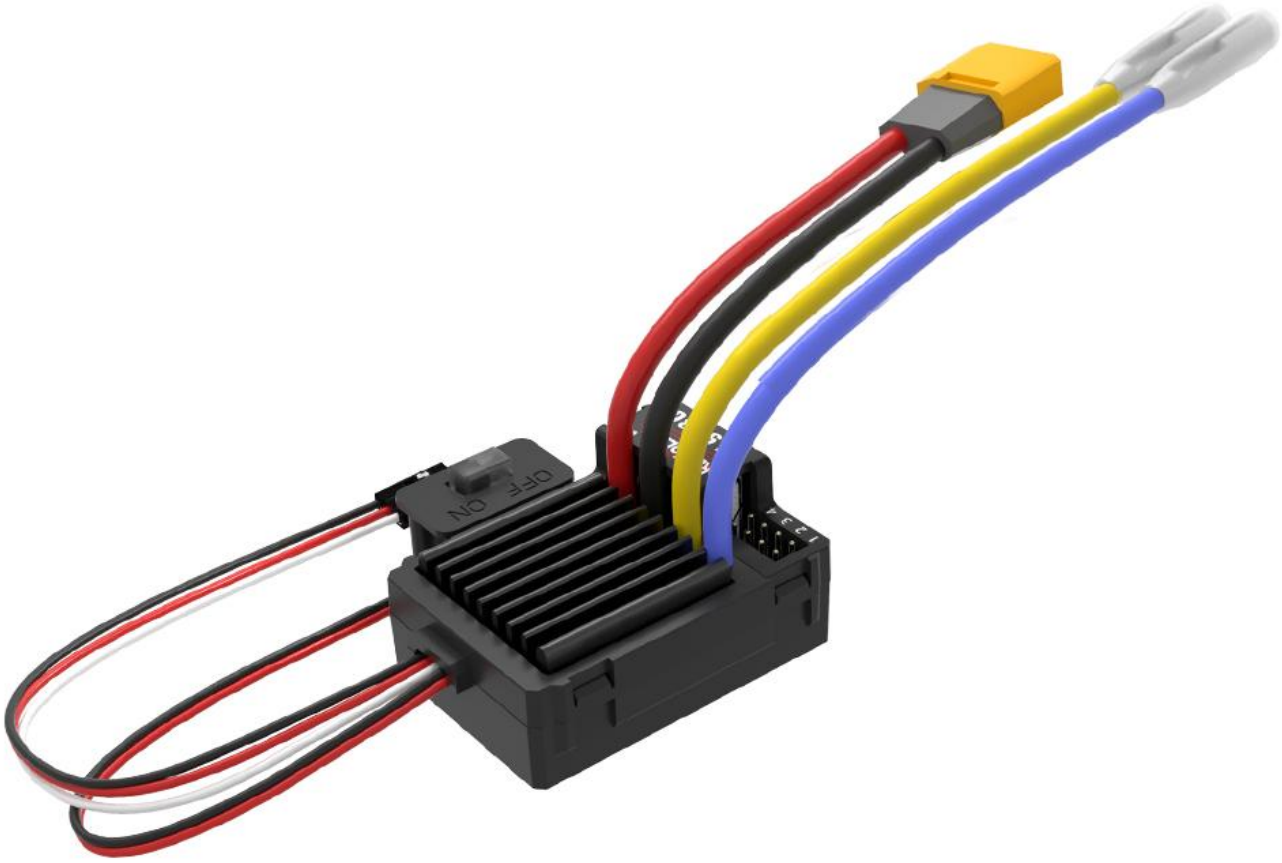
COOL 9030

（Brushed ESC for Cars & Boats）

User Manual

RadioLink Brushed ESC
(Single-motor & Dual-motor Climbing Vehicles / Drift Cars / Crawlers / Trailers / Bait Boats / Rescue Boats / Surveying Boats)



Note: This manual only introduces the basic usage of RadioLink COOL 9030 brushed ESC. For more details, please access to RadioLink website: https://www.radiolink.com/cool9030 or send emails to: after_service@radiolink.com.cn

Contents

Safety Precautions

1. Please make sure that all wires and connecting parts are well insulated before connecting the ESC to related parts. Short-circuiting will damage the ESC.

2. Please read the manuals of all the power equipment and the frame carefully before using the ESC to ensure that the power is reasonably matched, and avoid the motor overload due to the wrong power combination, which will eventually damage the ESC.

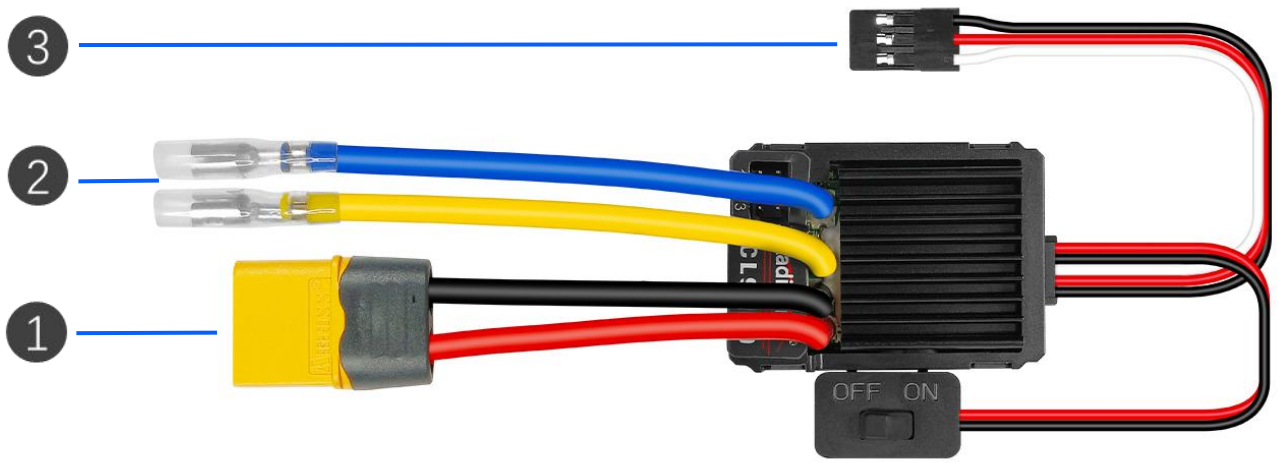
3. Please carry out wiring and debugging when the car is suspended for your safety and others'.

4. Please disconnect the battery and ESC after use. If the battery is not disconnected, even if the ESC switch is turned off, the ESC will continue to consume power. If the battery is connected for a long time without use, the battery will eventually be completely discharged, which will cause the malfunction of the battery or ESC.

RadioLink is not responsible for any damage caused by incorrect operation!

Part 1. Introduction of COOL 9030

1.1 COOL 9030 Overview

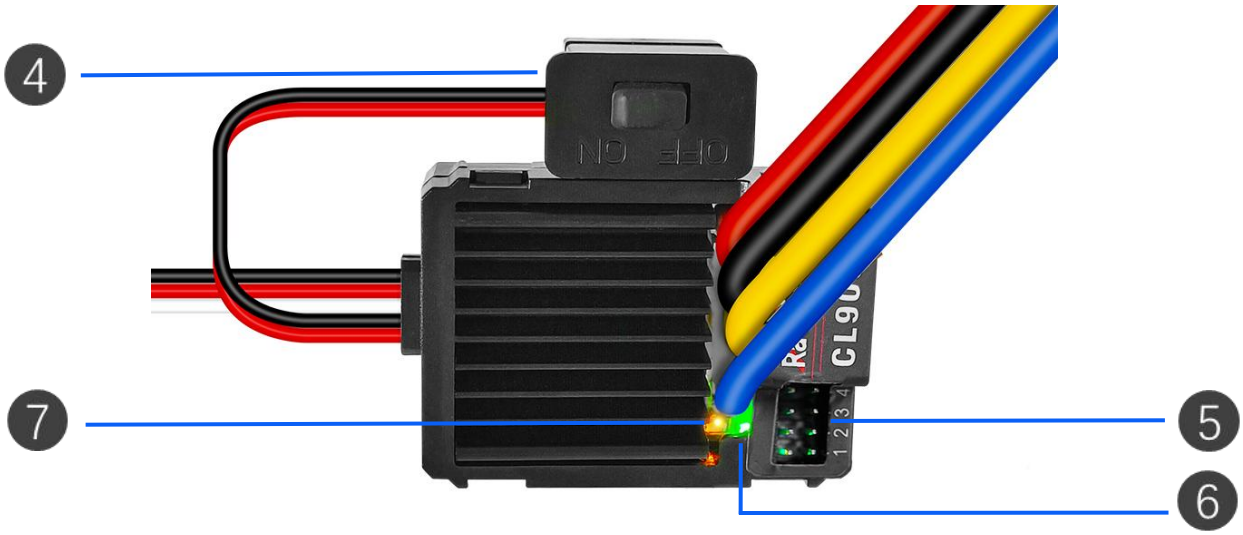


1 Power input: The power input of the ESC is connected to the power supply. At the same time, the voltage range of connected power supply should be within the range of 6~16.8V (for non-lithium batteries: NI-MH battery, nickel-cadmium batteries and lead-acid batteries, etc.), and 6-18V (for lithium batteries). Power supply outside this voltage range cannot guarantee the stability of the system.

Note: Except the voltage range, lithium batteries and non-lithium batteries have different using instructions. When using a lithium battery, please insert jumper cap 3 of COOL 9030; When using a non-lithium battery, please remove jumper cap 3. If the status of the jumper cap 3 does not match the actual battery used, the battery may be seriously over-discharged and damaged. Be sure to confirm the battery type of the ESC and check jumper cap status before use. For more details, please refer to Part 4. Usage of Jumper Cap.

2 Motor output: The motor connector is used to connect a brushed DC motor. At the same time, the rated working voltage of the connected brushed DC motor must meet the power supply voltage range of the ESC. Otherwise the stable operation of the ESC and the connected motor cannot be guaranteed.

3 Signal input: The signal input is used to connect the PWM signal input(single channel signal of the receiver) to the ESC. At the same time, the connector has a BEC output function. The output voltage of BEC can supply power to the receiver or servo. (The maximum current is 5A)



Switch introduction:

4 Control switch: The control switch is used to control the working state of the ESC. When the switch is turned on, the ESC starts to work, with the output voltage of 5.5V or 7.5V. When the switch is turned off, the ESC stops working,with no output voltage.

5 Jumper cap: The jumper cap is used to select the operating mode of the ESC, the type of input power supply, and the output voltage of BEC. Details will be introduced later.

LED light description:

6 Power light: The power light is used to indicate the current self-check and power supply status of the ESC system. The color of the light is green. Details will be introduced later.

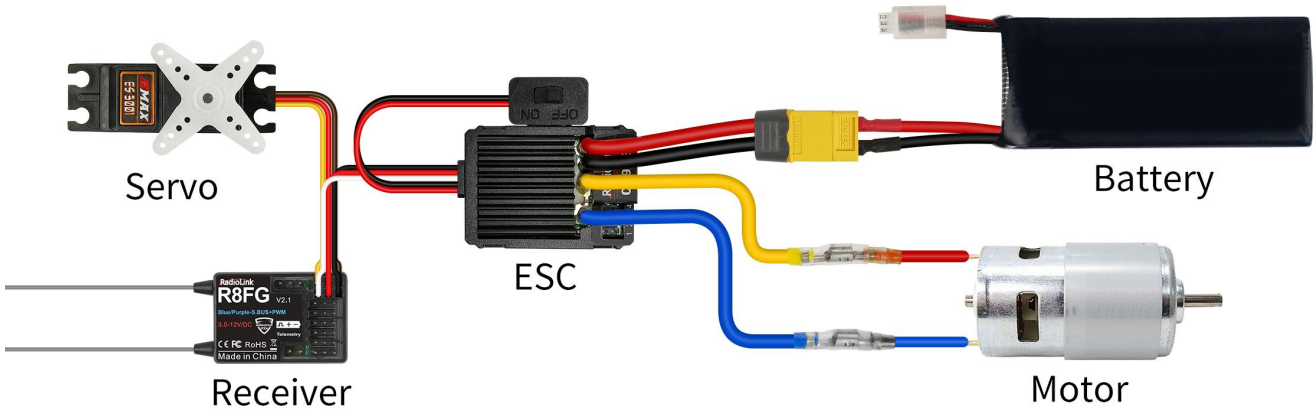
7 Status light: The status light is used to indicate the current self-check and operating status of the ESC system. The color of the light is red. Details will be introduced later.

1.2 Specifications

Specifications of COOL 9030	
Dimensions:	46.6*35.6*21mm
Weight:	49g
Compatible models	Cars & Boats
Constant Current:	90A@18V
BEC Voltage:	5A@5.5V，5A@7.5V
Peak Current:	100A

Input Voltage:	6~16.8V (NI-MH, Ni-Cd or lead-acid battery)；6~18V (Lithium Battery)
Low Voltage Protection:	6.5V@2S , 9.75V@3S ,13.0V@4S
Maximum Continuous Working Temperature of PCB:	100°C
Plug Input:	XT60
Plug Output:	Receptacle connectors
Motor Limit:	Brushed Motor Limit with 380/540/550/560/570
Internal Resistance:	7 milli-ohm
Drive Frequency:	PWM frequency 2KHz

Part 2. Connection of COOL 9030



Connect the signal cable of the ESC with the receiver correctly before use. Then connect the motor output cable of the ESC with the motor accurately (You can choose the connection direction based on actual usage.). Make sure the negative and positive poles of the power input cable are not reversed.

Connection to the receiver: Plug the receiver connection cable of the ESC into the throttle channel of the receiver. The receiver connection cable of the ESC outputs the voltage of 5.5V to the receiver and the servo, so please do not supply additional power to the receiver. Otherwise the ESC may be damaged.

Connection to the motor: There is no positive or negative connection between the brushed motor and the ESC. If the motor turns incorrectly, you can directly change the direction of the motor through the servo phase in the menu of the transmitter, or exchange the connection of the two motor output cables of ESC. Make sure the right connection and good contact between the motor and the ESC.

Connection to the battery: The battery connection cable of the ESC has positive and negative poles. When connecting the battery, please make sure that the (+) positive pole of the cable is connected to the (+) positive pole of the battery, and the (-) negative pole is connected to the (-). If the ESC is connected reversely, it will be damaged. Warranty service will not be provided if the ESC is damaged due to the reverse connection of the power supply.

2.1 Power Input

This brushed DC ESC supports two types of batteries as power supply, including non-lithium batteries(NI-MH battery, nickel-cadmium batteries and lead-acid batteries, etc.) and lithium batteries(polymer lithium batteries). At the same time, in order to make sure the stability of the system, the voltage of the input power supply must be within the range of 6.0V to 16.8V (6V to 18 V under the lithium battery mode).

The protection ways to the battery voltage are different when two types of batteries are used as power supply separately.Please check the below table for details:

Battery type	Under-voltage protection	Half-power protection	Over-voltage protection
2S lithium battery	6.0 V	6.5 V	8.7 V
3S lithium battery	9.0 V	9.75 V	13.05 V
4S lithium battery	12.0 V	13.0 V	17.4 V
Non-lithium battery	6.0 V	6.5 V	16.8 V

Note: In the table, the under-voltage protection value and half-power protection value of the lithium battery are based on the standard lithium battery (4.2V is the maximum voltage of a single cell of the standard lithium battery), but the over-voltage protection value is based on the standard high-voltage lithium battery (4.35V is the maximum voltage of a single cell of the standard high-voltage lithium battery).

The introduction of the three conditions are as follows, including under-voltage protection, half-power protection and over-voltage protection.

1. Under-voltage protection: It is an under-voltage protection state. When the voltage of the input power is lower than this value, the ESC will stop the output control of the motor, which means the ESC will not respond to the input signal at this time, and the power light will flash to give a reminder. At the same time, when the ESC enters the under-voltage protection state and the battery voltage rises back to the half-power protection value, the system will exit the under-voltage protection state. Then the system will return to normal operation, and the normal output control of the motor is restored.
2. Half-power protection: It is half-power output protection state. When the voltage of the input power supply is lower than the value, the ESC will reduce the output power of the motor to half of the original (The ESC can still respond to the input signal at this time). Meanwhile, when the ESC enters the half-power protection state and the battery voltage rises to near the over-voltage protection value, the system will not exit the half-power protection state. But when the battery voltage drops to the under-voltage protection value, the system will exit half-power protection state and enter the under-voltage protection state, with no output control of the motor.
3. Over-voltage protection: It is over-voltage protection state. When the voltage of the input power is higher than this value, the ESC will stop the output control of the motor, which means it will not respond to the input signal at this time,and the power light will flash to give a reminder. At the same time, when the ESC enters the over-voltage protection state and the battery voltage drops to below the over-voltage protection value, the system will resume normal operation and the normal output control of the motor will be restored. Then the system will return to normal operation, and the normal output control of the motor is restored.

2.2 Motor output

This brushed DC ESC only supports the operation and output control of brushed DC motors, and the instantaneous peak value of the output current of the ESC can reach 100A. Therefore, when using this ESC, a brushed DC motor must be correctly selected to avoid damage to the ESC. At the same time, the "M+" lead wire of the motor interface is connected to the positive pole of the motor (usually a yellow or red power supply line), and the "M-" lead wire is connected to the negative pole of the motor (usually a blue or black power supply line).In addition, the brushed DC motor load connected to the motor interface of the ESC must not have an additional circuit connection with the input power port, otherwise the ESC system will not operate normally.

Regarding the matching relationship between the speed of the brushed DC motor (conventional model) and the power battery (conventional lithium battery and Ni-MH battery), please refer to the following table:

Lithium battery	Ni-MH battery	Motor speed
2S lithium battery	5-6S Ni-MH battery	RPM < 30000 , 7.2 V
3S lithium battery	7-9S Ni-MH battery	RPM < 20000 , 7.2 V
4S lithium battery	10-12S Ni-MH battery	RPM < 15000 , 7.2 V

Note: The table is for reference only. When in specific application scenarios, users need to analyze the concrete cases to prevent the ESC and motor from being damaged or even battery damage accidents.

2.3 Signal input

The signal input (the throttle signal input) of this brushed DC ESC can only identify the PWM signal output by a single channel of the receiver. The signal with multiple channel codes (such as PPM signals, S.BUS signals, etc.)cannot be recognized. At the same time, the characteristics of the PWM signal need to meet the parameter characteristics in the table below to ensure that the ESC system is stably controlled by the control signal. The parameter characteristic table of the PWM signal is as follows:

Parameters	Minimum	Maximum
PWM signal frequency	7.15 Hz（140 ms）	400 Hz（2.5 ms）
PWM signal amplitude	2.8 V	5.4 V
PWM signal delay	0 ms	150 ms
PWM signal pulse width	0.8 ms（800 us）	2.2 ms（2200 us）

Note: The PWM signal delay parameters in the above table are used to measure the fault tolerance range of the ESC system for sudden signal interruption (loss). The specific value refers to the period from the interruption (loss) of the PWM signal to the recovery of signal.

This ESC system not only has basic control functions, but also has a response function to abnormal state of the control input signal. Regarding the abnormal state of control input signal, there are the following two situations:

1. **No signal input**: When the ESC is connected to the power supply, if the throttle input signal is not detected by ESC or the throttle signal delay time exceeds the PWM signal delay parameter, the system will identify the ESC as no signal input state, and the current abnormal state will be prompted by the flashing status light and the motor beeping at the same time.
2. **Abnormal Signal input**: when the ESC is connected to the power supply, if the throttle input signal is not within the midpoint range (The factory default setting of midpoint is 1500 us, and the midpoint range is within plus or minus 50 us of the midpoint value, which is 1450 us to 1550 us. When the throttle is calibrated, the calibration result shall prevail), the system will identify the ESC as abnormal signal input state, and the current abnormal state will be prompted by the flashing status light and the motor beeping at the same time.

Note: When the signal is in an abnormal state, set the throttle input signal back to the midpoint range to remove the fault prompt.

Part 3. Throttle calibration

This ESC system uses the standard receiver channel signal as a reference by default. However, unexpected effects may occur due to the differences in the parameter settings of each receiver and its remote controller (such as servo output ratio and servo midpoint value, etc.). Calibrate the throttle at this time so that the ESC can be adjusted to the signal output of the receiver to achieve the expected effects.

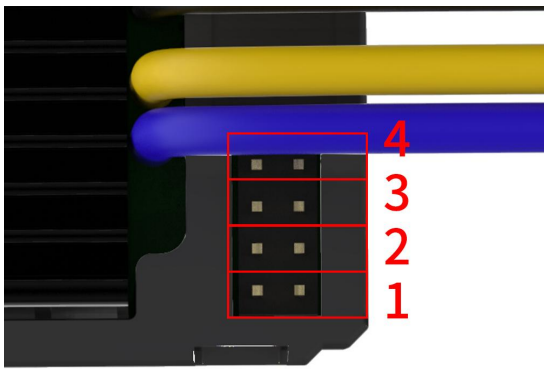
COOL 9030 is a two-way ESC, so the throttle calibration method is the same as that of the common two-way ESC. The specific steps are as follows

ESC Calibration Method	
Preparation	Connect the ESC, motor, battery, and receiver (Bind the receiver with the transmitter in advance, and the receiver output must be PWM signal output.). Turn on the transmitter, and keep other devices powered off.
Step 1	Push the throttle stick to the highest position and keep it. Then power on the ESC and the receiver. The motor will directly beep twice. (If the motor does not emit beep sounds, please refer to the following precautions)
Step 2	After two beeps, push the throttle stick to the lowest position and keep it. The motor will make two beeps again.
Step 3	After two beeps, push the throttle stick to the neutral position and keep it. The motor will emit a series of beep sound, indicating that the ESC throttle calibration is completed.

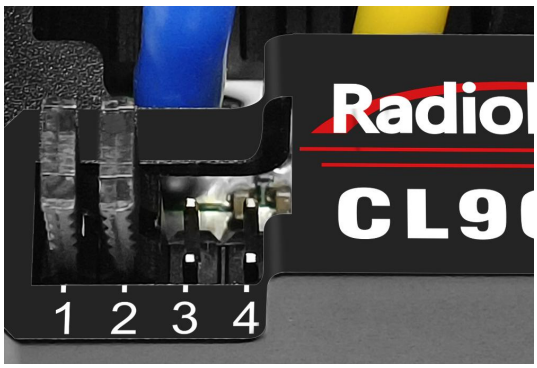
Note:

1. The order of the position of the throttle stick in the above calibration process is "the highest position - the lowest position - neutral position". If the motor does not directly emit beep sounds when the throttle stick is placed at the highest position, change the order of the position of the throttle stick to "the lowest position - the highest position - neutral position" for calibration.
2. Before calibrating, it is best to set the TRIM of the transmitter to “0” to avoid unnecessary trouble.

Part 4. Usage of Jumper Cap



Remove jumper cap



Insert jumper cap 1, 2

This ESC has four sets of jumper cap switches. The serial numbers of the switches from outside to inside are 1 to 4, as shown in the picture above. Insert the jumper cap and it is connected state. The 4 sets of switches in the right picture are all in the connected state. When the jumper caps are removed, the 4 sets of switches are in the off state, as shown in the left picture. The jumper cap is used to set the operation mode, battery type, and BEC output voltage. Jumper cap 1 and 2 are used to set the operation mode of the ESC. Jumper cap 3 is for battery type, and jumper cap 4 for BEC output voltage.

The different states of the 4 sets of jumper caps will correspond to the different operation modes of the ESC. Choose the operation mode you need, determine the type of the battery you use and the requirements for the BEC. Then refer to the following table to set the 4 sets of jumper caps.

Note: The ESC must be restarted after changing the state of the jumper cap. Otherwise, the corresponding mode and output will not take effect.

State / Jumper Cap / Function		Jumper Cap 1	Jumper Cap 2	Jumper Cap 3	Jumper Cap 4
Mode switch	Normal mode	Remove	Remove	/	/
	Brake mode	Insert	Remove	/	/
	Racing mode	Remove	Insert	/	/
	Climbing mode	Insert	Insert	/	/
Battery Type	Non-lithium battery	/	/	Remove	/
	Lithium battery	/	/	Insert	/
BEC output	5.5V	/	/	/	Remove
	7.5V	/	/	/	Insert

Mode switch

There are 4 operation modes of the ESC. Changing the state of jumper caps 1 and 2 to switch modes. When the throttle stick is in different positions, the response of the motor is also different. The specific relationship is as shown in the table below:

Jumper Cap 1&2	Operation Mode	Pull inward	Neutral position	Push forward
Both removed	Normal mode	Forward	No operation	Reverse
Jumper Cap 1 inserted only	Brake mode			Brake/Reverse
Jumper Cap 2 inserted only	Racing mode			Brake
Both inserted	Climbing mode		Brake	Reverse

Normal mode: Pull the trigger inward for forward operation, and push the trigger forward for backward operation. There is no brake for the transition between going forward and backward. With low heat, this mode is suitable to use in confined spaces.

Brake mode: It is the common mode. Pull the trigger inward for forward operation. When the operation of the trigger is changed from pulling inward to pushing forward, the ESC will perform the brake operation. Return the trigger to the neutral position at this time, and then push the trigger forward again. The ESC will perform the reverse operation.

Racing mode: Pull the trigger inward for forward operation, and push the trigger forward for brake operation. There is no reverse operation on ESC.

Climbing mode: Pull the trigger inward for forward operation, and push the trigger forward for reverse operation, When the trigger is at the neutral position, the ESC will perform the brake operation.

Battery Type

When using different types of batteries, change the state of Jumper cap 3 to make the battery type match the actual battery. Insert Jumper cap 3 when using a lithium battery, and remove Jumper cap 3 when using a non-lithium battery. Wrong state of Jumper cap 3 may cause serious over-discharge of the battery and damage the battery. Be sure to check Jumper cap 3 to confirm the battery type of the ESC before use.

BEC output

Different servos may have different requirements for the working voltage. Change the state of the Jumper cap 4 to select the BEC output voltage. You can choose the appropriate BEC output voltage according to the use requirements of the connected equipment. Remove Jumper cap 4 when using a common 5V servo, and BEC will output 5.5V voltage. Insert Jumper cap 4 when using high voltage servo, and BEC will output 7.5V voltage. Be sure to check Jumper cap 4 to confirm the right BEC output voltage before use. Otherwise, wrong BEC output voltage selection may damage the servos.

Part 5. ESC status

COOL 9030 ESC has two indicator lights, red and green, to display the current operating status of the ESC. The power light is used to indicate the current self-check and power supply status of the ESC system, and the color of the light is green. The status light is used to indicate the current self-check and operating status of the ESC system, and the color of the light is red. At the same time, the indicator lights have three states: on, off and flash. The flashing time(the interval between two flashes) of the lights flashing will vary according to the different prompts of the system.

COOL 9030 ESC indicates the status of the system not only by the two indicator lights, but also by the vibration and sound principle of the motor. The combination of the two ways achieve the sound and light prompt function of the ESC system. There are three sound prompt states of the motor, including short beep, long beep and tone beep state. The number of beeps and beep intervals in the three prompt states will vary according to different prompts of the system.

At the same time, the sound of the motor and the indicator light of this ESC system can work independently or coordinately. There is only motor sound prompt or only light prompt when in some status of the system (independently), while there are both motor sound prompt and indicator light prompt when in some other status of the system (coordinately).

5.1 Motor sound

When the device is started normally, the red and green indicators light should be always on, and the motor will make beep sound to prompt self-check, battery type report, and operation allowed in sequence (as shown in the table below). If the sound of the motor is incomplete when the ESC starts, inspect the ESC and the equipment connected.

Motor Sound	ESC status
Tone beep (Do-Re-Mi)	Self-check finished
Short beep	Battery type report
Long beep	Operation allowed

Note: There are three consecutive tones, Do-Re-Mi, in tone beep state.of the motor. The number of short beeps varies according to the battery type. You need to set the Jumper cap 3 first to match the type of the battery used. When using a non-lithium battery, the short beep will only be heard once. When using a lithium battery, the number of short beeps is determined by the number of the battery cells (For example, when 4S lithium battery is connected to this ESC system, 4 short beeps will be heard).

5.2 Indicator light

When the power light and status light of this ESC system are always on, the ESC is operating normally. If the power light or status light is flashing and there is no sound from the motor, you can refer to the following table to confirm the current system states:

Indicator light	Prompt mode	System states
Green light	Always on	Battery self-test failed
	Flash once every 0.2 second	Battery over-voltage warning
	Flash once every second	Battery under-voltage warning
Red light	Flash once every 0.2 second	System voltage self-test failed
	Flash once every 0.4 second	System output self-check failed

Note: In the above table, the mixed prompt mode of the power light and the status light means that the two prompts of system states are executed simultaneously. The prompts of power light and the status light are independent, which means the two prompts of system states can be executed independently.

5.3 Mixed prompt of motor and light

In the mixed prompt mode of the motor sound and indicator light, the red light works, but the green light doesn't. At the same time, when there is a battery over-voltage warning or battery under-voltage warning, the system state prompt will remove the motor sound prompt, and only retain the indicator light prompt. In the two system states of system high temperature warning and system low temperature warning, the time interval of two consecutive motor sounds is 1.5 seconds, while in the two system states of throttle signal loss and abnormal throttle signal, the time interval of two consecutive motor sounds is 2.5 seconds.

In this ESC system, the system states corresponding to the mixed prompt of the motor sound and indicator light are as follows:

Motor sound and red indicator light	System state
Four consecutive short beeps Flash once every 0.2 second	System high temperature warning (Above 85°C)
Three consecutive short beeps Flash once every 0.4 second	System low temperature warning(Below -40°C)
One short beep Flash once every 0.6 second	Throttle signal loss
Two consecutive short beeps Flash once every 0.8 second	Abnormal throttle signal

Meanwhile, when in the normal operating state mentioned above, the motor will respond to the signal. But in other abnormal operating state mentioned above, ESC will terminate the operation of the motor, with no response to signal input. At this time, the system can only enter the normal operating state after the corresponding fault is eliminated.

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