

**Features:**

- ◆ Compatible with Lithium and Nickel battery types. (Lithium-Ion / Lithium-Polymer or Nickel Metal Hydride / Nickel Cadmium)
- ◆ Extreme low output resistance, super current endurance.
- ◆ Multiple protection features: Low-voltage cut-off protection / over-heat protection / throttle signal loss protection.
- ◆ 3 start modes: Normal / Soft / Super-Soft, compatible with fixed-wing aircraft and helicopter.
- ◆ Throttle range can be configured to be compatible with all transmitters currently available on market.
- ◆ Smooth, linear and precise throttle response.
- ◆ Separate voltage regulator IC for microprocessor (except Pentium-6A and Pentium-10A), providing good anti-jamming capability.
- ◆ Supported motor speed (Maximum): 210000 RPM (2 poles), 70000 RPM (6 poles), 35000 RPM (12 poles).

**Specifications:**

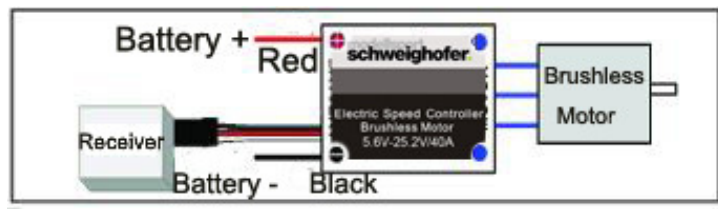
Model	ContinueCurrent	Burst Current(10s)	Battery Cell	Wt.(G)	BEC Output	BEC type	Dimension(W*L*H )
45A	45A	55A	2-6 Lipo/5-18 NiMH	42.5	5V/3A	Switch	28*60*13.5

BEC Output Capability	Linear Mode BEC(5V/2A)				Switch Mode BEC(5V/3A)	
	2S Li-Poly	3S Li-Poly	4 S Li-Poly	5 S Li-Poly	2S-4 S Li-Poly	5S-6 S Li-Poly
Standard micro servos(Max.)	5	4	3	2	5	4

**Note1:** BEC means the "Battery Elimination Circuit". It is a DC-DC voltage regulator to supplies the receiver and other equipments from the main battery pack. With the build-in BEC of an ESC, the receiver needn't to be supplied with an additional battery pack.

**IMPORTANT!** The ESC named "xxx-xxx-OPTO" hasn't a built-in BEC, an UBEC (Ultimate-BEC) or an individual battery pack should be used to power the receiver. And an individual battery pack is needed to power the program card when setting the programmable value of such ESCs, please read the user manual of program card for reference.

**Wiring Diagram:**



**Programmable Items:**

1. **Brake Setting:** Enabled / Disabled, default is Disabled
2. **Battery Type:** Li-xx(Li-ion or Li-poly) / Ni-xx(NiMH or NiCd), default is Li-xx.
3. **Low Voltage Protection Mode(Cut-Off Mode):** Soft Cut-Off (Reduce the output power gradually) or Cut-Off (Stop the output power immediately). Default is Soft Cut-Off.
4. **Low Voltage Protection Threshold(Cut-Off Threshold):** Low / Medium / High, default is Medium.
  - ◆ **When NOT using balance discharge monitoring and protection function** (i.e. **Not** plugging the balance charge connector into the BDMP socket on the Guard series ESC, the ESC only monitors the voltage of the whole battery pack )
    - 1) For lithium batteries, the number of battery cells is calculated automatically. Low / medium / high cutoff voltage for each cell is: 2.6V/2.85V/3.1V. For example: For 3 cells lithium pack, when "Medium" cutoff threshold is set, the cut-off voltage will be: 2.85\*3=8.55V.
    - 2) For nickel batteries, low / medium / high cutoff voltages are 0%/45%/60% of the startup voltage (i.e. the initial voltage of battery pack), and 0% means the low voltage cut-off function is disabled. For example: For a 10 cells NiMH battery, fully charged voltage is 1.44\*10=14.4V, when "Medium" cut-off threshold is set, the cut-off voltage will be:14.4\*45%=6.5V.
  - ◆ **When using balance discharge monitoring and protection function** (i.e. Plugging the balance charge connector on battery

pack into the BDMP socket on the Guard series ESC, the ESC monitors are not only the voltage of the whole battery pack but also the voltage of each cell). For lithium battery, low / medium / high cut off voltage for each cell is: 2.6V/2.85V/3.1V. When the voltage of any cell in battery pack is lower than the cut-off threshold, the protection function is activated.

**5. Startup Mode:** Normal /Soft /Super-Soft, default is Normal.

Normal is preferred for fixed-wing aircraft. Soft or Super-soft are preferred for helicopters. The initial acceleration of the Soft and Super-Soft modes are slower in comparison, usually taking 1 second for Soft startup or 2 seconds for Super-Soft startup from initial throttle advance to full throttle. If the throttle is closed (throttle stick moved to bottom) and opened again (throttle stick moved to top) within 3 seconds of the initial startup, the restart-up will be temporarily changed to normal mode to get rid of the chances of a crash caused by slow throttle response. This special design is very suitable for aerobatic flight when quick throttle response is needed.

**6. Timing:** Low / Medium / High, default is Low. *Note2*

Low timing value usually can be used for most motors. So we recommend the Low timing value for 2 poles motor and Medium timing value for motors with more than 6 poles to get a high efficiency. For higher speed, High timing value can be chosen.

**Note2:** After changing the timing setting, please test your RC model on ground prior to flight!

**Special Note**

Some high KV out-runner motors have very special construction, for the space between each magnet is very large, and many ESCs can't drive these motors. After much testing, our ESCs have proven to work very well with these types of motors. Some RC enthusiasts still have several questions about the programming value for these special motors. Therefore, we have provided some suggestions as

Programmable Value Suggestions Motor type	Timing	Startup Mode
Generic in-runner motor	Low	Aircraft Usually use "Normal" startup mode and helicopter use "Super-soft" startup mode
Generic out-runner motor	Low or Medium	
Align420LF (Made in TAIWAN, out-runner)	High (MUST)	
450TH (Made in TAIWAN, out-runner)	Low	Soft (MUST)

follows:

**Begin To Use Your New ESC**

1. Move the throttle to stick the bottom position and then switch on the transmitter.
2. Connect the battery to pack the ESC, when the ESC begins the self-test process, a special tone "b123" is emitted, which means the voltage of the battery pack is in normal range, and then N "beep" tones will be emitted, which means the number of lithium battery cells. Finally a long "beep-----" tone will be emitted, which means self-test is OK, 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 "b56712" is emitted after 2 beep tones ("beep-beep-"), which means the ESC has entered the program mode, it is because the throttle channel of your transmitter is reversed, please set it correctly;
  - ◆ If the very rapid "beep-beep-, beep-beep-" tones is emitted, which means the input voltage is too low or too high, please check your battery's voltage.
3. **"VERY IMPORTANT !"** Because different transmitters have different throttle range, we strongly suggest you use the "Throttle Range Setting Function" to calibrate throttle range.

**Alert Tone**

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

**Protection Function**

1. Abnormal start up protection: If the motor fails to start within 2 seconds of throttle application, the ESC will cut-off the output power. In this case, the throttle stick **MUST** be moved to the bottom again to restart the motor. (Such a situation happens in the following cases: The connection between ESC and motor is not reliable, the propeller or the motor is blocked, the gearbox is damaged, etc.)
2. Over-heat protection: When the temperature of the ESC is over 110 Celsius degrees, the ESC will reduce the output power.
3. Throttle signal loss protection: The ESC will reduce the output power if throttle signal is lost for 1 second, further loss for 2 seconds will cause its output to be cut-off completely.

**Program Example** Setting "Start Mode" to "Super-Soft", i.e. value #3 in the programmable item #5

<p><b>1. Enter Program Mode</b> Switch on transmitter, move throttle stick to top position, connect battery pack to ESC, wait for 2 seconds, "beep-beep" tone should be emitted. Then wait for another 5 seconds, special tone like "♪56712" should be emitted</p>
<p><b>2. Select Programmable Items</b> Now you'll hear 8 tones in a loop. When a long "beep-----" tone is emitted, move throttle stick to bottom to enter the "Start Mode"</p>
<p><b>3. Set Item Value (Programmable Value)</b> "Beep-", wait for 3 seconds; "Beep-beep-", wait for another 3 seconds; then you'll hear "beep-beep-beep", move throttle stick to top position, then a special tone "♪i5i5" is emitted, now you have set the "Start Mode" item to the value of "Super-Soft"</p>
<p><b>4. Exit Program Mode</b> After the special tone "♪i5i5", move throttle stick to bottom within 2 seconds.</p>

**Trouble Shooting**

Trouble	Possible Reason	Action
After power on, motor does not work, no sound is emitted	The connection is not correct between battery pack and ESC	Check the power connection. Replace the connector.
After power on, motor does not work, such an alert tone is emitted: "beep-beep-,beep-beep-,beep-beep-" (Each "beep-beep-" has the time interval of about 1 second)	Input voltage is abnormal, too high or too low. The connector of Balance charger is not located properly in BDMP adapter.	Check the voltage of battery pack Check the connection of the balance charger connector and the BDMP adapter.
After power on, motor does not work, such an alert tone is emitted: "beep-, beep-, beep-" (Each "beep-" has the time interval of about 2 seconds)	Throttle signal is irregular	Check the receiver and transmitter Check the cable of throttle channel
After power on, motor does not work, such an alert tone is emitted: "beep-, beep-, beep-" (Every "beep-" has the time interval of about 0.25 second)	The throttle stick is not at the bottom (lowest) position	Move the throttle stick to bottom position
After power on, motor does not work, a special tone "♪56712" is emitted after twice (beep-beep-)	Direction of the throttle channel is reversed, so the ESC has been entered the program mode	Set the direction of throttle channel correctly
The motor runs in the opposite direction	The connection needs to be changed between ESC and themotor.	Swap any two wire, connected between ESC andmotor
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, and thenreplace the battery pack
	Some connections are not reliable	Check all the connections: battery pack connection, throttle signal cable, motorconnections, etc.
Random stop or restart or irregular working state	There is strong electro-magnetic interference in flying field.	Reset the ESC to resume normal operation. If not, you might need to moveto another area to fly.

**Normal startup procedure:**

Move throttlestick to bottom and then switch on	Connect battery pack to ESC, special tone like "♪123" means power supply is OK	Several "beep-" tones should be emitted, presenting the number of lithium battery cells	When self-test is finished, a long "beep-----"tone should be emitted	Move throttle stick upwards to go flying
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**Throttle range setting: (Throttle range should be reset whenever a new transmitter is being used)**

Switch on transmitter, move throttle stick to top	Connect battery pack to ESC, and wait for about 2 seconds	"Beep-Beep-" tone should be emitted, means throttle range highest point has been correctly confirmed	Move throttle stick to the bottom, several "beep-" tones should be emitted, presenting the number of battery cells	A long "Beep-" tone should be emitted, means throttle range lowest point has been correctly confirmed
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**Program the ESC with your transmitter (4 Steps):**

1. Enter program mode
2. Select programmable items
3. Set item's value (Programmable value)
4. Exit program mode

<p><b>1. Enter program mode</b> 1) Switch on transmitter, move throttle stick to top, connect the battery pack to ESC 2) Wait for 2 seconds, the motor should emit special tone like "beep-beep-" 3) Wait for another 5 seconds, special tone like "56712" should be emitted, which means program mode is entered</p>
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<p><b>2. Select programmable items:</b> After entering program mode, you will hear 8 tones in a loop with the following sequence. If you move the throttle stick to bottom within 3 seconds after one kind of tones, this item will be selected.</p> <ol style="list-style-type: none"> <li>1. "beep" brake (1 short tone)</li> <li>2. "beep-beep-" battery type (2 short tone)</li> <li>3. "beep-beep-beep-" cutoff mode (3 short tone)</li> <li>4. "beep-beep-beep-beep-" cutoff threshold (4 short tone)</li> <li>5. "beep-----" startup mode (1 long tone)</li> <li>6. "beep-----beep-" timing (1 long 1 short)</li> <li>7. "beep-----beep-beep-" set all to default (1 long 2 short)</li> <li>8. "beep-----beep-----" exit (2 long tone)</li> </ol> <p><b>Note: 1 long "beep-----" = 5 short "beep-"</b></p>
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**3. Set item value (Programmable value):**  
You will hear several tones in loop. Set the value matching to a tone by moving throttle stick to top when you hear the tone, then a special tone "♪i5i5" emits, means the value is setted and saved. (Keeping the throttle stick at top, you will go back to step 2 and you can select other items; Moving the stick to bottom within 2 seconds will exit program mode directly)

Tones Items	"beep-" 1short tone	"beep-beep-" 2short tones	"beep-beep-beep-" 3short tones
<b>Brake</b>	Off	On	
<b>Battery type</b>	Li-ion/Li-poly	NiMH/NiCd	
	Soft-Cut	Cut-Off	
<b>Cutoff thre shold</b>	Low	Medium	High
<b>Start mode</b>	Normal	Soft	Super soft
	Low	Medium	High

<p><b>4. Exit program mode</b> There have 2 ways to exit program mode: 1. In step 3, after special tone "♪i5i5", please move throttle stick to the bottom position within 2 seconds. 2. In step 2, after tone "beep-----beep-----"(ie. The item #8), move throttle stick to bottom within 3 seconds.</p>
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