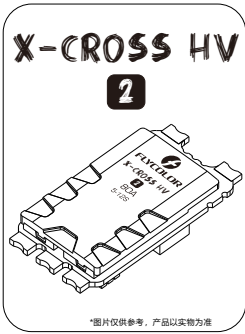# FLYCOLOR®

多旋翼飞行器
无刷电子调速器说明书

ATTENTION
感谢您购买本产品！本产品功率强大，错误的使用可能导致人身伤害和设备损坏，强烈建议您在使用设备前仔细阅读本说明书并保存，严格遵守规定的操作程序。我们不承担因使用本产品或擅自对产品进行改造所引起的任何责任，包括但不限于对附带损失或间接损失的赔偿责任。我们有权在不经通知的情况下变更产品的设计、外观、性能及使用要求。

X-CROSS HV 2

*图片仅供参考，产品以实物为准

01 主要特性

● ARM 32-bit Cortex 核心MCU，工作频率高达48MHz；
● 高性能、低ESR、国际知名大品牌Mosfet，不惧大电流；
● BLHeli-32 固件，超快响应速度，卓越的性能；
● 宽电压支持，最高支持12S的锂电池，适用于X-Class级别无人机；
● 电调上自动检测油门信号，支持普通PWM油门模式（1-2ms）的脉宽输入、Oneshot125（125-250us）、Oneshot42（41.7-83.3us）和Multshot（5-25us）；支持所有Dshot数字信号；
● 尺寸小，重量轻，适合较窄机臂的无人机使用；
● Damped light再生制动，使得效率更高，油门从大到小变化时电机减速响应更加迅速，稳定性和灵活性显著加强；
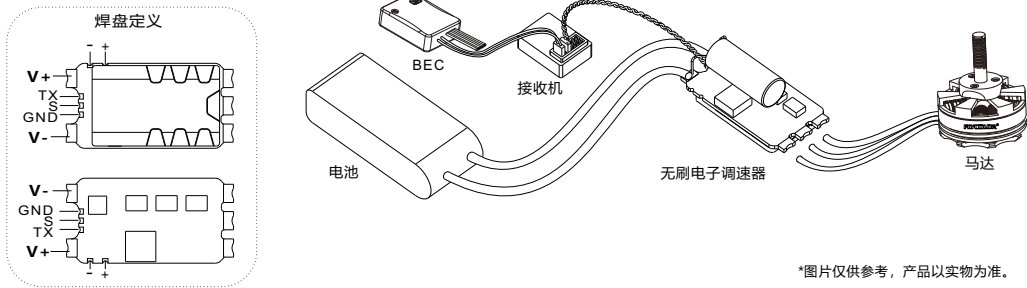● 信号线为双绞硅胶线，有效降低信号在铜线内传输所产生的干扰,使飞行更稳定；
● 铝合金散热器，帮助减缓温升。

02 产品规格

型号	持续电流(散热良好)	瞬间电流(散热良好)	BEC	锂电节数	重量(供参考)	尺寸(供参考)	LED设置	典型应用(供参考)
X-Cross HV 2-60A	60A	80A	No	5-12S	25.5g	55x28x10mm	No	650-1000 X-Class
X-Cross HV 2-80A	80A	100A	No	5-12S	25.5g	55x28x10mm	No	650-1200 X-Class

*ESC BLHeli-32固件:**Flycolor_X_Cross_HV**;

03 连线示意图

*为避免短路和漏电，请确保连接处绝缘良好。

焊盘定义
V+
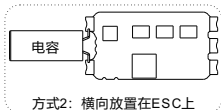TX
S
GND
V-

V-
GND
TX
V+

BEC
接收机
电池
无刷电子调速器
马达

*图片仅供参考，产品以实物为准。

ATTENTION
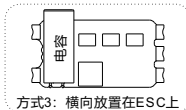●所有焊接要求良好的焊接技术，任何时候都需要避免因焊接而造成元件或线材之间短路；
●电解电容引脚焊接越短越好，避免大电流烧断引脚；
●如电流较大时，建议将配件中的两个电容焊接在ESC电源上；
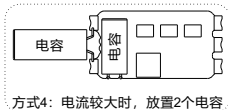●无论任何时候都要注意极性，供电之前一定要反复检查；
●根据个人安装方式，电解电容可以焊接位置不同，见下图。

负极标识
正极
负极
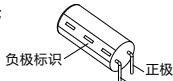
方式1：横向放置在ESC上
方式2：横向放置在ESC上
方式3：横向放置在ESC上
方式4：电流较大时，放置2个电容
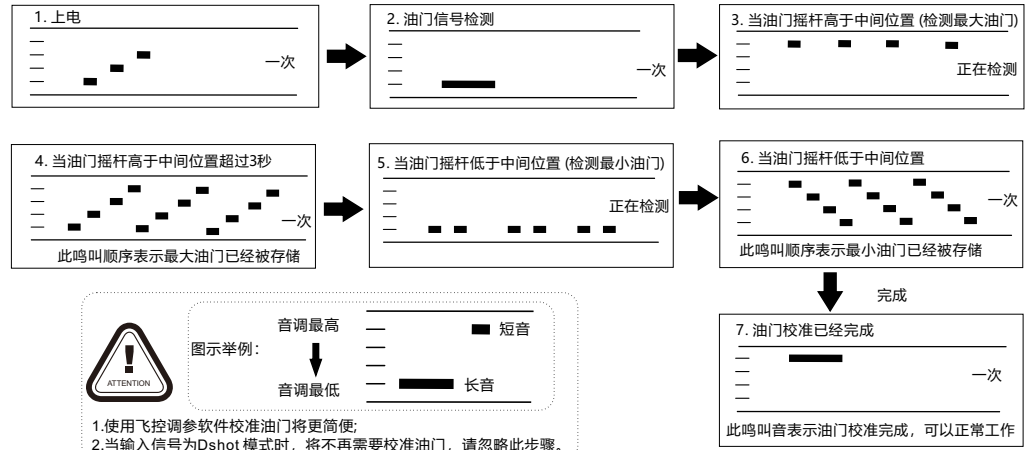电容 �电

04 编程参数值

以下的参数需要通过BLHeliSuite32调参软件设置

1. 启动功率（Rampup power）：
启动功率可以设置为从3%-150%的相对值。这是在启动和提高转速时允许最大功率。对于低转速，为了便于低反电动势电压检测，最大功率是被限制的。
启动功率也影响双向操作，参数是用来限制在更改转向时的功率。在启动过程中，实际功率取决于油门输入，可低于设定的最大启动功率，但最低是设定的四分之一。

2. 电机进角（Motor timing）：
电机进角可以设置为1°-31°，通常设置中等数值进角可适用于大部分电机，但如果电机运转不顺畅时，可以尝试改变进角。对于一些高感电机，其换向退磁时间较长，尤其在低速运转的时候，电机会在油门快速增加的情况下停转或者不顺畅。将进角改高会有有助于改善这个现象，因为高进角允许更长的换向退磁时间。

3. PWM频率（PWM frequency）：电机PWM频率可设置为16KHz-48KHz。更高PWM频率使电机运行更顺畅。频率可设定有可能会导致油门轻微移动时造成大的波动。

4. Demag补偿（Demag compensation）：Demag补偿是防止电机由于换向引起停转的一个功能，典型的现象是在快速增加油门时电机停转或不顺畅，尤其在低转速运行时。如前面所述，设置高进角可以帮助改善，但有可能降低效率。一般情况下，Demag补偿参数的值越高，保护越好。如果补偿值设置得太高，最大功率将有所降低。

5. 最大加速度（Maximum Acceleration）：最大加速度可以设置在0.1% / ms-25.5%/ ms之间，也可以设置为最大值，在这种情况下加速度不受限制。限制加速度的主要目的是避免在加速不一致造成失步的情况。例如：当设置为10% / ms时，这意味着对电机施加的功率不允许每毫秒增加10%以上。

6. 电机转向（Motor Direction）：电机转向可以设置为正转/反转/双向3D/双向3D反转/双向soft/双向soft反转。在双向模式下，油门中点为零点，中点以上为正转,中点以下为反转；当选择双向操作时，不可油门校准。

7. 鸣叫声强度（Startup Beep Volume）：设置正常上电时鸣叫声强度。

8.警报音强度（Beacon/Signal Volume）：设置警报音响起时的强度。如果油门信号在零点位置的时间超过一个设定的时间，电调将开始报警。请注意如果设置一个高的警报强度将会导致电机或ESC发热。

9.警报音延迟（Beacon delay）：设置警报音开始之前的延时。

10.启用油门校准（Throttle Cal Enable）：如果禁用，将不能油门校准。

11. 最小油门，最大油门和中心油门（Min throttle, max throttle and center throttle）：设置电调的油门范围；中点油门只用于双向操作；设置值正常的为900us到2100us的输入信号。对于其他输入信号，该值必须按比例设置。对于Dshot输入信号，这些设置无效。

12.温度保护（Thermal protection）：可以启用或禁用。温度保护阀值可以设置，当温度高于阈值时,电机功率降低；当温度高于阈值15℃时,电机功率降低到25%；电机功率不会低于25%。

13.低转速功率保护（Low RPM power protect）：低转速功率限制可以启用或禁用。禁用它可以保证低KV电机在低电压运行时实现全功率。然而禁用它将增加同步丢失的风险，伴随着电机或ESC发热的可能性。

14.低压保护（Low Voltage Protection）：低压保护可以设置2.5V/节-4.0V/节锂电池，或者可以禁用。当启用时，如果电池电压低于设定阈值将限制电机的功率。此功能主要用于固定翼飞机。

15.电流保护（Current Protection）：X-Cross HV 2 系列不支持此功能。

16.电流传感器调节（Current Sense Calibration）：当电流显示不准确时，可以调节此值，调节范围：**-99%～154%**。

17.停车制动（Brake on stop）：可以启用或禁用制动。当设置启用时，在通电状态，油门在零点位置电机将会有拖刹，阻止电机转动。如果油门没有零点，此项无效。

18.LED控制（LED control）：对于支持的ESC，可以控制发光二极管(如果ESC支持)。

19.无 Damped 模式（Non Damped Mode）：OFF- 有Damped 现象为刹车；ON- 无Damped 现象为无刹车。

20.音乐设置（Music Note Config）：可以设置个性化音乐。

21.正弦调制方式(Sine Modulation Mode)：可以启用或禁用。正弦调制模式可以使运行效率提高百分之几，运行更流畅。

22.自动遥测（Auto Telemetry）:当启用自动遥测时，ESC将以32ms的间隔自主地输出遥测，而不管是否存在来自输入信号的遥测请求。

23.堵转保护（Stall Protection）:当电机尝试启动未能成功，将停止启动。Normal-保护，Relaxed-无保护。

05 正常工作及提示音

1. 上电 ... 一次
2. 油门信号检测 ... 一次
3. 零点油门检测 ... 一次
4. 此时电机准备就绪，可以启动。 OK

06 油门校准

1. 上电 ... 一次
2. 油门信号检测 ... 一次
3. 当油门摇杆高于中间位置 (检测最大油门) ... 正在检测
4. 当油门摇杆高于中间位置超过3秒 ... 一次
此鸣叫顺序表示最大油门已经被存储
5. 当油门摇杆低于中间位置 (检测最小油门) ... 正在检测
6. 当油门摇杆低于中间位置 ... 一次
此鸣叫顺序表示最小油门已经被存储
完成
7. 油门校准已经完成 ... 一次
此鸣叫音表示油门校准完成，可以正常工作

ATTENTION
图示举例：
音调最高 ■ 短音
音调最低 ■ 长音
1.使用飞调调参软件校准油门将更便捷；
2.当输入信号为Dshot模式时，将不再需要校准油门，请忽略此步骤。

07 注意事项

● 电调接入飞行系统后，每次上电会自动检测输入的油门信号,然后执行相应的油门模式；
● 首次使用无刷电调或更换遥控设备后需要进行油门行程校准；Dshot 模式时，将不再需要校准油门；
● 请勿刷除"Flycolor_X_Cross_HV"以外的固件,以免损坏电调；
● 无论任何时候都要注意极性，供电之前一定要反复检查；
● 在插拔或者做任何连接时，请关闭电源；

● 当选择Dshot时，建议保留电调原本的双绞信号线中的地线，确保信号地线连接正常；
● 使用BLHeli-32 开源程序，当电机出现异常（如启动不顺畅）或者要求达到更高转速时，可尝试更改进角参数；
● 请不要超出ESC工作电流范围使用；如果需要OSD显示电流，请选用带电流计的飞控或者分电板；
● 如需更多信息，请联系飞盈佳乐售后或者技术支持。

4. 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. Generally, a higher value of the compensation parameter gives better protection. If demag compensation is set too high, maximum power can be somewhat reduced.

5. 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 e.g. 10%/ms, it means that the power applied to the motor is not allowed to increase by more than 10% per millisecond.

6. Motor Direction: Rotation direction can be set to Normal/Reversed/Bidirectional 3D/Bidirectional 3D Rev./Bidirectional Soft/Bidirectional Soft 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.

7. Startup Beep Volume: Sets the strength of beeps under normal operation.

8. Beacon/Signal Volume: 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 giventime. Note that setting a high beacon strength can cause hot motors or ESCs!

9. Beacon delay: Beacon delay sets the delay before beacon beeping starts.

10. Throttle Cal Enable: If disabled, throttle calibration is disabled.

11. Min throttle, max 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 900us to 2100us input signal, and for the other input signals, the values must be scaled. For Dshot input signal, these settings have no effect.

12. Thermal protection: Thermal protection can be enabled or disabled. And the temperature threshold can be programmed .

13. Low RPM power protect: Power limiting 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 toasting motor or ESC.

14. Low Voltage Protection: Low voltage protection can be set between 2.5V and 4.0V per lipo cell. Or it can 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.

15. Current Protection: This feature is not available for X-Cross HV 2 series.

16. Current Sense Calibration: When the current display is not accurate, this value can be adjusted, and the value range is: - 99% ~ 154%.

17. Brake on stop: Brake on stop can be set between 1% and 100%, or disabled. When not disabled, brake will be applied when throttle is zero. For nonzero throttle, this setting has no effect.

18. LED Control: LEDs can be controlled on ESCs that support it.

19. Non Damped Mode: **OFF**- Damped light is available ; **ON**- No Damped light。

20. Music Note Config: Set up personalized music.

21. Sine modulation mode: Sine modulation mode can give a few percent more efficient running, as well as smoother running.

22. Auto Telemetry: When auto telemetry is enabled, the ESC will autonomously output telemetry at 32ms intervals, regardless of whether or not there are telemetry requests from the input signal.

23. Stall Protection: If the motor has attempted to start but not succeeded for a few seconds, it will stop attempting and wait for throttle to be zeroed before attempting again. Normal-protection is available, Relaxed- no protection.

FLYCOLOR®

Thank you for using our product. Any improper operation may cause personal injury or 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 unannounced.

X-CROSS HV 2

*All pictures are for reference only

01 Main features

- ARM 32-bit Cortex MCU, frequency up to 48 MHZ.
- International famous brand MOSFET with high performance and low ESR, not afraid of large current;
- BLHeli_32 firmware,which is designed for superior functionality and performance.
- Wide voltage support, up to 12S LiPo, suitable for x-class drone.
- Supports regular 1-2ms pulse width input, as well as Oneshot125 (125-250us), Oneshot42 (41.7-83.3us) and Multshot (5- 25us). The input signal is automatically detected by the ESC upon power up. Dshot signal is supported at any rate.
- Small size, light weight, suitable for the drone with narrow arms.
- Damped light does regenerative braking, causing very fast motor retardation, and inherently also does active freewheeling.
- The silicone twisted-pair of the throttle signal cable effectively reduces the crosstalk caused by signal transmission, and makes flight more stable.
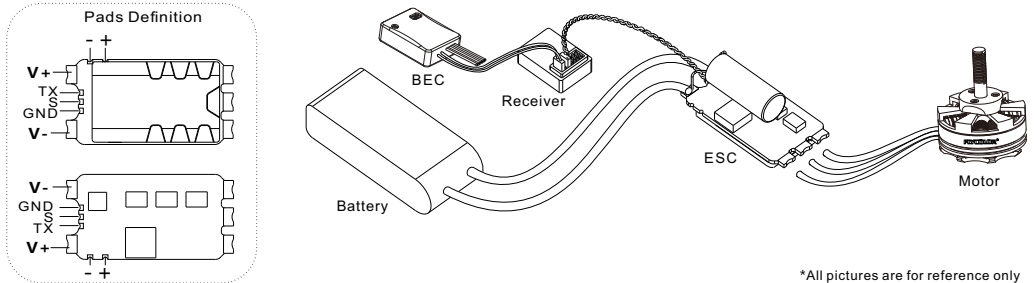- Aluminum heat sink effectively slow down the temperature rise.
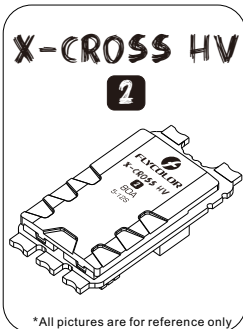
02 Specifications

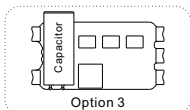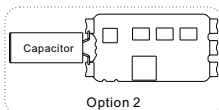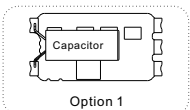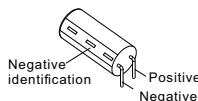| Model	Con. Current (good heat dissipation)	Burst Current (good heat dissipation)	BEC	LiPo	Weight (For reference)	Size (For reference)	LED	Typical Applications (For reference)
X-Cross HV 2-60A	60A	80A	No	5-12S	25.5g	55x28x10mm	No	650-1000 X-Class
X-Cross HV 2-80A	80A	100A	No	5-12S	25.5g	55x28x10mm	No	650-1200 X-Class

*ESC BLHeli-32 firmware: **Flycolor_X_Cross_HV**;

03 Connect diagram

*Please ensure all solder joints are insulated with heat shrink where necessary.

Pads Definition

V+
TX
S
GND
V-

V-
GND
S
TX
V+

BEC
Receiver
ESC
Battery
Motor

*All pictures are for reference only

- All welding requires good welding technology, short circuit between the element or the wire should be avoided at any time.
- The shorter the welding of electrolytic capacitor pin, the better, to avoid burning off the pin with high current;
- If the current is large, it is recommended to weld two capacitors in the accessories on the ESC power supply;
- Observe polarity at all times. Check and double check before applying power.
- According to personal installation method, electrolytic capacitor can be welded at different positions, as shown in the figure below.
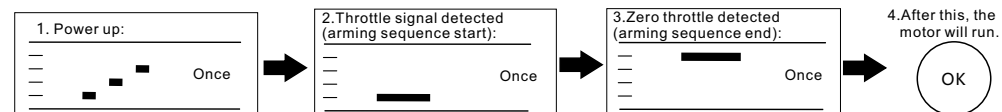
Negative identification
Positive
Negative

Capacitor — Option 1
Capacitor — Option 2
Capacitor — Option 3
Capacitor / Capacitor — Option 4: Place 2 capacitors when the current is large
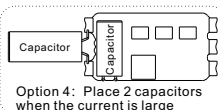
04 Programming parameter

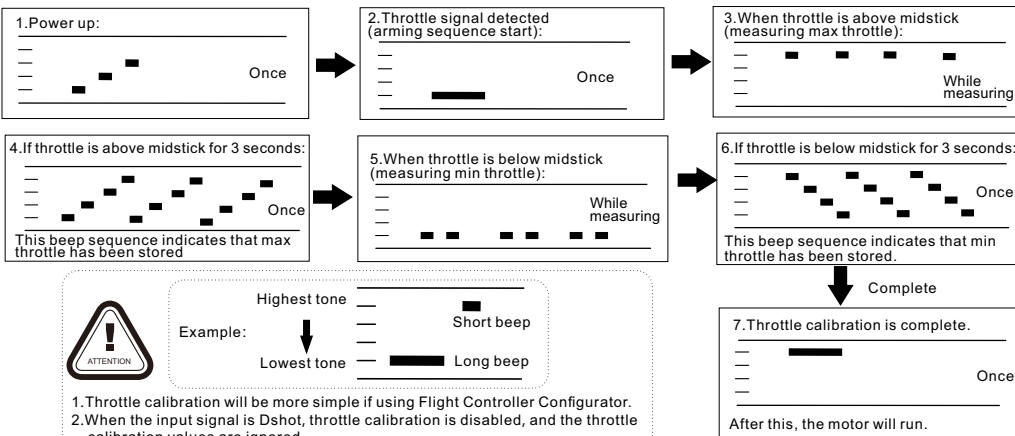**Programming parameters below can be accessed from the configuration software (BLHeliSuite32):**

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 startup. 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. Motor timing: Motor timing can be set between approximately 1° and approximately 31° in approximately 1° 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 to high will allow more time for demagnetization, and often helps.

3. PWM frequency: Motor pwm frequency can be programmed between 16kHz and 48kHz. Higher pwm frequency can run motors smoother. Programmable frequency also allows for moving of small but potentially disturbing humps 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.

05 Beeps-Normal operation

1. Power up:
Once

2. Throttle signal detected (arming sequence start):
Once

3. Zero throttle detected (arming sequence end):
Once

4. After this, the motor will run.
OK

06 Beeps - Throttle calibration

1. Power up:
Once

2. Throttle signal detected (arming sequence start):
Once

3. When throttle is above midstick (measuring max throttle):
While measuring

4. If throttle is above midstick for 3 seconds:
Once
This beep sequence indicates that max throttle has been stored

5. When throttle is below midstick (measuring min throttle):
While measuring

6. If throttle is below midstick for 3 seconds:
Once
This beep sequence indicates that min throttle has been stored.
Complete

7. Throttle calibration is complete.
Once
After this, the motor will run.

Example:
Highest tone → Short beep
Lowest tone → Long beep

1. Throttle calibration will be more simple if using Flight Controller Configurator.
2. When the input signal is Dshot, throttle calibration is disabled, and the throttle calibration values are ignored.

07 Attention

- ESC will automatically detect the input throttle signals every time as soon as it powered on, and then execute the corresponding signal-receiving mode.
- User need to calibrate the throttle range when starting to use a new ESC or another transmitter. When the input signal is Dshot, throttle calibration is disabled.
- Please don't flash any other firmware except "Flycolor_X_Cross_HV".
- Observe polarity at all times. Check and double check before applying power.
- Power off before unplugging ,plugging in or making any connections.
- It is suggested that keep the ground wire in the original signal wire connecting well.
- 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.
- Please do not exceed the current range.
- Please use a PDB or Flight Control with currentmeter if OSD is required to display the current.
- Please contact Flycolor sales or technical support for more information.