

SEAL User Manual

Brushless ESC for marine

Thank you for purchasing ZTW Seal Series Brushless Electronic Speed Controller (ESC). This is a series of high-end and high quality and good performance ESC. We all know that that boaters crave for more power than cars and airplanes and we have come up with a whole new way to put the power to the water – The new SEAL line water-cooling brushless speed controls for marine applications. This series of ESC also feature with good water cooling system, using state-of-art MOSFET, exposed finned sink. This is a pro-level product, please read the manual thoroughly before starting using it. ZTW Model have no control over the use, installation, application, or maintenance of these products, thus no liability shall be assumed nor accepted for any damages, losses of costs resulting from the use of this item. Any claims arising from the operating, failure or malfunctioning etc. will be denied. We assume no liability for personal injury, property damage or consequential damages resulting from our product or our workmanship. As far as is legally permitted, the obligation for compensation is limited to the invoice amount of the product in question.

Safety Precautions

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 use 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.
- 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 the 230 Deg F / 110 Deg C high temperature limit.
- 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 or allow it to get wet while powered up.
- Always fly at a designated flying site and abide by the rules and guidelines set by your flying club.

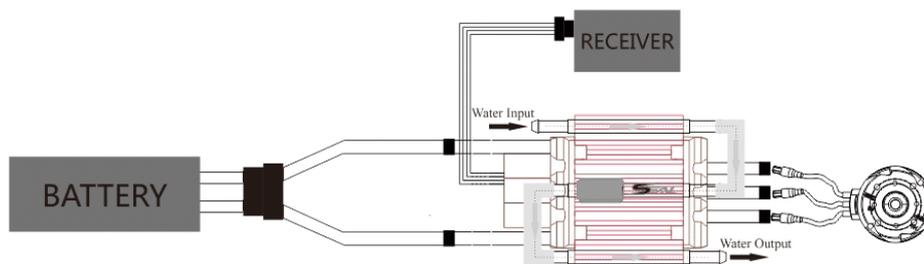


Noted: Wrong battery polarity will damage the ESC and void the warranty.

Wire Connection

1. The speed controller can be connected to the motor by soldering directly or with high quality connectors. Always use new connectors, which should be soldered carefully to the cables and insulated with heat shrink tube. The maximum length of the battery pack wires shall be within 6 inches.

- Solder controller to the motor wires.
- Solder appropriate connectors to the battery wires.
- Insulate all solder connectors with heat shrink tubes.
- Plug the “JR” connector into the receiver throttle channel.
- Controller Red and Black wires connects to battery pack Red and Black wires respectively.



Specifications

Type	PN#Model	Cont.\Burst Current(A)	Battery cell NiXX/Lipo	BEC Output	Weight (g)	Size (mm) W*L*H	User Program
Seal 70A SBEC 5A	6070200	70A\90A	5-18NC/2-6Lipo	5.5V/5A	113	49*66*23	YES
Seal 90A SBEC 5A	6090200	90A\110A	5-18NC/2-6Lipo	5.5V/5A	113	49*66*23	YES
Seal 130A SBEC 8A	6130200	130A\150A	5-18NC/2-6Lipo	5.5V/8A	171	62*65*24	YES
Seal 160A SBEC 8A	6160200	160A\180A	5-18NC/2-6Lipo	5.5V/8A	171	62*65*24	YES
Seal 200A SBEC 8A	6200300	200A\300A	5-24NC/2-8Lipo	6V/8A	230	50*90*41	YES
Seal 120A OPTO HV	6120400	120A\150A	18-38NC/6-12Lipo	NONE	125	62*65*24	YES
Seal 150A OPTO HV	6150400	150A\180A	18-38NC/6-12Lipo	NONE	130	62*65*24	YES
Seal 300A OPTO HV	6300400	300A\1000A	18-42 NC/6-14 Lipo	NONE	640	146*84*29	YES
Seal 500A OPTO	6500500	500A\2000A	18-42 NC/6-14Lipo	NONE	949	105*185*28	YES

Features

1. Programmable two way mode.
2. over-heat protection, low-voltage protection and lost-signal protection.
3. Secondary sub-menu setting by LCD program card or PC interface.
4. Firmware updating by PC interface.
5. Unique metal shape designing gives your new fashion visual impact.
6. Super smooth and accurate throttle linearity.
7. Support and match with most of the motors, including high RPM motors.
8. Programmable motor timing.
9. Utilizes new smaller MOSFET technology to minimize weight.
10. Auto motor shut down if signal is lost or there is interference.
11. Insterted Anti-spark circuit on the PCB.

Throttle Calibration

The ZTW 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. We have two modes for the direction : one direction mode and two direction mode. You can choose different mode by different throttle calibration method .

1. One direction mode

Step 1. Switch your Transmitter ON and set the throttle stick to its maximum position .

Step 2. Connect the battery pack to the ESC. Wait for about 2 seconds, the motor will beep for twice, then put the throttle in the MINIMUM position, the motor will also beep, which indicates that your ESC has got the signal range of the throttle from your transmitter.

2. Two direction mode

Step 1. Switch your Transmitter ON and set the throttle stick to its maximum position .

Step 2. Connect the battery pack to the ESC. Wait for about 2 seconds, the motor will beep for twice, then put the throttle in the NEUTRAL position, the motor will also beep, which indicates that your ESC has got the signal range of the throttle from your transmitter.

Entering the programming Mode

- Turn on your radio and set the throttle stick to top position (100%).
- Plug the battery pack into your controller.
- Wait for 2 seconds, you will hear 4 groups of two sets of fast beeps, after this you will hear four single beeps to indicate you have successfully entered the programming mode.

Selecting the Programmable Item

The Programming items are arranged in Sequence, each Programmable Item is equivalent to an audible tone emitting for four times. You will hear 8 tones in a loop with the following sequence. When the desired tone for the Programmable Item is reached, move the throttle stick down to its minimum position. The motor will emit one special tone confirming the desired programmable item has been entered.

Selecting the Desired Value

The motor has been emitting sequentially. If the desired value of the programmable item is reached, set the throttle stick to its maximum position. The motor will emit one special tone confirming the new setting is saved.

Disconnecting the Battery

If you don't want to go on to programming, disconnect the battery pack directly. If you want to go on to programming, keep waiting to the next programmable item to select the value you need.



Note: You could also select the LCD program card to program your desired function. Program card is as the option spare part, its programming procedure is described in the LCD program card user manual.

Programming Menu 1– Brake Type

1. Turn on your radio and set the throttle stick to top position (100%)
2. Plug the battery pack into your controller
3. Wait for 2 seconds, you will hear 4 groups of two sets of fast beeps, after this you will hear single short beep indicates you are at Brake menu, You will hear this beep four times please make choice before it enters into next selection.
4. Then pull the throttle stick to minimum position, you will hear a music tone to confirm you enter into the Brake sub–menu
5. Brake type options will be indicated in beeps in sequence (For beeps code please refer to “The Tones Sequence and Code”)
6. Move your stick to top position when you hear the desired option, then you will hear a music tone to confirm that you have set your brake type and saved.
7. You will enter into next menu after short moment for further settings; or unplug the battery to exit the programmable mode.

Programming Menu 2– Battery Type

1. Turn on your radio and set the throttle stick to top position (100%).
2. Plug the battery pack into your controller.
3. Wait for 2 seconds, you will hear 4 groups of two sets of fast beeps, after this you will hear 2 short beeps indicates you are at Battery menu. You will hear this beep four times please make choice before it enters into next selection.
4. Then pull the throttle stick to minimum position, you will hear a music tone to confirm you enter into the Battery Type sub–menu.
5. Battery type options will be indicated in beeps in sequence (For beeps code please refer to “The Tones Sequence and Code”).
6. Move your stick to top position when you hear the desired option, then you will hear a music tone to confirm that you have set your brake type and saved.
7. You will enter into next menu after short moment for further settings; or unplug the battery to exit the programmable mode.

Programming Menu 3– Voltage Cutoff Threshold

2.8V/50%/ 3.0V/60%/ 3.2V/65%/No Protection

1. Turn on your radio and set the throttle stick to top position (100%).
2. Plug the battery pack into your controller.
3. Wait for 2 seconds, you will hear 4 groups of two sets of fast beeps, after this you will hear 3 short beeps indicates you are at Voltage Cutoff Threshold menu. You will hear this beep four times please make choice before it enters into next selection.
4. Then pull the throttle stick to minimum position, you will hear a music tone to confirm you enter into the Voltage Cutoff Threshold sub–menu.
5. Voltage Cutoff Threshold will be indicated in beeps in sequence (For beeps code please refer to “The Tones Sequence and Code”).
6. when you hear the desired option move your stick to top position, then you will hear a music tone to confirm that you have set your Voltage Cutoff Threshold and saved.
7. You will enter into next menu after short moment for further settings; or unplug the battery to exit the programmable mode.

Note:

- 1) 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; 2.8V/ 3.0V/3.2V/No Protection. For example: the voltage cutoff options for an 11.1V/ 3 cell Li–Po pack would be 8.4V (Low)/ 9.0V (Med)/ 9.6V (High).
- 2) For Ni–xx/Life packs–low / medium / high cutoff 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 $1.44V \times 6 = 8.64V$, when “LOW” cutoff voltage is set, the cutoff voltage is: $8.64V \times 50\% = 4.3V$ and when “Medium” or “High” is set, the cutoff voltage is now $8.64V \times 65\% = 5.61V$.

Programming Menu 4–Restore Factory Setup

1. Turn on your radio and set the throttle stick to top position (100%).
2. Plug the battery pack into your controller.
3. Wait for 2 seconds, you will hear 4 groups of two sets of fast beeps, after this you will hear four 4 short beeps indicates you are at Restore Factory Setup menu. You will hear this beep four times please make choice before it enters into next selection.
4. Then pull the throttle stick to minimum position, you will hear a music tone to confirm you enter into the Restore Factory Setup sub–menu.
5. There is only one option for this selection(For beeps code please refer to “The Tones Sequence and Code”).
6. when you hear the desired option move your stick to top position, then you will hear a music tone to confirm that you have set your Motor Timing and saved.
7. You will enter into next menu after short moment for further settings; or unplug the battery to exit the programmable mode.

* Auto – ESC determines the optimum motor timing automatically.

* 2° and 8° – Set for most of in–runner motors.

* 15° and 22° –Set for motors with 6 or more poles.

* 30° – Setting for motors with more poles.

In most cases, automatic timing works well for all types of motors. However for high efficiency we recommend the Low timing setting for 2 pole motors (general in–runners) and high timing for 6 poles and above (general out–runners). For higher speed, High timing can be set. Some motors require different timing setups therefore we suggest you to follow the manufacturer recommended setup.



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

Programming Menu 6–Motor Rotation

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

1. Turn on your radio and set the throttle stick to top position (100%).
2. Plug the battery pack into your controller.
3. Wait for 2 seconds, you will hear 4 groups of two sets of fast beeps, after this you will hear 1 long beep and 1 short beeps indicates you are at Motor Rotation menu. You will hear this beep four times please make choice before it enters into next selection.
4. Then pull the throttle stick to minimum position, you will hear a music tone to confirm you enter into the Motor Rotation sub–menu.
5. Motor Rotation options will be indicated in beeps in sequence (For beeps code please refer to “The Tones Sequence and Code”).
6. when you hear the desired option move your stick to top position, then you will hear a music tone to confirm that you have set your Motor Rotation and saved.
7. You will enter into next menu after short moment for further settings; or unplug the battery to exit the programmable mode.

Programming Menu 7– Start–up Rate

1. Turn on your radio and set the throttle stick to top position (100%).
2. Plug the battery pack into your controller.
3. Wait for 2 seconds, you will hear 4 groups of two sets of fast beeps, after this you will hear 1 long beep and 2 short beeps indicates you are at Start–up Rate menu. You will hear this beep four times please make choice before it enters into next selection.
4. Then pull the throttle stick to minimum position, you will hear a music tone to confirm you enter into the Start–up Rate sub–menu.
5. Start–up Rate options will be indicated in beeps in sequence (For beeps code please refer to “The Tones Sequence and Code”).
6. when you hear the desired option move your stick to top position, then you will hear a music tone to confirm that you have set your Start–up Rate and saved.
7. You will enter into next menu after short moment for further settings; or unplug the battery to exit the programmable mode.

Note:

- * **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.

Programming Menu 8–Low Voltage Cutoff Type

1. Turn on your radio and set the throttle stick to top position (100%).
2. Plug the battery pack into your controller.
3. Wait for 2 seconds, you will hear 4 groups of two sets of fast beeps, after this you will hear 3 long beeps indicates you are at Low Voltage Cutoff Type menu. You will hear this beep four times please make choice before it enters into next selection.
4. Then pull the throttle stick to minimum position, you will hear a music tone to confirm you enter into the Low Voltage Cutoff sub–menu.
5. Low Voltage Cutoff type options will be indicated in beeps in sequence (For beeps code please refer to “The Tones Sequence and Code”).
6. when you hear the desired option move your stick to top position, then you will hear a music tone to confirm that you have set your Voltage Cutoff Threshold and saved.
7. You will enter into next menu after short moment for further settings; or unplug the battery to exit the programmable mode.

Noted:

- * **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.

The Tones Sequence and Code

- | | |
|-------------------------------|--|
| 1. Beep– | Brake Type (1 short beep) |
| 2. Beep–Beep– | Battery Type (2 short beeps) |
| 3. Beep–Beep–Beep– | Cut off Voltage Threshold (3 short beeps) |
| 4. Beep–Beep–Beep–Beep– | Restore Factory Setup Defaults (4 short beeps) |
| 5. Beep–---- | Motor Timing (1 long beep) |
| 6. Beep–----Beep– | Motor Rotation (1 long tone 1 short beep) |
| 7. Beep–----Beep– Beep– | Start up Strength (1 long tone 2short beeps) |
| 8. Beep–----Beep– Beep– Beep– | Low Voltage Cut off Type (1 long tone 3 short beeps) |

Remark: One long tone “Beep-----” is equal to five short tones “Beep-”

Tone of value Prog.Item	BEEP-	BEEP- BEEP-	BEEP- BEEP- BEEP-	BEEP- BEEP- BEEP- BEEP-	BEEP -----	BEEP ----- BEEP-	BEEP ----- BEEP- BEEP-	BEEP ----- BEEP- BEEP- BEEP-	BEEP----- BEEP-BEEP- BEEP-BEEP-
Brake Type	Brake OFF	Soft Brake	Mid Brake	Hard Brake					
Battery Type	NiCd/NiMH	LiPo	LiFe						
Cut Off Voltage Threshold	2.8V/50%	3.0V/60%	3.2V/65%	No Protection					
Restore Factory Setup Defaults	BEEP-								
Motor Timing	Auto	2°	8°	15°	22°	30°			
Motor Rotation	Forward	Reverse							
Start Up Strength	10%	15%	20%	25%	30%	35%	40%	45%	50%
Low Voltage Cut Off Type	Reduce Power	Cut Off Power							

Alert Tones

The ZTW ESC is equipped with audible alert tones to indicate abnormal conditions at power up.

1. Continuous beeping tone (****) — Indicates that throttle stick is not in the minimum position.
2. Single beeping tone followed by a one second pause (* * * *)— Indicates that the battery pack voltage exceeds the acceptable range. (The ESC automatically checks and verifies the battery voltage once the battery is connected).

Using Your New ESC

Improper polarity or short circuit will damage the ESC therefore it is your responsibility to double check all plugs for proper polarity and first fit BEFORE connecting the battery pack.

Built-in Intelligent ESC Safety Functions

1. Over-heat protection: When the temperature of ESC exceeds 110 deg C, the ESC will reduce the output power to allow it too cool.
2. Lost Throttle signal protection: The ESC will automatically cut power to the motor when it detects a lost of throttle signal for 2 seconds, then the motor will emit continuous beeping tone.

ZTW LCD Program Card

LCD program Card Can be used as follows:

Working as an individual device to set the parameters of ESC.

Specification:

Dimension	Weight	Power supply
91mm*54mm*18mm (L*W*H)	68g	DC 5.0V~12.0V

How to connect the LCD program card:

1. Disconnect the battery from the ESC;
2. Disconnect the signal cable of the ESC from the receiver; then plug it into the socket marked with (⌈⊕⊖)
3. Connect the battery to the ESC and turn on the ESC.
4. ZTW Version/Date will be displayed on the LCD screen when ESC is connected, then press any buttons “Ready to connect ESC” will be showed on the LCD Screen, this means that connection between LCD and ESC is established.
If the data connection between LCD and ESC is failed, the LCD Screen is always showing (Ready to connect ESC); Please check if signal wire is connected correctly; if not repeat step1-3.
5. If the connection is established successfully, the first programmable item will be displayed on LCD screen. It's ready to set the parameters now.

⚠ **Note1: Please strictly connect according to the above sequence. The sequence of step 2 and step 3 can not be reversed. Otherwise, the LCD program card can not work properly.**

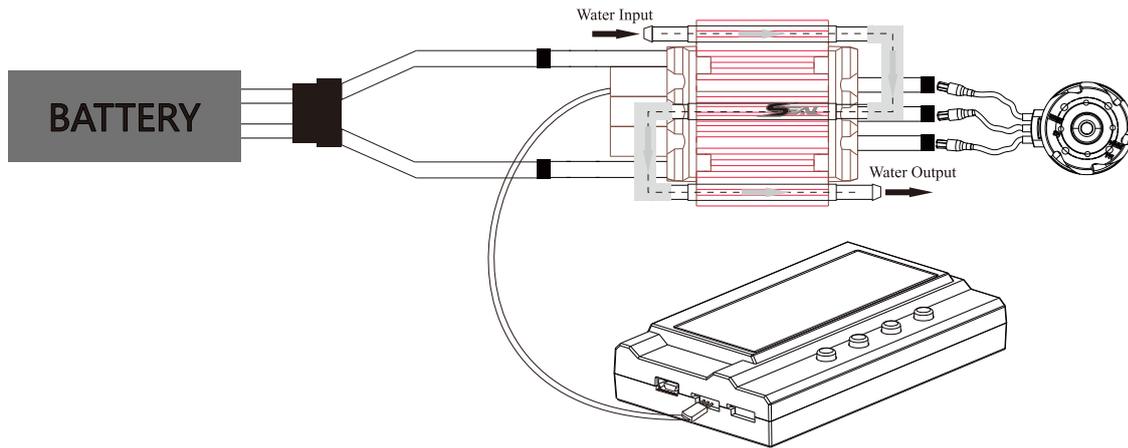
⚠ **Note2: A separate power is needed if the ESC is without BEC.**

Connect an additional power (5-12V) to the socket marked with (⊕⊖) on the left of the LCD program card for power supply. Please be sure that the polarity is connected correctly. Plug the signal wire into the socket marked with (⌈⊕⊖) first. Then connect an additional power (5-12V) to the socket marked with (⊕⊖). Then switch on the ESC. If the sequence is wrong, LCD will not work properly.

⚠ **Note3: The power supply should be lower than 12V, or the program card will be damaged.**

Operation:

a) Working as an individual device to program the ESC



Trouble Shooting

Trouble	Possible Reason	Action
Motor doesn't work, but there are audible tones signalling 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 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
	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.
Motor doesn't work and no audible tone emitted after connecting the battery BUT servos are working. Or Motor doesn't work after powering up the ESC. An alert tone with single beeping tones followed by a short pause (***) is emitted.	Faulty ESC	Replace ESC
	Poor / loose connection between ESC and motor	Clean connector terminals or replace connectors.
Motor doesn't work after powering up the ESC. An alert tone with continuous beeping tones (***) is emitted.	Burnt motor coils	Replace motor
	Poor soldered connections(dry joints)	Re-solder the cable connections
	The battery pack voltage exceeds the acceptable range.	Replace with a freshly charged battery pack Check battery pack voltage
Motor doesn't work after powering up the ESC. ESC emits two audible tones followed by short beeps (●●●●●●●●)	The throttle stick is not in the minimum position at power up.	Move the throttle stick to the minimum position.
Motor doesn't work after powering up the ESC. ESC emits two audible tones followed by short beeps (●●●●●●●●)	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 or access the Motor Rotation function via the ESC programming mode and change the pre-set parameters.
Motor doesn't work, but there are audible tones signalling the number of cells after powering up ESC.	The ESC throttle calibration has not set up.	Set up the ESC throttle calibration.
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.

Trouble	Possible Reason	Action
	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 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	Reduce Prop size or resize the motor.



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