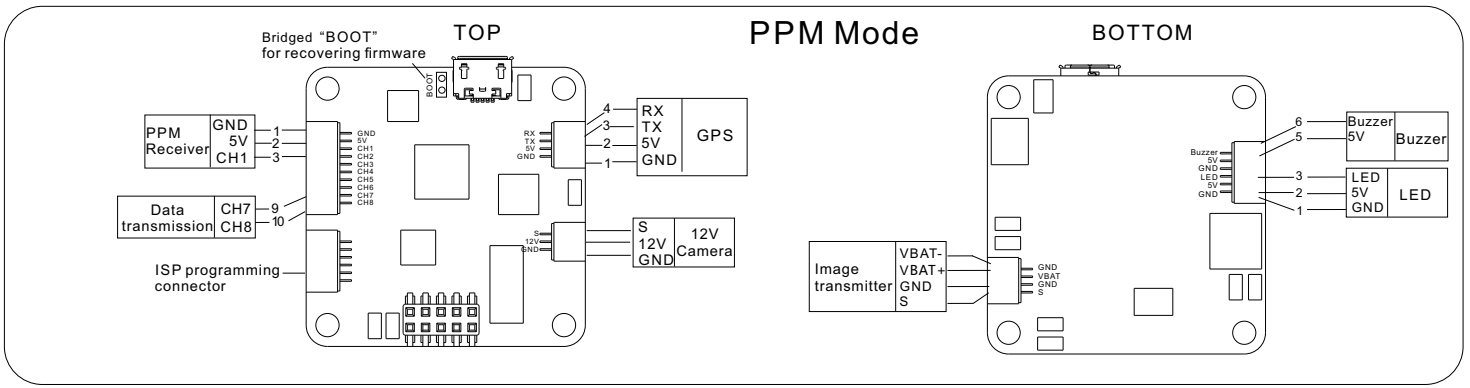
Bridged "BOOT" for recovering firmware

TOP

SBUS Mode

BOTTOM





05 ESC Programming parameter

Programming parameters below in table that can be accessed from the configuration software (BLHeliSuite) via connect the flight controller :

Function	1	2	3	4	5	6	7	8	9	10	11	12	13
1 - Closed loop P gain	0.13	0.17	0.25	0.38	0.50	0.75	1.00	1.5	2.0	3.0	4.0	6.0	8.0
2 - Closed loop I gain	0.13	0.17	0.25	0.38	0.50	0.75	1.00	1.5	2.0	3.0	4.0	6.0	8.0
3 - Closed loop mode	HiRange	MidRange	LowRange	Off	/	/	/	/	/	/	/	/	/
4 - Multi gain	0.75	0.88	1.00	1.12	1.25	/	/	/	/	/	/	/	/
5 - Startup power**	0.031	0.047	0.063	0.094	0.125	0.188	0.25	0.38	0.50	0.75	1.00	1.25	1.50
6 - Commutation timing	Low	MediumLow	Medium	MediumHigh	High	/	/	/	/	/	/	/	/
7 - Pwm frequency	High	Low	DampedLight	/	/	/	/	/	/	/	/	/	/
8 - Pwm dither***	Off	3	7	15	31	/	/	/	/	/	/	/	/
9 - Demag compensation	Off	Low	High	/	/	/	/	/	/	/	/	/	/
10 - Rotation direction	Normal	Reversed	Bidirectional	/	/	/	/	/	/	/	/	/	/
11 - Input pwm polarity	Positive	Negative	/	/	/	/	/	/	/	/	/	/	/

Default values are marked in dark gray.

*:Only enabled for some ESCs. From code rev 14.4, damped light is default on the ESCs that support it. For prior code revisions, high is default.

** :Default startup power varies by ESC. Generally the default power is lower for larger ESCs.

***:For code revs 14.4 and before, dither range was 7/15/31/63.

- Closed loop P gain sets the proportional gain for the rpm control loop. This setting controls the gain from speed error to motor power.
- Closed loop I gain sets the integral gain for the rpm control loop. This setting controls the gain from integrated speed error (summed over time) to motor power.
- Closed loop mode sets the range of speeds that the control loop can operate on.
 - For the high range, throttle values from 0% to 100% linearly correspond to rpm targets from 0 to 200000 electrical rpm
 - For the middle range, throttle values from 0% to 100% linearly correspond to rpm targets from 0 to 100000 electrical rpm
 - For the low range, throttle values from 0% to 100% linearly correspond to rpm targets from 0 to 50000 electrical rpm
 - When closed loop mode is set to off, the control loop is disabled.
- Multi gain scales the power applied to the motor for a given input. Note that this is only for PWM input, for PPM input it has no effect. Beware that a low multi gain will also limit the maximum power to the motor.
- Startup is always done with the direct startup method, which runs the motor using back emf detection from the very start. In this mode power is given by the throttle used, but limited to a maximum level. This maximum level can be controlled with the startup power parameter. Beware that setting startup power too high can cause excessive loading on ESC or motor!
- Commutation timing can be adjusted in three steps. Low is about 0°, mediumlow 8°, medium 15°, mediumhigh 23° and high 30°. Typically a medium setting will work fine, but if the motor stutters it can be beneficial to change timing.
- Pwm frequency:
 - High: High pwm frequency is around 20kHz.
 - Low: Low pwm frequency is around 8kHz.
 - Damped light : This mode adds loss to the motor for faster retardation. Damped light mode always uses high pwm frequency. This mode is only supported on some ESCs (where fet switching is sufficiently fast).
- Pwm dither is a parameter that adds some variation to the motor pwm off cycle length. This can reduce problems (like throttle steps or vibration) in rpm regions where the pwm frequency is equal to harmonics of the motor commutation frequency, and it can reduce the step to full throttle. It is primarily beneficial when running damped light mode. Dither is not applied in closed loop mode.
- 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 described earlier, setting high commutation timing normally helps, but at the cost of efficiency. Generally, a higher value of the compensation parameter gives better protection. If demag compensation is set too high, maximum power can be somewhat reduced.
- The rotation direction setting can be used to reverse motor rotation.
- The input pwm polarity setting can be used to inverse the throttle behaviour. This is intended to be used with receivers that provide negative pwm. When using PPM input it must be set to positive.

Programming parameters that can only be accessed from configuration software (BLHeliSuite):

- Throttle minimum and maximum values for PPM input (will also be changed by doing a throttle calibration).
- Throttle center value for bidirectional operation with PPM.
- Beep strength, beacon strength and beacon delay.
- Programming by TX. If disabled, the TX can not be used to change parameter values (default is enabled).
- Thermal protection can be enabled or disabled (default is enabled).
- Temperature is above 140°C, motor power is limited to 75%; Above 145°C, motor power is limited to 50%; Above 150°C, motor power is limited to 25%. Above 155°C, motor power is limited to 0%.
- PWM input can be enabled or disabled (default is disabled). If disabled, only 1-2ms PPM and 125-250us OneShot125 are accepted as valid input signals.
- Power limiting for low RPMs can be enabled or disabled (default is enabled). 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 toasting motor or ESC.
- Brake on stop can be enabled or disabled (from rev14.5, default is disabled). When enabled, brake will be applied when throttle is zero. For nonzero throttle, this setting has no effect.

06 Attention

- User need to calibrate the throttle range when starting to use a new ESC or another transmitter.
- BLHeli open-source firmware, when some abnormality occurs in ESC driving the motor or need the motor to reach a higher RPM, user can try to change the timing.
- User also can connect the flight control to the computer to update the firmware or change the setup via configuration software (BLHeliSuite).
- Please contact Flycolor sales or technical support for more information.