

Thank you for purchasing PA Quantum Electronic Speed Controller (ESC)

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Specification:

	PA Quantum 65
Continuous current	65A
Burst Current (<10s)	80A
SBEC Output (Peak Loads 10sec)	5.5V/4A (max)
Li-ion/ LiPo	2-6 Cells
NiMh/NiCd	5-18 Cells

Note: The PA Quantum 65A SBEC has a 4A switching power regulator chip which supports the high torque micro servos in the most demanding load-conditions imposed during aggressive 3D aerobatics, providing bulletproof reliability. In this form of flying the servos actuating oversized control surfaces and may stall momentarily under extreme aerodynamic loads. These loads may cause most low and medium power BECs to overheat and shutdown resulting in catastrophic loss of control.

The PA Quantum ESC's high power SBEC has been specifically designed for extreme aerobatics and therefore has the capability to support the higher momentary peak loads to eliminate the possibility of unwanted shutdowns. This high power SBEC is also capable of supporting continuous simultaneous multiple servo operations typically found in CCPM equipped hardcore 3D E-helicopters.

The higher and stable SBEC voltage also reduces the possibility of receiver brownouts that occasionally occur on some 2.4GHz receivers in instances where conventional linear BECs are subjected to high servo loads causing the BEC voltage to drop below the voltage threshold required by the 2.4GHz receiver.

Features:

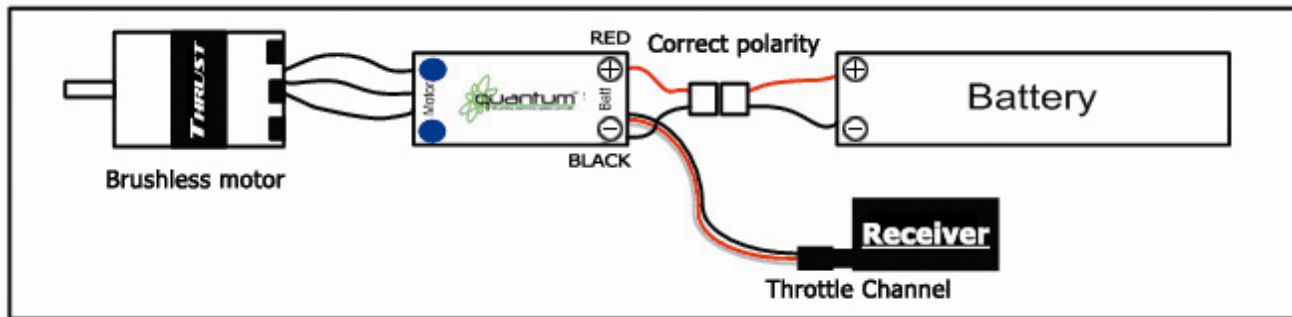
- ♦ Extremely low internal resistance
- ♦ Super smooth and accurate throttle linearity
- ♦ Safety thermal over-load protection
- ♦ Auto throttle shut down in signal lose situation
- ♦ Supports high RPM motors
- ♦ Power arming protection (prevents the motor from accidentally running when switched ON)
- ♦ NEW Advanced programming software
- ♦ Built in programmer card interface *
- ♦ PC Link programming interface *
- ♦ Upgradeable firmware interface *
- ♦ Automatic Lipo cell count detection (also automatically sets the LVC point)
- ♦ ESC over voltage protection (automatically disables when battery voltage exceeds 26V when initially connected).
- ♦ A Green LED indicated that the ESC is powered ON or plugged to the PC (programming and upgrades)

* Programmer card, software and USB linker are optional upgrades.

PA Quantum ESC allows you to program all functions to fit your specific needs, which makes it very efficient and user friendly:

1. User programmable low voltage cutoffs (LiPo and NiCd/NiMh)
2. User programmable brake setting (we recommend using brake for only folding props applications)
3. User programmable timing settings (to enhance ESC efficiency and smoothness)
4. User programmable low voltage cutoff type (power reduction or immediate shutdown)
5. User programmable soft acceleration start ups (for delicate gearbox and helicopter applications)
6. User programmable governor mode (for helicopter applications)
7. User programmable switching frequency

Wiring Diagram:



Settings:

- 1. Low Voltage Cutoff thresholds (LVC): Auto/6.2V/9.3V/12.4V/ 15.5V/18.6V/19.2V**
Auto:- Automatically detects the number of Lipo cells and sets the LVC point to 3.1V (Default)
6.2V :- LVC for 2S Lipo @ 3.1V/cell
9.3V :- LVC for 3S Lipo @ 3.1V/cell
12.4V:- LVC for 4S Lipo @ 3.1V/cell
15.5V:- LVC for 5S Lipo @ 3.1V/cell
18.6V:- LVC for 6S Lipo @ 3.1V/cell
19.2V:- LVC for 6S Lipo @ 3.2V/cell (higher battery protection)

Note: Auto option is used ONLY for LiPo packs! If using NiMH or NiCd set the LVC to your preference.

- 2. Brake: ON/OFF**

ON- Sets the propeller to the brake position when the throttle stick is at the minimum position (Recommended for folding props).

OFF- Sets the propeller to freewheel when the throttle stick is at the minimum position. (Default)

- 3. Timing setup: Auto/Low / Medium/ High.**

Automatic - ESC automatically determines the optimum motor timing (Default)

Low - For low pole count motors (under 6) and provides higher efficiency but less power.

Medium - General timing setting for most motors providing a good balance of power and efficiency.

High - For higher pole count motors (6 or more) and provides better power but less efficiency.

In most cases, automatic timing works well with all types of motors. However, for higher efficiency the Low timing setting can be used, medium timing for a good balance of power and efficiency and high timing for more power with lower efficiency. 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 on the ground first after making any changes to your motor timing!

- 4. Low Voltage Cutoff Type: Reduce Power / Hard cutoff**

Reduce Power – ESC reduces motor power when the pre-set LVC threshold value is reached (recommended). Throttle response remains linear to allow sufficient power to safely land. (Default)

Hard Cutoff – ESC instantly cuts motor power when the pre-set LVC threshold value is reached. Restart motor by first lowering the throttle back to zero and then advancing the throttle.

- 5. Soft Acceleration Start ups: Disable / Soft /Very soft**

Disable – Provides quick acceleration start ups with a linear throttle response. This is recommended for fixed wing models fitted with direct drive setups. (Default)

Soft – Provides initial slow 1 second ramp-up from start to full RPM intended to protect delicate gears from stripping under instant load. This setting is recommended for either fixed wing models equipped with gearboxes or helicopters.

Very Soft – Provides initial very slow ramp-up from start to full RPM. For helicopter applications.

6. Governor Mode: Disable / Low/ High (Helicopter application)

Disable- Disables the governor mode (Default)

Low - Enables the governor mode for Low KV motors

High - Enables the governor mode for High KV motors

Note: Once the Governor Mode is enabled, the ESC's Brake and Low Voltage Cutoff Type settings will automatically be reset to No Brake and Reduce Power respectively regardless of what settings they were previously set.

7. Switching Frequency: 8kHz/ 12kHz/ 16kHz

8kHz - Sets ESC switching frequency for most brushless motors. (Default)

12kHz - Sets ESC switching frequency for low inductance brushless motors.

16kHz - Sets ESC switching frequency for very low inductance motors.

Using Your New ESC

Wrong polarity and short circuit will damage the ESC and void warranty therefore it is your responsibility to double check all plugs for proper polarity and firm fit BEFORE connecting the battery pack.

Built-in Intelligent ESC Safety Functions

1. Continuous warning beeping tone (****) - Indicates that throttle stick is not in the minimum position when powering up the ESC.
2. **Over-heat protection:** When the temperature of ESC exceeds 90 deg C (194F), the ESC will reduce the output power (at 50%) to allow it to cool.
3. **Loss Throttle signal protection:** The ESC will automatically cutoff the power to the motor when it detects a loss of throttle signal for more than 2 second.

Powering up the ESC for the first time and setting the Automatic Throttle Calibration

The PA Quantum 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 memorize" your Transmitter's throttle output signals and only repeated if you change your transmitter.

1. Switch your Transmitter **ON** and set the throttle stick to its **maximum** position.
2. Connect the battery to the ESC. The ESC will emit a welcome tone.
3. Next, the ESC will emit 4 long audible beep tones during which you should move the throttle stick to the minimum position.
4. The ESC will emit 2 audible beep tones (Lo-Hi) confirming the calibration has been memorized.

The throttle is now calibrated and your ESC is ready for operation.

Test run the motor and verify its rotation. If the motor runs reverse, swap any two of the three motor cables.

Note:

- Verify that the throttle travel adjustment (ATV) is set at maximum span.
- Disable any throttle mix/curves in the transmitter. For Futaba radios set the throttle channel to Reverse.

Normal ESC 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. The ESC produces an audible welcome tone followed by beeps (the number of beeps corresponds to the number of LiPo cells connected at the time).
4. The ESC is now ready for use.

Note: the tone for the number of cells connected is only available if the LVC is set to Auto. On Manual LVC, the ESC will only emit the welcome tone.

Warning: ALWAYS disconnect the battery pack from the ESC just before switching the TX OFF.

Tip: Even with the LVC type set to “reduce power” we strongly advise you to set up your TX timer to warn you PRIOR to the LVC! If you reached the LVC power reduction, land ASAP to avoid permanent damage to your LiPo pack.

Entering the Programming Mode:

1. Switch your Transmitter **ON** and set the throttle to its **maximum** position.
 2. Connect the battery pack to the ESC.
 3. Wait until you hear 4 audible beep tones followed by 5 tones in ascending frequency confirming that the ESC has now entered the programming mode and will start the sequence of the main functions menu.
 4. Now the ESC will emit 8 tone counts as it sequences through the 7 main functions. The 8th tone denotes that it will repeat the sequence (if the throttle stick is left at the maximum position) or will exit the programming mode (if the throttle is moved to the minimum position.)
 5. Refer to the programming diagram and count the number of tones i.e. Tone #1 (LVC), Tone #2 (Brake), Tone #3 (Timing), Tone #4 (LVC Type), Tone #5 (Acceleration), Tone #6 (Governor), Tone #7 (Switching Frequency) & Tone #8 (Ready to repeat the sequence or exit).
 6. Move the throttle stick down to access any one of the functions menu. Once entering the settings menu, the ESC will emit the number of tones corresponding to the function in the sequence; e.g. for Brake setting, 2 beep tones and for governor mode 6 tones etc.
 7. The ESC will then sequence through the settings menu and the number of tones will correspond to the number of setting options for the specific function; e.g. Brake function 1st tone for ON and 2nd tone for OFF etc.
 8. To set up the desired settings **move the throttle stick to maximum**. 3 beeps will indicate that the setting has been stored. If the throttle stick is left at the minimum position, the ESC will continue to cycle through the main functions menu.
 9. The ESC will then emit an ascending tone to denote that it has returned to the main function menu and ready to repeat the cycle to allow another function to be programmed or to exit.
 10. To exit the programming mode, move the throttle stick to the minimum position at the 8th beep tone. A Lo-Hi tone will indicate exiting.
- Alternatively, you may disconnect the battery from the ESC at anytime to exit.

General Safety Precautions

- Always stand behind the motor and away from the spinning prop when powering up the ESC. Keep all spectators at least 25 feet away from the arc of the spinning prop.
- Do not install the 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.
- Never use ruptured or punctured battery cells.
- Never use battery packs that are known to overheat. Never short circuit battery or motor terminals.
- Always use proper insulation material for cable insulation.
- Always use proper cable connectors.
- Do not exceed the number of cells or servos specified by the ESC.
- **Wrong battery polarity will damage the ESC and void the warranty.**
- Install the ESC in a suitable location with adequate ventilation for cooling. This ESC has a built-in over temperature cutoff protection feature that will immediately cut power to the motor once the ESC temperature exceeds 90°C (194°F).
- Use only batteries that are supported by the ESC and ensure the correct polarity before connecting.
- 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.
- 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 the battery pack is connected and keep away from the propeller at all times. Never stand in-line or directly in front of any rotating parts.
- Do not immerse the ESC underwater while powered up.
- Do fly at a designated flying site and abide by the rules and guidelines set by your flying club.
- Never disconnect the battery while the motor is running.

Trouble Shooting

Trouble	Possible Reason	Action
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 connector terminals from any flux or oil residue or replace connector. To clean rotate the spring of the bullet connectors a few times.
	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
	ESC throttle cable connected to receiver in reversed polarity.	Check the ESC cable connected to the ESC to ensure the connectors are in the correct polarity.
	Faulty ESC	Replace ESC
Motor doesn't work and no audible tone emitted after connecting the battery BUT servos are working.	Poor / loose connection between ESC and motor	Clean connector terminals or replace connectors
	Poor soldered connections (dry joints)	Re-solder the cable connections
	Burnt motor coils	Replace motor
Motor doesn't work after powering up the ESC.	The battery pack voltage is not within the acceptable range.	Replace with a freshly charged battery pack Check battery pack voltage
Motor doesn't work after powering up the ESC.	The ESC is unable to detect the normal throttle signal from the receiver	Check and verify that the ESC cable is connected to the Throttle channel on the receiver. Check the transmitter and receiver to verify that there is throttle signal output. (Connect a spare servo to verify throttle channel operation)
An alert tone with continuous beeping (****) is emitted after powering up the ESC and motor doesn't work.	The throttle stick is not in the <u>minimum</u> position at power up.	Move the throttle stick to the minimum position.
Motor doesn't work after powering up the ESC even though throttle is at minimum position. The ESC emits 4 beeps followed by the programming audible tones.	Reversed throttle channel caused the ESC to enter the programming mode.	Enter the servo reverse menu on your transmitter and reverse the throttle channel. Note: For Futaba radios set the throttle channel to Reverse.
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.
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 Cutoff (LVC) 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 or hesitates in flight	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.
	Possible loose motor cable connection.	Check motor cable bullet connectors for connectivity.
ESC Overheats	Inadequate Ventilation	Relocate the ESC to allow better ventilation
	Servos drawing too much current and over loading the ESC.	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

QUANTUM 65A PROGRAMMING FLOW CHART

