MANUAL OF ESC FOR AIRCRAFT AND HELICOPTER

REV 2.2

Features

1. Equipped with high-speed, small-sized, multifunctional MCU.
2. Full protection feature including low-voltage protection, over-heat protection, signal lost protection, safe power on protection, and self-check functions.
3. Excellent startup performance, great throttle linear and quick throttle response, excellent low-speed performance.
4. Max speed: 240,000 RPM (2 poles), 80,000 RPM (6 poles), 40,000 RPM (12 poles).
5. Individual power circuit for MCU and BEC to improve anti-interference capability.
6. The parameters of ESC can be configured via program card or transmitter .
7. Program card is displayed by LED panel, make setting conveniently and easily.
8. The low-voltage threshold and start-up power can be programmed quantized and precisely by program card.
9. Throttle range can be configured to be compatible with different receivers.
10. Three throttle curve options make helicopter control more flexible.
11. Motor reverse rotation available.

Specification

Table 1 (BEC is Linear Mode)

Model	Continuous Current	Burst current (10S)	Li-XX	Size(mm) L*W*H	Weiht (g)	BEC （Linear）	Program Function
XP-3A	3A	4A	1	11×13×4	0.7	NO	YES
XP-7A	7A	9A	1-2	22×12×5	5	5V/1A	YES
XP-12A	12A	15A	1-3	22×17×7	8	5V/1A	YES
XP-18A	18A	23A	2-3	45×24×6	18	5V/2A	YES
XP-25A	25A	30A	2-4	50×28×12	31	5V/2A	YES
XP-30A-I	30A	40A	2-4	50×28×12	34	5V/2A	YES
XP-30A-II	30A	40A	2-4	59×28×12	36	5V/3A	YES
XP-35A	35A	45A	2-4	59×28×12	38	5V/3A	YES
XP-40A	40A	50A	2-5	58×28×11	35	5V/3A	YES
XP-45A	45A	55A	2-5	58×28×11	35	5V/3A	YES
XP-50A	50A	65A	2-5	59×28×15	44	5V/3A	YES
XP-60A	60A	80A	2-6	63×28×18	51	5V/3A	YES
XP-80A	80A	100A	2-6	63×28×18	60	5V/3A	YES
XP-100A	100A	120A	3-6	96×55×21	165	NO	YES
XP-120A	120A	150A	3-6	96×55×21	170	NO	YES
XP-150A	150A	180A	3-6	96×55×21	175	NO	YES
XP-80A-HV	80A	100A	3-10	96×55×21	168	NO	YES
XP-100A-HV	100A	120A	3-10	96×55×21	170	NO	YES
XP-120A-HV	120A	150A	3-10	96×55×21	180	NO	YES

Max. load of Built-in Linear BEC（5V/3A）:

Li-xx Battery	2 cells	3 cells	4 cells	5 cells
Qty of standard servo (Max.)	5	5	4	3

Note: For ESC without built-in BEC, an UBEC or individual battery pack should be required to power the receiver and servos. and the red line (+5V) in 3 pin must be pulled out !

Table 2 (BEC is Switch Mode)

Model	Continuous Current	Burst current (10S)	Li-XX	Size(mm) L*W*H	Weiht (g)	BEC （switch）	Program Function
XP-35A-SW	35A	45A	2-4	59×28×12	40	5.2V/3A	YES
XP-40A-SW	40A	50A	2-5	59×28×11	38	5.2V/3A	YES
XP-45A-SW	45A	55A	2-5	59×28×11	38	5.2V/3A	YES
XP-50A-SW	50A	65A	2-5	59×28×15	50	5.2V/3A	YES
XP-60A-SW	60A	80A	2-6	63×28×18	55	5.2V/3A	YES
XP-80A-SW	80A	100A	2-6	63×28×18	62	5.2V/3A	YES
XP-30A-SW-F	30A	45A	2-4	60×28×13	40	5.2V/3A	YES
XP-40A-SW-F	40A	55A	2-4	60×28×13	45	5.2V/3A	YES

Note: This series of production adopts high efficiency switch mode BEC. Even it work with high voltage, BEC still can export stable 3A current, so it can drive more servos and keep self-heating small. The series of production is very suitable for helicopters with more servos.

Using ESC

Normal Startup Procedure

Move throttle stick to the bottom position (full Off throttle) → Switch on the transmitter →Connect battery pack to ESC → System detects the Min throttle signal, makes a long "beep" sound → System detects battery voltage and makes several short "**beep-**" sounds, which denotes the number of battery cells → when self-test is finished → "♪ **1 2 3**" tone should be emitted →ready for start.

Set Throttle Range (Throttle range should be setup when a new transmitter is being used)

Push the throttle stick to the top position (full On throttle) → switch on the transmitter →Connect battery pack to ESC → System detects the Max throttle signal, and makes two "**beep-**" sounds, which denotes that Max throttle has been confirmed and saved → Pull the throttle stick to the bottom position within 5 seconds(program mode will be entered if you wait for 6 seconds) →System detects the Min throttle signal, makes a long "**beep-**" sound → System detects battery voltage and makes several short "**beep-**" sounds, which denotes the number of battery cells →when self-test is finished → "♪ **1 2 3**" tone should be emitted → Ready for start.

If the system doesn't detect the throttle signal, it will make "**beep-**" sounds continuously without stopping.

Any fault in self- test, it will make 20 very short "**beep-**" sounds.

Protection

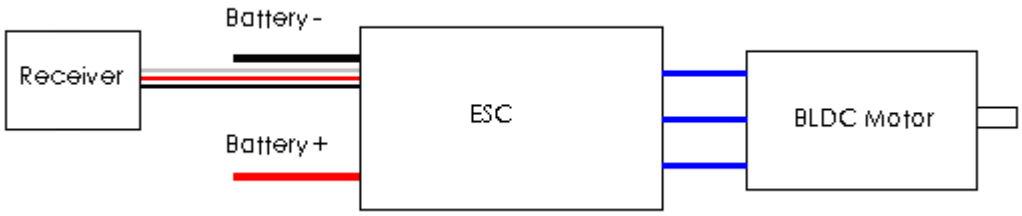
A. Low voltage protection: When power voltage is lower than the cutoff threshold, ESC will reduce output power or cut off. Read the "Configurable parameter" for more information.

B. Throttle signal lost protection: The ESC will reduce output power to 20% if throttle signal lost for 1 second, the output power will recover if signal is detected.

C. Over heat protection: when the temperature of ESC is over 110℃,the ESC will reduce output power, the min output power can be reduced to 35%. The output power will raise after temperature gets low.

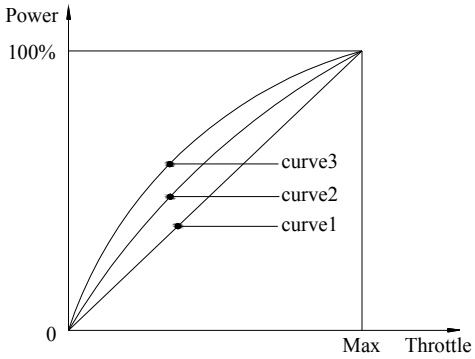
D. Self-test: ESC will start self-test when power on.. If self-test fail, ESC will continuously emit 20 short "**beep-**" tones.

Wiring Diagram



Configurable parameter with program card

1. **Cut Off Voltage** (Low Voltage Protection Threshold): user can set proper voltage threshold according to cell quantity in range of 00.0-49.9V, default is 00.0V.
   Note: System will calculate battery cells and set proper threshold automatically if this setting is 00.0V, Protection voltage for each Li-XX cell is 2.85V.
2. **Start Power Percent** : to set the Percent of output power when motor start in range of 00% - 29%, default is 00%. Under default setting, output power is decided automatically by system according to throttle stick position.
3. **Advance Timing** (Timing Mode): Low, Middle and High, default is Middle. Low advance timing is recommended for high inductance and low KV motors. High advance timing is recommended for low inductance and high KV motors, e.g. high KV outrunner motors. For some high KV motors, if it shakes while rotating in high speed, the "**High**" timing mode is recommended.
4. **Brake Type**: Off, Soft brake and Hard brake. default is Off (brake disable). Soft brake: less forceful and brake time is longer. Hard brake: more forceful and brake time is shorter .If Soft brake or Hard brake is selected, When the Motor is stop and the throttle is closed, brake will be continued. **Soft brake and hard brake are designed for glider, especially suitable for folding propeller glider**.
5. **Start Mode**: Fast, Soft and Very Soft. Default is Fast. Fast is preferred for fixed-wing aircraft, but Soft and Very Soft is recommended for helicopters. Soft and Very Soft both are 4 seconds very soft start. The speed of propeller rotation rises in slow-speed during the 4 seconds. The rotation speed is little faster in Soft and is slower in Very Soft. Soft and Very Soft are suitable for helicopters. When setting Soft or Very Soft mode, if the throttle is closed then the motor stopped and the throttle opened again within 4 seconds, start will be Fast mode. But if beyond 4 seconds, start will be 4 seconds Soft mode or Very Soft mode again.
6. **Cut Off Type** (Low Voltage Protection Mode): Reduce power and Cutoff output power for selecting, default is Reduce the output power gradually to 50% of the current power.
7. **Throttle Curve**: Curve1, Curve2 and Curve3. default is Curve1.

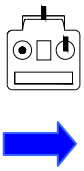


8. **Motor Rotation**: Forward and Reverse. default is Forward.

Program ESC with transmitter

1.Enter program mode

1. Switch on transmitter ,move throttle stick to top position,connect the battery pack to ESC
2. Wait for 2 seconds ,the motor should emit **"beeb-beeb-"**tone
3. Wait for another 6 seconds ,special tone like **"♪ i3i3"** should be emitted ,which means program mode is entered

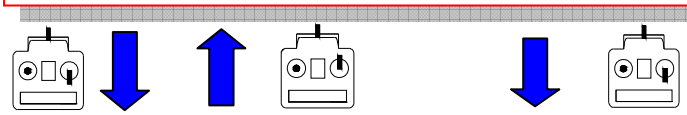


2.Select programmable items

After entering program mode ,you will hear 9 tones in a loop in the following sequence. If you move the throttle stick to bottom within 2 seconds after one kind of tone, this item will be selected.

(1) "beeb-"	(1 short tone)	**Brake**
(2) "beeb- beeb-"	(2 short tone)	**Timing**
(3) "beeb- beeb- beeb-"	(3 short tone)	**Startup mode**
(4) "beeb- beeb- beeb- beeb-"	(4 short tone)	**Cutoff mode**
(5) "beeb----- "	(1 long tone)	**Throttle curve**
(6) "beeb----- beeb- "	(1 long 1 short)	**Li-xx cells**
(7) "beeb----- beeb- beeb-"	(1long 2 short)	**Cutoff threshold**
(8) "beeb----- beeb- beeb- beeb-"	(1 long 3 short)	**Reverse setting**
(9) "beeb----- beeb----- beeb-----"	(3 long stone)	**Exit**

Note: 1 long "beeb-----" = 5 short "beeb-".

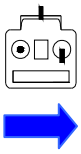


3.Set item value

After entering the item, you will hear several tones in loop, Set the value matching to a tone by moving throttle stick to top within 2 second when you hear the tone, then you will hear special tone like **"♪ 5 6 5 6".** It means the value is set and saved.

Wait for 3 second, you will go back to step 2, if push the throttle stick to the bottom position within 2 second, you will exit the program mode quickly.

Tone / Items	beeb- 1 tone	beeb-beeb- 2 tone	beeb-beeb-beeb- 3 tone	beeb- beeb-… N tone
1.Brake	Off	Soft brake	Hard brake	
2.Timing	Low	Mid	High	
3.Start Mode	Fast	Soft	Very Soft	
4.Cutoff Mode	Reduce power	Shut down		
5.Throttle Curve	Curve 1	Curve 2	Curve 3	
6.Li-xx Cells Number	Auto detect	2 cells	3 cells	N cells
7.Cutoff threshold	Low(2.6V)	Mid(2.85V)	High(3.1V)	
8.Motor Rotation	Forward	Reverse		



4.Exit program

There are two ways to exit program mode:

1. In step 2, after 3 long tone (The item #9)， please move throttle stick to the bottom position within 2 seconds.
2. In step 3,after special tone **"♪ 5 6 5 6"**, please move throttle stick to the bottom position within 2 seconds.

Note: 1. In "Li-xx Cells Number"setting, 1 long "**beeb-----**" = 5 short "**beeb-**". For example,1 long "**beeb-----**" plus 3 short "**beeb-**" (5+3 =8), means a 8 cells Li-xx battery pack..

2. If a Li-xx battery pack is more than 4 cells, you'd better set the "Li-xx Cells Number" manually.

Program example with transmitter

Setting "**Timing Mode**"to "**High**", i.e. value #3 in program item #2

1． Enter Program mode Push the throttle stick to the top position, switch on the transmitter, connect battery to the ESC; wait for 2 seconds, **"beeb- beeb-"** will be emitted, then wait for another 6 seconds, special tone **"♪ i 3 i 3"** will be heard, that means program mode is entered.
2． Select Programmable Items There are 9 different tones in loop, when you hear **"beeb- beeb-"** (2 short tone),push the throttle stick to the bottom position within 2 seconds, the "**Timing Mode**"is selected.
3． Set Item Value (Programmable Value) There are 3 tones match to 3 item value. When you hear **"beeb- beeb- beeb-"** (3 short tone),push the throttle stick to the top position within 2 seconds, special tones **"♪ 5 6 5 6"** will be heard, that means "**Timing Mode**"is set as "**High**" and saved.
4． Exit Program Mode After hearing special tones **"♪ 5 6 5 6"** , push the throttle stick to the bottom within 2 seconds, you will exit program mode.