

Thank you for purchasing THUNDER POWER's Electronic Speed Controller (ESC).

Features:

- Great innovation of **Lithium Battery Balance Discharge Monitoring and Protection Design**, which provides real time monitoring of the discharge voltage of each lithium (Li-ion/Li-poly) cell in a battery pack. Never worry about over discharge problem again; your lithium battery pack could have a much longer life. (**Important Note: This function is ONLY available for Thunder Power Smart Guide / LiPo Saver Series ESC**)
- Extreme low output resistance, super current endurance.
- Full protection features: Low-voltage cutoff protection, over-heat protection, and throttle signal loss protection.
- 3 startup modes: Normal, Soft, or Very-Soft, can be used for both fixed-wing aircraft and helicopter models.
- Throttle range can be configured, fully compatible with all market available transmitters.
- Smooth and accurate speed control, excellent throttle linearity.
- Microprocessor uses 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).
- Our pocket-sized **eZ Programmer** card can be purchased separately for extremely easy programming of the ESC in the field.

WARNING: High power systems for RC models can be very dangerous, so we strongly suggest you read this manual carefully. We have no control over the correct use, installation, application, or maintenance of our products; therefore, no liability shall be assumed nor accepted for any damages, losses, or costs resulting from the use of the product. Any claims arising from the operating, failure, or malfunctioning, etc. of the ESC will be denied. We assume no liability for personal injury, property damage, or consequential damages resulting from using our product or our workmanship. As far as is legally permitted, the obligation to compensation is limited to the invoice amount of the affected product.

Specification: Smart Guide / LiPo Saver Series

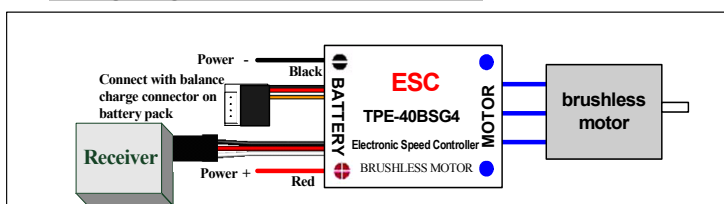
Thunder Power Electronic Speed Controllers For Brushless Motors											
Class	Model	Cont. Current	Burst Current (>10s)	BEC Mode	BEC Output	# of Battery Cells		User Programmable	Balance Discharge Protection	Weight	Size
						Li-ion Li-poly	NiMH NiCd				LxWxH mm
18A	TPE-18BSG3	18A	22A	Linear	5V/2A	2-3	5-12	YES	YES	24g	45x26x10
25A	TPE-25BSG3	25A	35A	Linear	5V/2A	2-3	5-12	YES	YES	27g	45x26x11
30A	TPE-30BSG3	30A	40A	Linear	5V/2A	2-3	5-12	YES	YES	29g	45x26x11
40A	TPE-40BSG4	40A	55A	Switch Mode	5V/3A	2-4	5-15	YES	YES	40g	55x28x15
40A	TPE-40BSG5	40A	55A	Switch Mode	6V/3A	2-5	5-18	YES	YES	TBA	TBA
60A	TPE-60BSG6	60A	80A	Switch Mode	6V/3A	2-6	5-18	YES	YES	TBA	TBA
80A	TPE-80BSG6	80A	100A	Switch Mode	6V/3A	2-6	5-18	YES	YES	TBA	TBA
80A	TPE-80OPT6	80A	100A	N/A	N/A	2-6	5-18	YES	YES	TBA	TBA
100A	TPE-100OPT12	100A	120A	N/A	N/A	5-12	10-36	YES	YES	TBA	TBA

Specification: High Grade Series

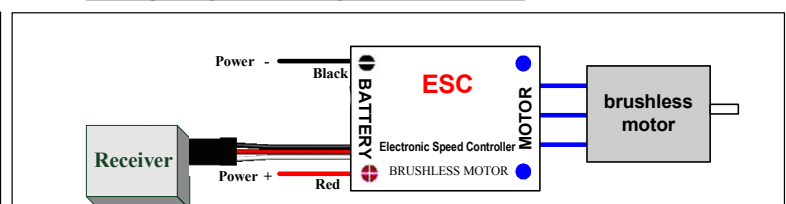
Thunder Power Electronic Speed Controllers For Brushless Motors											
Class	Model	Cont. Current	Burst Current (>10s)	BEC Mode	BEC Output	# of Battery Cells		User Programmable	Balance Discharge Protection	Weight	Size
						Li-ion Li-poly	NiMH NiCd				LxWxH mm
6A	TPE-6B3	6A	8A	Linear	5V/0.8A	2-3	5-9	YES	N/A	6g	24x12x7.5
10A	TPE-10B4	10A	12A	Linear	5V/1A	2-4	5-12	YES	N/A	9g	27x17.5x7.5
12A	TPE-12B4	12A	15A	Linear	5V/2A	2-4	5-12	YES	N/A	13g	32x24x10
18A	TPE-18B4	18A	22A	Linear	5V/2A	2-4	5-12	YES	N/A	19g	45x24x11
25A	TPE-25B4	25A	35A	Linear	5V/2A	2-4	5-12	YES	N/A	22g	45x24x11
30A	TPE-30B4	30A	40A	Linear	5V/2A	2-4	5-12	YES	N/A	25g	45x24x11
80A	TPE-80OPT6	80A	100A	N/A	N/A	2-6	10-18	YES	N/A	TBA	TBA
100A	TPE-100OPT12	100A	120A	N/A	N/A	5-12	10-36	YES	N/A	TBA	TBA

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

Wiring Diagram for LiPo Saver Series:



Wiring Diagram for High Grade Series:



Lithium Battery Balance Discharge Monitoring and Protection Adapter:

Each Smart Guide / Lipo Saver Series ESC is provided with a Lithium Battery Balance Discharge Monitoring and Protection Adapter. See LiPo Saver Series table above for the # of battery cells individually monitored by each Smart Guide / LiPo Saver model.

VERY IMPORTANT! You **MUST** connect the adapter with the balance charge connector on battery pack **BEFORE** connecting the main power to ESC.

Programming Features Explanation:

- 1. Brake Settings:** Brake Enabled or Brake Disabled. **Default is Brake Disabled.**
- 2. Battery Type:** Li-xx(Li-ion or Li-poly) or Ni-xx(NiMH or Nicd). **Default is Li-xx.**
- 3. Cutoff Type (Low Voltage Protection Mode):** Soft cutoff (Gradually reduces the output power) or Cutoff (Immediately stops output power, also known as Hard Cutoff). **Default is soft cutoff.**
- 4. Cutoff Voltage (Low Voltage Protection Threshold):** Low, Medium, or High. **Default is Medium.**
 - ◆ **When NOT using balance discharge monitoring and protection function** (i.e. **Not** plugging the balance charge connector into the balance discharge monitoring and protecting socket on the LiPo Saver Series ESCs, the ESC only monitors the voltage of the whole battery pack)
 - 1) For Li-xx battery, the number of battery cells is calculated automatically. Low / medium / high cutoff voltage for each cell is: 2.75V / 3.0V / 3.25V. For example: For a 3 cell LiPo, when medium cutoff voltage is set, the cutoff voltage will be: $3.0 \times 3 = 9.0V$.
 - 2) For Ni-xx battery, low / medium / high cutoff voltages are 0% / 50% / 65% of the startup voltage (i.e. the initial voltage of battery pack), and 0% means low voltage cutoff function is disabled. For example: For a 6 cell NiMH battery, fully charged voltage is $1.44 \times 6 = 8.64V$; when "medium" cutoff voltage is set, the cutoff voltage will be: $8.64 \times 50\% = 4.3V$.

(Important: For the LiPo Saver Series ESCs, the low / medium / high cutoff voltage for each Ni-xx battery cell is 0% / 45% / 60%)
 - ◆ **When using balance discharge monitoring and protection function** (i.e. Plugging the balance charge connector on the battery pack into the balance discharge monitoring and protection socket on Smart Guide / LiPo Saver Series ESC, the ESC monitors not only the voltage of the whole battery pack but also the voltage of each cell). For lithium batteries, low / medium / high cut off voltage for each cell is: 2.85/3.1V/3.35V. When the voltage of any cell in battery pack is lower than the cutoff threshold, the low voltage cutoff protection function is activated. **Note:** Only the Smart Guide / LiPo Saver Series provides this feature.
- 5. Start Mode:** Normal, Soft, or Very-Soft. **Default is Normal start.**

Normal is good for fixed-wing aircraft. Soft or Very-soft are good for helicopters. The initial speeds of Soft and Very-Soft mode are very slow, usually it takes about 1 second (Soft startup) or 2 seconds (Very-Soft startup) from startup to full speed. But if throttle is closed (throttle stick moved to bottom) and opened again (throttle stick moved up) within 3 seconds after the first startup, the restart-up will be temporarily changed to normal mode to lesson the chances of crash caused by slow throttle response in aerobatic flying.
- 6. Timing:** Low, Middle, or High. **Default is Low.**

In normal cases, Low timing can be used for most motors. But for high efficiency, we recommend the **Low** or **Medium** timing for most motors. For higher speed, the **High** timing can be chosen.

Important: After you change the timing setting, please test your RC model on ground first!

Special Hint

Some high KV out-runner motors have very special structures, the space between each alnico is very large, and many ESCs can't start up these motors. After much R&D, our ESCs have shown to have very good compatibility with these types of motors. But some RC fans still have several questions about the programming value for these special motors. Therefore, we have provided some suggestions as follows:

Motor	Programming Value Suggestion	Timing	Startup Mode
General in-runner motor		Low	Aircraft use "Normal" startup mode Helicopter use "Very-Soft" startup mode
General out-runner motor		Medium	
Align 420LF (Made in TAIWAN, out-runner)		High (MUST)	
450TH (Made in TAIWAN, out-runner)		Low	Soft (MUST)

Note: When this manual refers to "beep"s or music playing, it is referring to the sound emitted by the ESC.

For extremely easy programming, please consider using the Thunder Power eZ Programmer card (for details, visit our web site at www.thunderpower-batteries.com).

Programming Example: The following 4 steps are an example of setting **Start Mode** to "Very Soft". Please read and understand all 4 steps before attempting the programming. (See also Page 3 for details on setting up all Programming Features.)

1. Enter Programming Mode 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, and a special tone like "56712" should be emitted, which means programming mode is entered.
2. Select Items Now you'll hear 8 "beep" tones in loop. When a long "beeeeeep" tone is emitted, move throttle stick to bottom within 3 seconds to enter the " Start Mode "
3. Set Item Value You will again hear tones in a loop as follows: "Beep", wait for 3 seconds; "Beep-beep", wait for another 3 seconds; then you'll hear "beep-beep-beep", within 3 seconds of hearing the "beep-beep-beep", move throttle stick to top position, then a special tone "1515" is emitted. Now you have set the "Start Mode" item to the value of "Very-Soft Start".
4. Exit Programming After the special tone "1515", move throttle stick to bottom within 2 seconds.

Normal startup procedure:

Move throttle stick to bottom, switch on transmitter	Connect battery pack to ESC, special tone like "♪123" means power supply is OK	When self-test is finished, a long "beeeeeep" tone should be emitted	ESC begins to play music, ready to fly	Several "beep-" tones should be emitted, presenting the value of each program item	Move throttle stick upwards to go flying
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Throttle range setting: (Throttle range should be reset when ever 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, and wait for about 1 second	"Beep" tone should be emitted, means throttle range lowest point has been confirmed	ESC begins to play music, ready to fly
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Programming with throttle stick on transmitter (4 Steps):

1. Enter programming mode (see box below)
2. Select the programmable items (see box at right)
3. Set programmable item's value (see box at lower left)
4. Exit programming (see box at lower right)

1. Enter programming mode

- 1) Switch on transmitter, move throttle stick to top, connect the battery pack to ESC
- 2) Wait for 2 seconds, the motor should emit tone like "beep-beep"
- 3) Wait for another 5 seconds, special tone like "567i2" should be emitted, this means the programming mode is entered

**2. Select the programmable items:**

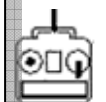
After entering programming mode, you will hear 8 tones in a loop in the sequence listed in 1 - 8 below. If you move the throttle stick to the bottom within 3 seconds after one kind of tone, then this item is selected.

- | | | |
|--------------------------|--------------------|------------------|
| 1. "beep" | brake setting | (1 short tone) |
| 2. "beep-beep" | battery type | (2 short tone) |
| 3. "beep-beep-beep" | cut off type | (3 short tone) |
| 4. "beep-beep-beep-beep" | cut off voltage | (4 short tone) |
| 5. "beeeeeep" | start mode | (1 long tone) |
| 6. "beeeeeep-beep" | timing | (1 long 1 short) |
| 7. "beeeeeep-beep-beep" | set all to default | (1 long 2 short) |
| 8. "beeeeeep-beeeeeep" | exit | (2 long tone) |

**3. Set programmable item's value:**

Once an item is selected, you will again hear tones in loop. Set the value matching to a tone by moving the throttle stick to the top when you hear the tone, then a special tone "i5i5" emits and 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 throttle stick to bottom within 2 seconds will exit you from the programming mode directly)

Tones	"beep"	"beep-beep"	"beep-beep-beep"
Items	1 short tone	2 short tones	3 short tones
Brake Setting	Disabled	Enabled	
Battery type	Li-ion / Li-poly	NiMh / Nicd	
Cut off type	Soft cutoff	Hard cutoff	
Cutoff voltage	Low	Medium	High
Start mode	Normal	Soft	Very-soft
Timing	Low	Medium	High

**4. Exit programming mode**

There are 2 ways to exit programming:

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 "beeeeeep-beeeeeep" (i.e. item #8), move throttle stick to bottom within 3 seconds.

Trouble Shooting

Trouble	Possible Reason	Action
After power on, motor will not 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 will not work, such an alert tone is emitted: "beep-beep, beep-beep, beep-beep" (Every "beep-beep" has a time interval of about 1 second)	Input voltage is wrong, too high or too low	Check the voltage of battery pack
After power on, motor will not work, such an alert tone is emitted: "beep, beep, beep "(Every "beep" has a time interval of about 2 seconds)	Throttle signal is irregular	Check the receiver and transmitter Check the throttle channel cable
After power on, motor will not work, such an alert tone is emitted: "beep, beep, beep" (Every "beep" has a time interval of about 0.25 second)	Throttle stick is not in bottom(lowest) position	Move the throttle stick to bottom
After power on, motor will not work, a special tone "56712" is emitted after 2 beep tones (beep-beep)	Direction of the throttle channel is reversed, so the ESC has entered the programming mode	Set the direction of the throttle channel correctly
The motor runs in the opposite direction	The connection between ESC and the motor needs to be changed.	Swap any two wire connections between ESC and motor
The motor stops running while in working state	Throttle signal is lost	Check the receiver and transmitter Check the throttle channel cable
	ESC has entered Low Voltage Protection mode	Land RC model as soon as possible, and then recharge the battery pack or replace with new pack
	Some Connections are not reliable	Check all the connections: battery pack connection, throttle signal cable, motor connections, etc.
Random stop and restart or irregular working state	There is a strong electro - magnetic interference in flying area.	The normal function of the ESC may be disturbed by strong Electro - Magnetic interference. If so, simply reset the ESC to resume normal operation by following the instruction manual. If the function could not resume, you might need to move to another area to fly.

Protection Function

1. Start up protection: If the motor failed to start up in 2 seconds while the throttle stick is being moved 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 the ESC is over 110°C (230°F), the ESC will reduce the output power.
3. Throttle signal lost protection: The ESC will gradually 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.
4. **"VERY IMPORTANT!"** Because different transmitters have different throttle ranges, we strongly suggest you use the "Throttle Range Setting Function" to calibrate the throttle range. Please read the instruction on page 3 - "Throttle Range Setting".