

Manual of Sensorless Brushless Motor Speed Controller

Thank you for purchasing Our Electronic Speed Controller (ESC) for sensorless brushless motor. High power system for RC model can be very dangerous, we strongly suggest you reading this manual carefully.

Features:

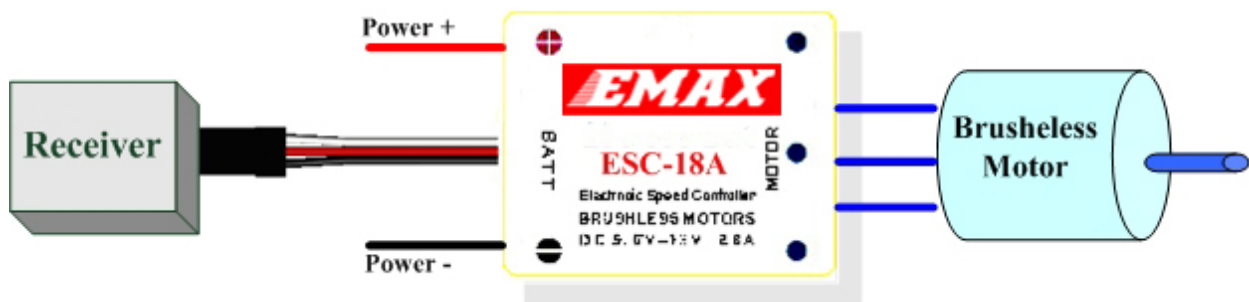
- ✓ Great innovation: First on earth with Lithium battery Balance Discharge Monitoring and Protection Design, real time monitoring the discharge voltage of each Li-xx (Li-ion/Li-poly) cell in a battery pack. No longer worry about over discharge problem, your Lithium battery pack will have much longer life. This design help you to reduce costs for buying battery packs.
- ✓ Dual PCBs for 18A and 25A series: Control circuit and MOSFET circuit use separate PCB, adiabatic air gap between 2 PCBs reduces the heat exchange form MOSFET to control circuit, so the ESC works more reliable.
- ✓ Startup music playing functionality.
- ✓ Extreme low resistance, super current endurance.
- ✓ Full protection features: Low-voltage cutoff protection / over-heat protection / throttle signal lost protection
- ✓ 3 startup modes: Normal / Soft / Super-Soft startup, can be used for both fixed-wing aircraft or helicopter models
- ✓ Throttle range can be configured, fully compatible with all market available transmitters.
- ✓ Smooth and accurate speed control, excellent throttle linearity.
- ✓ Microprocessor and BEC(Battery Elimination Circuit) use separate voltage regulator IC , with good anti-jamming capability.
- ✓ Supported highest motor speed: 210000 RPM(2 poles), 70000 RPM(6 poles), 35000 RPM(12 poles).
- ✓ Own complete intellectual property rights, software can be upgraded for our customers.
- ✓ Programming CARD in a very small size can be purchased additionally (for easily programming the ESC on field).

Specification:

MODEL \ FUNCTION	30A	25A			18A			12A	
		GV1.1 Aircraft edition	GHV1.1 Heli edition	S1.1 Standard Edition	GV1.1 Aircraft edition	GHV1.1 Heli edition	S1.1 Standard Edition	G1.1 Aircraft edition	GH1.1 Heli edition
Balance discharge protection		●	●		●	●			
Dual Heat Radiators	●		●			●			
Current (Continues)	30A	25A	25A	25A	18A	18A	18A	12A	12A
Current (Burst, > 10 seconds)	40A	35A	35A	35A	22A	22A	22A	15A	15A
BEC Output	2A	2A	2A	2A	2A	2A	2A	1A	2A
Input: Li-ion / Li-poly NiMh / Nicd	2-4 5-12	2-4 5-12	2-4 5-12	2-4 5-12	2-4 5-12	2-4 5-12	2-4 5-12	2-4 5-12	2-4 5-12
User Programming Function	●	●	●	●	●	●	●	●	●
Weight	25g	25g	27g	24g	22g	24g	21g	12g	13g
Size (mm ³)	25*45* 11	24*45* 11	24*45* 12	24*45* 11	24*45* 11	24*45* 12	24*45* 11	24*32* 8	24*32* 10

- Remark:**
- 1) "●" = The function is available;
 - 2) "G" means "Best for aircraft", there isn't a heat radiator on BEC circuit; "H" means "Best for Heli", there is a aluminum heat radiator on BEC circuit ,the BEC output is more stabilized; "S" means standard edition, it is suitable for beginners and Intermediate Player;
"V" means Balance discharge protection function is provided.
 - 3) Balance discharge protection function is unavailable for 12A series because of the light weight consideration.

Wiring Diagram:



Feature Explanation:

1. **Brake Settings:** brake enabled / brake disabled, default is brake disabled
2. **Battery Type:** Li-xx(Li-ion or Li-poly) / Ni-xx(NiMh or Nicd), default is Li-xx.

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3. **Low Voltage Protection Mode(Cutoff Mode):** power reducing / power cutoff, default is power reducing.
4. **Low Voltage Protection Threshold(Cutoff Threshold):** low / medium / high, default is medium cutoff voltage.
 - **When not using Balance discharge protection function** (i.e. **Do not** plug the balance charge connector into the balance discharge protection socket on ESC, in this case , the ESC only monitor the voltage of whole battery pack)
 - 1) For Li-xx battery, number of battery cells are judged automatically, low / medium / high cutoff voltage for each cell are: 2.5V/2.75V/3.0V. For example: 3 Cell Li-Poly, when medium cutoff voltage is set, the cutoff voltage is: $2.75 \times 3 = 8.25V$.
 - 2) For Ni-xx battery, low / medium / high cutoff voltages are 60%/65%/70% of the startup voltage. For example: 6 cell NiMH battery, fully charged voltage is $1.44 \times 6 = 8.64V$, when low cutoff voltage is set, the cutoff voltage is : $8.64 \times 60\% = 5.2V$.
 - **When using Balance discharge protection function** (i.e. Plug the balance charge connector into the balance discharge protection socket on ESC, in this case , the ESC monitor the voltage of whole battery pack **AND** the voltage of each cell) For Li-xx battery, low / medium / high cut off voltage for each cell are: 2.5V/2.75V/3.0V. When the voltage of one cell in battery pack is lower than the cutoff threshold, the protecting program is activated.
5. **Startup mode:** normal / soft / super-soft, default is normal startup.

Normal is good for fixed-wing aircraft. Soft / super-soft are good for helicopters. The initial speeds of soft / super-soft mode are pretty slow ,1sec(soft startup) / 2secs(super-soft startup) from startup to full speed. But if throttle is closed (throttle stick moves to bottom)and opened again(throttle stick moves up) within 3 seconds after the first startup, the startup will be in normal mode to get rid of the chances of crash caused by slow throttle response in aerobatic fly.
6. **Timing:** low / medium / high, default is medium timing.

In normal cases, low timing can be used for most motors. But for high efficiency, we recommend the **Low** timing for 2 poles motor and **Medium** timing for 6 poles and above. For higher speed, **High** timing could be used.

Attention: High timing could cause problem with some motors. Please test on ground first!

Special Hint

Some high KV out-rotor motors have very special configuration, the space between each alnico is very large, and some ESC can't startup these motors. After program updating, our ESCs have very good compatibility with these motors. But some RC fans still have several questions about the programming value for special motors. So we just give some suggestion as follows:

Motor	Programming Value Suggestion	Timing	Startup Mode
General inner - rotor motor		Low	Aircraft use "normal" startup mode
General out-rotor motor		Medium	Helicopter use "super-soft" startup mode
Align 42OLF (Made in TAIWAN)		High (MUST)	
450TH (Made in TAIWAN)		Medium	Soft (MUST)

Begin To Use Your New ESC

Before using your new ESC, please check all the connections to make sure that they are reliable, then start up the ESC in the following sequence:

1. Move the throttle stick to bottom, and then switch on the transmitter.
2. Connect battery pack to ESC, the ESC begin the self-test process, after 2 seconds a long "beep-----" tone should be emitted, means self-test is OK, and then the motor begin to play music, now the aircraft/helicopter is ready to go flying.
 - If nothing is happened, please check the battery pack and all the connections;
 - If a special tone " 56721" is emitted after 2 beep tone (beep-beep-), means the ESC has entered the programming mode, i.e. the throttle channel of your transmitter is reversed, please set it correctly;
 - If a very rapid "beep-beep-, beep-beep-" tone is emitted, means the input voltage is too high or too low, please check your battery.
3. After the motor begin to play music, several "beep-"tone should be emitted, present the setting value of each program item. You can move throttle stick upwards to go flying at this time. It is unnecessary to wait the "beep-"tone finished.
4. **"VERY IMPORTANT!"** Because different transmitter has different throttle range, we strongly suggest you using the "Throttle Range Setting Function" to calibrate throttle range. Please read the instruction on page 3-----"Throttle Range Setting".

Alert Tone

1. Input voltage abnormal alert tone: The ESC begin to check the voltage of battery pack when power on, when the voltage is not in acceptable range, such a alert tone will be emitted: "beep-beep-, beep-beep-,beep-beep-"(every "beep-beep-" has a time interval about 1 second.)
2. Throttle signal abnormal alert tone: When the ESC can't detect the normal throttle signal, such a alert tone will be emitted: "beep-,beep-,beep-"(every "beep-" has a time interval about 2 seconds.)
3. Throttle stick not in bottom alert tone: When the throttle stick is not in bottom (lowest) position, a very rapid alert tone will be emitted: "beep-,beep-,beep-" (every "beep-" has a time interval about 0.25 second.)

Protection Function

1. Start up protection: If the motor failed to start up in 2 seconds while the throttle stick moving up, the ESC will cut off the output power. In this case, the throttle stick **MUST** be moved to bottom again to restart the motor. (Such a situation happens in the following cases: The connection between ESC and motor is not reliable, Propeller is blocked, Gearbox is damaged, etc.)
2. Over-heat protection: When the temperature of control circuit PCB is over 110°C, the ESC will reduce the output power.

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3. Throttle signal lost protection: The ESC will reduce output power if throttle signal lost for 1 second, further lost for 2 seconds will cause its output cut off.

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Normal startup procedure:

Switch on transmitter, move throttle stick to bottom	Connect battery packs to ESC, special tone like "♪123" means power supply is OK	When self-test is finished, a long "beep-----"tone should be emitted	Begin to play music, ready to go flying	Several "beep-" tone should be emitted, present the value of each program item	Move throttle stick upwards to go flying
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Throttle range setting: (Throttle range should be set each time when a new transmitter is used together with this ESC)

Switch on transmitter, move throttle stick to top	Connect battery packs to ESC, and then wait for about 2 seconds	"Beep-beep" tone should be emitted, means throttle range highest point has been confirmed	Move throttle stick to bottom, wait for about 1 seconds	"Beep-" tone should be emitted, means throttle range lowest point has been confirmed	Begin to play music, ready to go flying
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Programming with transmitter(4 Steps):

1. entering programming mode
2. selecting items
3. set item value
4. exit programming

1. Entering programming mode

- 1) Switch on transmitter, move throttle stick to top, connect the battery packs to controller
- 2) Wait for 2 seconds, the controller should emit tone like "beep-beep"
- 3) Wait for another 5 seconds, special tone like "56721" should be emitted, this means programming mode is entered



2. Selecting items:

After entering programming mode, you can hear 8 tones in a loop in following sequence. After one tone within 3 seconds, if you move the throttle stick to bottom, then this item is selected.

- | | | |
|--------------------------|--------------------|------------------|
| 1. "beep" | brake | (1 short tone) |
| 2. "beep-beep" | battery type | (2 short tone) |
| 3. "beep-beep-beep" | cutoff mode | (3 short tone) |
| 4. "beep-beep-beep-beep" | cutoff threshold | (4 short tone) |
| 5. "beep-----" | startup mode | (1 long tone) |
| 6. "beep-----beep" | timing | (1 long 1 short) |
| 7. "beep-----beep-beep" | set all to default | (1 long 2 short) |
| 8. "beep-----beep-----" | exit | (2 long tone) |

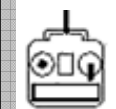
Remark: 1 long "beep-----" = 5 short "beep"



3. Set item value:

You will hear tones in loop. Set the value matching to a tone by moving throttle stick to top after hearing this tone, then you can hear the special tone "i5i5" means the value is set and saved. (Keeping the stick at top, you will go back to step 2 and you can select other items; Moving the stick to bottom within 2 seconds, you will exit the programming mode directly)

Tones	"beep-" 1 short tone	"beep-beep-" 2 short tones	"beep-beep-beep" 3 short tones
Brake	Off	On	
Battery type	Li-xx	Ni-xx	
Cutoff mode	Reduce power	Shut down	
Cutoff threshold	Low	Midium	High
Startup mode	Normal	Soft	Super soft
Timing	Low	Midium	High



4. Exit programming

There are 2 ways:

1. In step 3, after special tone "i5i5", move throttle stick to bottom within 2 seconds.
2. In step 2, after tone "beep-----beep-----", move throttle stick to bottom within 3 seconds.

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Programming example

Setting startup mode to "super-soft", i.e. value #3 in program item #5

1.Entering Programming Mode

Switch on transmitter, move throttle stick to top, connect battery pack to ESC, wait for 2 seconds, "beep-beep" tone should be emitted. Then wait another 5 seconds, special tone like "56721" should be emitted, means programming mode is entered.

2.Selecting Items

Now you'll hear 8 tones in a loop. When a long "beep-----" tone is emitted, move throttle stick to bottom, select the "Startup Mode" item

3.Set Item Value

"Beep-", wait for 3 seconds; "Beep-beep-", wait for another 3 seconds; then you'll hear "beep-beep-beep", move throttle stick to top, then a special tone "1515" is emitted, now you have set the "Startup Mode" in "Super-soft Startup"

4.Exit Programming

After the special tone "1515", move throttle stick to bottom within 2 seconds.

Trouble Shooting

Trouble	Possible Reason	Action
After power on, motor can't work, no sound is emitted	The connection between battery pack and ESC is not OK	Check the power connection. Replace the connector.
After power on, motor can't work, such a alert tone is emitted: "beep-beep-, beep-beep-,beep-beep-" (every "beep-beep-" has a time interval about 1 second.)	Input voltage abnormal, too high or too low	Check the voltage of battery pack
After power on, motor can't work, such a alert tone is emitted: "beep-, beep-,beep- " (every "beep-" has a time interval about 2 seconds.)	Throttle signal is abnormal	Check the receiver and transmitter Check the cable of throttle channel
After power on, motor can't work, such a alert tone is emitted: "beep-, beep-,beep- "(every "beep-" has a time interval about 0.25 second.)	Throttle stick not in bottom(lowest) position	Move the throttle stick to bottom
After power on, motor can't work, a special tone "56721" is emitted after 2 beep tone (beep-beep-)	The direction of throttle channel is reversed, so the ESC has entered the programming mode	Set the direction of throttle channel correctly
The motor runs in opposite direction	The connection between ESC and the motor need to be changed.	Swap any two wire connections between ESC and motor
The motor stop running while in working state	Throttle signal is lost	Check the receiver and transmitter Check the cable of throttle channel
	ESC has entered Low Voltage Protection mode	Land RC model as soon as possible, Replace the battery pack
	Some Connections are not reliable	Check all the connections: battery pack connection, throttle signal cable, motor connections, etc.