



User Manual for 4-Max High Voltage ESC

Thank you for purchasing 4-Max High Voltage Brushless Electronic Speed Controller (ESC)

High power systems for RC model can be very dangerous and we strongly suggest that you read this manual carefully.

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4-Max High Voltage ESC's (programmed by PP-PROGCARD-HV)			
Model No.	BEC	LIPO	NICD/NIMH
PP-TESC90HVAU	No BEC	6-12 Cell	16-38 Cell
PP-TESC120HVAU	No BEC	6-12 Cell	16-38 Cell

The speed controller can be connected to the motor by soldering directly or with high quality connectors with a minimum diameter of 4mm. Always use new connectors, which should be soldered carefully to the cables and insulated with heat-shrink tube. Only used "Leaded Solder"

I. Wires Connection

- ◆ Solder suitable connectors (mating halves to those fitted to your motor) to the ESC motor wires.
- ◆ Solder suitable connectors to the battery connecting wires on the ESC.
- ◆ Insulate all connectors with heat shrink tubing.
- ◆ Plug the long "servo" type wire/connector into the receiver's throttle channel.
- ◆ When ready to fly, connect the main Red and Black wires on the ESC to your battery pack paying close attention to polarity.

II. ESC Features

- ◆ Uses new generation of MOSFET to ensure high efficiency and low heat.
- ◆ Easy to program by 4-Max HV Programming box.
- ◆ Advance governor mode keeps the motor speed constant when the load on the motor changes
- ◆ 5 motor timing options and soft acceleration start-ups make the motors run smoothly
- ◆ Super smooth and accurate throttle linearity
- ◆ Supports high RPM motors.
- ◆ Power arming protection (prevents the motor from accidentally running when switched ON)
- ◆ Built-in Intelligent ESC Safety Functions:
 1. Over Temperature Protection: When the temperature of ESC exceeds 110 deg C, the ESC will reduce the output power to allow it to cool.
 2. Lost Throttle Signal Protection: The ESC will automatically reduces output power to the motor when it detects throttle signal loss for 2 second, a subsequent loss of throttle signal beyond 2 seconds, will cause the ESC automatically to cut all power to the motor.
- ◆ All functions are programmable to meet your specific needs.

III. Setting

1. Brake Type (Brake Off/Soft Brake/Mid Brake/Hard Brake)

- * Brake off — Set the propeller to freewheel when the throttle stick is at the minimum position.
- * Soft Brake — Set the propeller to 30% of the brake position when the throttle stick is at the minimum position (Recommended for folding props and some aerobatic aircraft).
- * Mid Brake — Set the propeller to 60% of the brake position when the throttle stick is at the minimum position (Recommended for folding props and some aerobatic aircraft).
- * Hard Brake — Set the propeller to 100% of the brake position when the throttle stick is at the minimum position (Recommended for folding props).

2. Battery Type (NiCd or NiMh/LiPo/LiFe)

- * NiCd/NiMh — Set Low voltage protection threshold for NiCd / NiMh cells.
- * LiPo — Set Low voltage protection threshold for LiPo cells and automatically detects the number of cells within the pack.
- * LiFe — Set Low voltage protection threshold for LiFe cells.

Note: Selecting the NiCd/NiMh option for the battery type, triggers the ESC to automatically set the cut off threshold to the factory default of 60%. The cut off threshold can then be subsequently altered through the Low Voltage protection function, if required. The ESC will read the initial voltage of the NiCd/NiMh pack once it is plugged in and the voltage read will then be used as a reference for the cut off voltage threshold.

3. Cut off Voltage Threshold (Low Voltage Protection Threshold)

- Low(2.8V/50%) / Medium(3.0V/60%) / High(3.2V/65%)(recommended) / No Protection
- * For Li-xx packs — number of cells are automatically calculated and requires no user input apart from defining the battery type. This ESC provides 4 setting options for the low voltage protection threshold; Low (2.8V)/ Medium (3.0V)/ High (3.2V)/No protection. For example: the voltage cut off options for an 11.1V/3 cell Li-Po pack would be 8.4V (Low)/ 9.0V(Med)/ 9.6V(High).
- * For Ni-xx/LiFe packs — low/medium/high cut off voltages are 50%/60%/65% of the initial voltage of the battery pack. For example: A fully charged 6 cell NiMh pack's voltage is 1.44Vx6=8.64V, when "LOW" cut off voltage is set, the cut off voltage is: 8.64Vx50%=4.3V and when "Medium" of "High" is set, the cut off voltage is now 8.64Vx65%=5.61V.

4. Restore factory setup defaults (set the ESC parameters back to default values)

Factory Default	Brake Type	Brake OFF
	Battery Type	LiPo with Automatic Cell Detect
	Cut Off Voltage Threshold	3.0V/60%
	Motor Timing	Auto
	Governor Mode	RPM OFF
	Motor Rotation	Forward
	Soft Acceleration Start Up	30%
	Low Voltage Cut off	Type Reduce Power

5. Motor Timing (to enhance ESC efficiency and smoothness) Auto/2°/8°/15°/22°/30°

Auto	ESC determines the optimum motor timing automatically
2° 8°	For most inrunner motors.
15° 22°	For motors with 6 or more poles.
30°	For most outrunners

Automatic timing works well for most types of motors. However for high efficiency we recommend the Low timing setting for 2 pole motors (in-runners) and high timing for 6 poles and above (general outrunners). For higher speed, High timing can be set. Some motors require different timing setups therefore we suggest you to follow the manufacturer recommended setup or use the automatic timing setting if you are unsure.

Note: Run your motor for a short period on the ground first after making any changes to your motor timing!

6. SBEC Voltage Output (5V/5.5V/6V)

Note: This is not applicable as it is an OPTO ESC and therefore does not have any SBEC built in.

7. Governor Mode-for heli. (RPMOFF/ 1st Soft Start / 2nd Soft Start / Governor Mode 1 / Governor Mode 2)

- * RPM off: Rpm control off
- * Soft Start For 1st soft-start, there will be a 8-second delay from start to full rpm. For 2nd soft-start, there will be a 18-second delay from start to full rpm. Note: If the throttle is cut off after starting less 3 Seconds, then the next start will be as normal start. If the throttle is cut off after starting more than 3 Seconds, the next start will be as soft start.
- * Governor Mode 1: There will be a 2-3 second delay from start to full rpm; If lower the throttle to the 80% position of the full throttle or lower than 80% position, the RPM would be definitely changed, the lost RPM will be detected and compensated automatically by the ESC that makes sure to keep the RPM at the same speed. (Note: This function is only for Low KV motor)
- * Governor Mode 2: There will be a 2-3 second delay from start to full rpm; If lower the throttle to the 80% position of the full throttle or lower than 80% position, the RPM would be definitely changed, the lost RPM will be detected and compensated automatically by the ESC that makes sure to keep the RPM at the same speed. (Note: This function is only for High KV motor)

Note1: If the throttle is cut off after starting less 3 Seconds, then the next start will be as normal start. If the throttle is cut off after starting more than 3 Seconds, the next start will be as soft start.

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Note2: Once the Governor Mode is enabled, the ESC's Brake and Low Voltage Cut off Type settings will automatically be reset to Brake Off and Reduce Power respectively, regardless of what settings they were previously set.

8. Motor Rotation (Forward / Reverse)

Motor rotation is usually reversed by swapping any two of the three motor wires. However, in cases where the motor cables have been directly soldered to the ESC cables, motor rotation can be reversed by changing the setting value on the ESC.

9. Start Up Strength (Low/Mid/High)

- * Low(10%-15%-20%) Sets ESC start up strength for the motors which needs low start up current.
* Mid (25%-30%-35%) Sets ESC start up strength for the motors which needs mid start up current.
* High(40%-45%-50%) Sets ESC start up strength for the motors which needs high start up current.

10. Low Voltage Cut Off Type (Reduce Power / Cut Off Power)

- * Reduce Power - ESC reduces motor power when the pre-set Low Voltage Protection Threshold value is reached (recommended).
* Cut Off Power - ESC instantly cuts motor power when the pre-set Low Voltage Protection Threshold value is reached.

IV. Using Your New ESC (one time Setup procedure - Throttle range setting)

- 1. Improper polarity or short circuit will damage the ESC. Therefore it is your responsibility to double check all plugs for proper polarity and firm fit BEFORE connecting the battery pack.
2. Powering up the ESC for the first time and setting the Automatic Throttle Calibration:
4-MAX ESC features Automatic Throttle Calibration to attain the smoothest throttle response and resolution throughout the entire throttle range of your transmitter. This step is done once to allow the ESC to "learn and memorise" your transmitter throttle output signals and only needs to be repeated if you change your transmitter or receiver.

- * Switch your transmitter ON and set the throttle stick to maximum position.
* Power up your receiver.
* Connect the battery pack to the ESC. Wait for about 2 seconds, the motor will beep two tone, then pull the throttle stick to the zero power position, the motor will also beep, which indicates that your ESC has got the signal range of the throttle from your transmitter. The throttle is now calibrated and your ESC is ready for operation.

V. ESC Normal start up procedure

- 1. Switch your transmitter ON and set the throttle to its minimum position.
2. Connect the battery pack to the ESC.
3. When the ESC is first powered up, it emits two sets of audible tones in succession indicating the status of its state.
* The first set of tones denotes the number of cells in the LiPo pack connected to the ESC. (Three beeps (***) indicates a 3 cell LiPo pack while 4 beeps (****) indicates a 4 cell LiPo pack).
* The second set denoting brake status; one beep(*) for Brake "ON" and two beeps (**) for Brake "OFF".
Now, the ESC is ready for use.

VI. Program the ESC by LED Program box

The following sequence of connections are VERY IMPORTANT or the program box will not work.

Remove the propeller or rotor blades for safety before commencing any programming or changes.

- 1. Connect the short servo type wire from the ESC to the right hand set of pins on the top of the program box paying close attention to the polarity. The negative pin must be on the left when viewed from the front.
2. Connect a battery (6S - 12S LiPo) to the main red and black battery power leads on the ESC.
3. Connect a separate battery with a voltage between 5.0V and 6.3V to the pins on the top left of the programming box. Again paying close attention to the polarity. The negative pin must be on the left when viewed from the front. After a second or two the LED's on the programming box will illuminate. The left 2 digits indicate the programming function and the right 2 digits indicate the value of that function.
4. Press the "Menu" Key on the Program box and circularly select each programmable item. Press the "Value" Key to amend the value, next press the "OK" Key to confirm (Program the ESC), at the same time the Red LED of Program box will blink and motor will beep. Once all functions are set to your preferences you can then turn off the ESC. The modified values will be saved in ESC.
5. Press the "Reset" Key to restore to factory default settings.

Programming Parameters on LED Programming box P/N PP-PROGCARD-HV

Table with 9 rows and 10 columns. Columns: Function, Brake Type, Battery Type, Cut Off Voltage, Motor Timing, SBEC Voltage Output, Governor Mode, Motor Rotation, Start Up Strength, Low Voltage Cut Off Type. Values include settings like 1-Brake Off, 2-Soft Brake, 3-Mid Brake, 4-Hard Brake, etc.

VII. General Safety Precautions

- ◆ DO NOT install propeller (fixed wing) or drive pinion (helicopter) on the motor when you test the ESC and motor for the first time to verify the correct settings on your radio. Only install your propeller or pinion after you have confirmed that the settings on your radio is correct.
◆ Switch your transmitter ON and ensure the throttle stick is in the minimum position before connecting the battery pack.
◆ NEVER switch your transmitter OFF while the battery is connected to your ESC.
◆ NEVER use ruptured or punctured battery cells.
◆ NEVER use battery packs that are known to overheat.
◆ Use batteries that are supported by the ESC and ensure the correct polarity before connecting. Wrong battery polarity will damage the ESC and void the warranty!
◆ NEVER short-circuit battery or motor terminals.
◆ Always use proper insulation material for cable insulation.
◆ DO NOT exceed the number of cells specified by the ESC.
◆ Always use appropriate cable connectors.
◆ Install the ESC in a suitable location with adequate ventilation for cooling.
The ESC has built-in over-temperature cut-off protection that will immediately cut power off the motor once the ESC temperature exceeds 230°F/ 110°C limit.
◆ Only connect your battery pack just before flying and DO NOT leave your battery pack connected after flying.
◆ Handle your model with extreme care once battery pack is connected and keep away from the propeller at all times. NEVER stand in-line or in front of any rotating parts.
◆ DO NOT immerse the ESC in water while powered up.
◆ Only fly at a designated flying site and abide by the rules and guidelines set by the flying club.



IX. Trouble Shooting

Trouble	Possible Reason	Action
Motor doesn't work, but there are audible tones of automatic detection of the number of cells after powering up ESC	The ESC throttle calibration has not set up	Set up the ESC throttle calibration
Motor doesn't work and no audible tone emitted after connecting the battery, Servos are not working either	Poor/loose connection between battery pack and ESC	Clean the connector terminals or replace connector
	No power	Replace with a freshly charged battery pack
	Poor soldered connections (dry joints)	Re-solder the cable connections
	Wrong battery cable polarity	Check and verify cable polarity - Replace ESC if it was connected incorrectly
	ESC throttle cable connected to receiver in the reverse polarity	Check the ESC cable connected to the ESC to ensure the connectors are in the correct polarity
	Faulty ESC	Replace ESC
Motor runs in reverse rotation	Wrong cables polarity between the ESC and the motor	Swap any two of the three cable connections between the ESC and the motor or access the Motor Rotation Function via the ESC programming mode and change the pre-set parameters
Motor stops running in flight	Lost throttle signal	Check proper operation of the radio equipment Check the placement of the ESC and the receiver and check the route of the receiver's aerial and ESC cables to ensure there is adequate separation to prevent RF interference Install a ferrite ring on the ESC's throttle cable
	Battery pack voltage has reached the Low Voltage Protection threshold	Land the model immediately and replace the battery pack
	Possible bad cable connection	Check and verify the integrity of the cable connections
Motor restarts abnormally ESC Overheats	Possible RF Interference at the flying field	The normal operation of the ESC may be susceptible to surrounding RF interference Restart the ESC to resume normal operation on the ground to verify recurrence. If the problem persists, test the operation of the ESC at a different flying field
	Inadequate cooling	Relocate the ESC to allow better cooling
	Servos drawing too much current and over loading the BEC within ESC (if fitted)	Use servos that are adequately sized for the ESC. The maximum BEC current drawn should be within the BEC limits
	Over sized motor or prop	Prop down or resize the motor