Manual of Sensorless Brushless Motor Speed Controller Ver HW-01-080623.1

Thank you for purchasing our Quazar Electronic Speed Controller (ESC). Please remember that power systems for model planes can be very dangerous, so it is necessary to read this manual carefully. Since we have no control over how our products are used by the user, no liability shall be assumed or accepted for any damages, losses, or costs resulting from the use of this unit. We can assume no liability for personal or property damage.

Features:

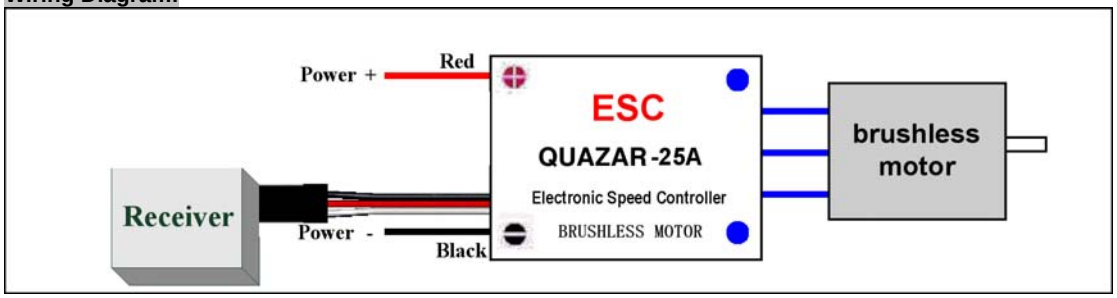
- Multiple protection features: Low-voltage cut-off protection / over-heat protection / throttle signal loss protection.
- 3 start modes: Normal / Soft / Super-Soft, compatible with fixed-wing aircraft and helicopters.
- Throttle range can be configured and is fully compatible with all transmitters currently available on the market.
- Smooth, linear and precise throttle response.
- Separate voltage regulator IC for microprocessor, providing good anti-jamming capability.
- Supported motor speed (Maximum): 210000 RPM (2 poles), 70000 RPM (6 poles), 35000 RPM (12 poles).
- Our pocket-sized **Program Card** can be purchased separately for easy programming.
- With a program card, you can activate the music playing function of the ESC. There are 15 different songs available.

Specifications:

Class	Model	Cont. Current	Burst Current (>10s)	BEC Mode	BEC Output	Battery Cell		User Programmable	Weight	Size
						Li-ion Li-poly	NiMH NiCd			L*W*H
18A	Quazar-18	18A	22A	Linear	5V/2A	2-4	5-12	Available	24g	45*26*11
25A	Quazar-25	25A	35A	Linear	5V/2A	2-4	5-12	Available	27g	45*26*12
30A	Quazar-30	30A	40A	Linear	5V/2A	2-4	5-12	Available	29g	45*26*12
40A	Quazar-40	40A	55A	Switch	5V/3A	2-6	5-18	Available	40g	55*28*15
60A	Quazar-60	60A	80A	Switch	5V/3A	2-6	5-18	Available	65g	70*31*14
80A	Quazar-80	80A	100A	Switch	5V/3A	2-6	5-18	Available	67g	70*31*14

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:



Feature Explanation:

1. **Brake Settings**：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 (Gradually reduces the output power) or Cut-Off (Immediately stops output power). Default is Soft Cut-Off.
4. **Voltage Protection Threshold(Cut-Off Threshold)**：Low / Medium / High, default is Medium.
   a. 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 a 3 cell lithium pack, when medium cutoff voltage is set, the cut-off voltage will be: 2.85*3=8.55V.
   b. 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 low voltage cut-off function is disabled. For example: For a 10 cell NiMH battery, fully charged voltage is 1.44*10=14.4V, when “medium” cut-off voltage is set, the cut-off voltage will be:14.4*45%=6.5V。
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 in aerobatic flight.

6. **Timing**：Low / Medium / High, default is Low. Usually, 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 can be chosen.

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

Special Note

Certain out-runner motors, listed below, have special construction. 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 follows:

Programmable Value Suggestion / Motor	Timing	Startup Mode
Generic in-runner motor	Low	Usually, aircraft use "normal" startup mode and helicopter use "super-soft" startup mode
Generic out-runner motor	Low or Medium	
Align 420LF (Made in TAIWAN, out-runner)	High (MUST)	
450TH (Made in TAIWAN, out-runner)	Low	Soft (MUST)

Begin To Use Your New ESC

Please start the ESC in the following sequences:

1. Move the throttle stick to the bottom position and then switch on the transmitter.
2. Connect the battery pack to the ESC, the ESC begins the self-test process, a special tone " ♪123" is emitted, which means the voltage of the battery pack is in normal range, and then N "beep" tones will be emitted, 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 happens, please check the battery pack and all the connections;
   - If a special tone " ♪ 5671̇2̇" is emitted after 2 beep tones ("beep-beep-"), 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, means the input voltage is too low or too high, please check your battery's voltage.

3. "**VERY IMPORTANT!**" Because transmitters have different throttle ranges, we strongly suggest the operator use the "Throttle Range Setting Function" to calibrate throttle range. Please read the instruction on page 4------"Throttle Range Setting".

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. 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 C**,** 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

1. Enter Program 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 another 5 seconds, special tone like "♪5671̇2̇" should be emitted, which means program mode is entered.

2. Select Programmable Items
Now you'll hear 8 tones in loop. When a long "beep------" tone is emitted, move throttle stick to bottom to enter the "Start Mode"

3. Set Item Value (Programmable 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 position, then a special tone "♪1̇5̇1̇5̇" is emitted, now you have set the "Start Mode" item to the value of "Super-Soft"

4. Exit Program Mode
After the special tone "♪1̇5̇1̇5̇", move throttle stick to bottom within 2 seconds.

Troubleshooting

Trouble	Possible Reason	Action
After power on, motor does not work, no sound is emitted	The connection between battery pack and ESC is not correct	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-” (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 does 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 cable of throttle channel
After power on, motor does not work, such a alert tone is emitted: “beep-, beep-, beep-” (Every “beep-” has a time interval of about 0.25 second)	The throttle stick is not in the bottom(lowest) position	Move the throttle stick to bottom
After power on, motor does not work, a special tone “ ♪ 56712” is emitted after 2 beep tone (beep-beep-)	Direction of the throttle channel is reversed, so the ESC has entered the program mode	Set the direction of 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 cable of throttle channel
	ESC has entered Low Voltage Protection mode	Land RC model as soon as possible, and then replace the battery pack
	Some Connections are not reliable	Check all the connections: battery pack connection, throttle signal cable, motor connections, 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 normal operation does not resume, you might need to move to another area to fly. Also, check wire routing and ESC installation.

Normal startup procedure:

Move throttle stick to bottom and then switch on transmitter.	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

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

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

1. Enter program mode

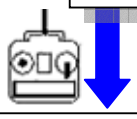
1) Switch on transmitter, move throttle stick to top , connect the battery pack to ESC
2) Wait for 2 seconds, the motor should emit special tone like "beep-beep-"
3) Wait for another 5 seconds, special tone like "♪5671i2" should be emitted, which means program mode is entered

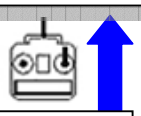
2. Select programmable items:

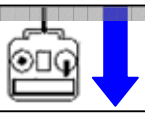
After entering program mode, you will hear 8 tones in a loop in the following sequence. If you move the throttle stick to bottom within 3 seconds after one kind of tones, this item will be selected.

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)

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



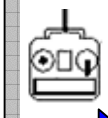




3. Set item value (Programmable value):

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 set 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-" 1 short tone	"beep-beep-" 2 short tones	"beep-beep-beep" 3 short tones
Brake	Off	On	
Battery type	Li-ion / Li-poly	NiMH / NiCd	
Cutoff mode	Soft-Cut	Cut-Off	
Cutoff threshold	Low	Medium	High
Start mode	Normal	Soft	Super soft
Timing	Low	Medium	High



4. Exit program mode

There are 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.