INSTRUCTION MANUAL

TORO SC

SC120

BRUSHLESS ESC FOR SHORT COURSE

INTRODUCTION

Congratulations and thank you for purchasing TORO, Short Course(SC), high performance brushless motor electronic speed control. The TORO SC,brushless ESC represents a latest technologies, providing all the features and robust design qualities.

SAFETY NOTE

⚠ **WARNING**: This is an extremely powerful brushless motor system. We strongly recommend removing your pinion gear for your own safety and the safety of those around you before performing calibration and programming functions with this system. Please keep your hands, hair, cloth, clear from the gear train and wheels of an armed high performance system.

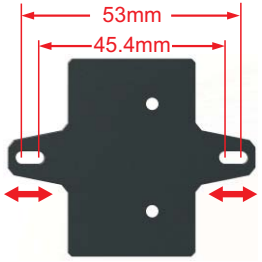
- **WATER & ELECTRONICS DON'T MIX*!***
  Never allow water, moisture, or other foreign materials to get inside ESC, motor, or on the PC Boards. ***Water damage will void the warranty!***
- **NO REVERSE VOLTAGE*!***
  Reverse battery polarity can damage ESC & void warranty. Disconnect battery immediately if a reverse connection occurs.
- **DISCONNECT BATTERIES WHEN NOT IN USE**
  Always disconnect the battery pack from the speed control when not in use to avoid short circuits and possible fire hazard.
- **2 - 4 LI-PO CELLS ONLY**
  Never use fewer than 2 or more than 4 LIPO cells in the vehicle's main battery pack. The TORO SC handles up to 4S LIPO input (16.8 Volts MAX).
- **TRANSMITTER ON FIRST**
  Turn on the transmitter first THEN turn on the speed control.
- **INSULATE WIRES**
  Always insulate exposed wiring with heat shrink tubing or electrical tape to prevent short circuits, which can damage ESC.
- **SHORT COURSE OR SMALLER**
  The TORO SC is intended for4x4 Short Course or Smaller.

BEFORE YOU BEGIN

1)Plan Speed Control Placement

- Choose a location for the speed control that is protected from debris. To prevent radio interference place the speed control as far away from the radio receiver as possible and keep the power wires as short as possible.

- For best results clean the bottom of the speed control and chassis. Peel off the cover on one side of the doubled-sided tape, and stick to the bottom of the speed control. Peel off other side and stick the ESC to the chassis.
- You may use the mounting plate(included) to fix the ESC to the chassis.



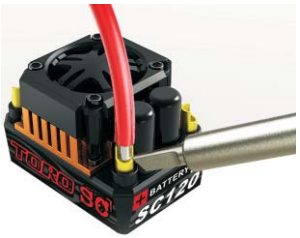
- Use a small piece of double-sided tape on the ON/OFF switch.

2)Soldering

TIPS & TRICKS: Place the speed control upright and use double sided tape to secure it to the bench. Doing so provides a stable work area and allows easy access to the solder posts.

Attaching Wires to the Speed Control:

- Red wires are usually used to connect the speed control to the positive battery terminal.
  Black wire is typically used for the battery negative terminal. Inspect the housing on the speed control next to each post or refer to the diagrams to determine which color wire to attach to each post.



- Strip back the insulation of the wire by about 2.4mm to 3.2mm (3/32" to 1/8") and "pre-tin" the wire by heating the end and applying solder until it is thoroughly covered.
  CAUTION: *Be very careful not to splash yourself with hot solder.*
- Place the tip of the iron in the notch on top of the post and apply a small amount of solder to the post. When the solder has flowed, remove the soldering iron, wipe the tip clean and apply a small amount of fresh solder to it.
- Pre-Heat both the wire and the post.
- Hold the wire so the tinned end is in contact with the notch of the post. Now touch the iron tip to the wire and the post. Wait about 4 seconds for the solder to flow, and then remove the iron while still holding the wire. You may let go of the wire after a second or two when the solder sets.

  Same techniques described in the preceding section may be used to solder the wires to the battery or to battery connectors.

  IMPORTANT: Take precautions if removing factory battery connectors. Connecting the battery backwards will cause damage, and will void warranty. When soldering connectors to a battery pack, cut only one wire of the battery pack at a time to ensure that the exposed wires cannot short together.

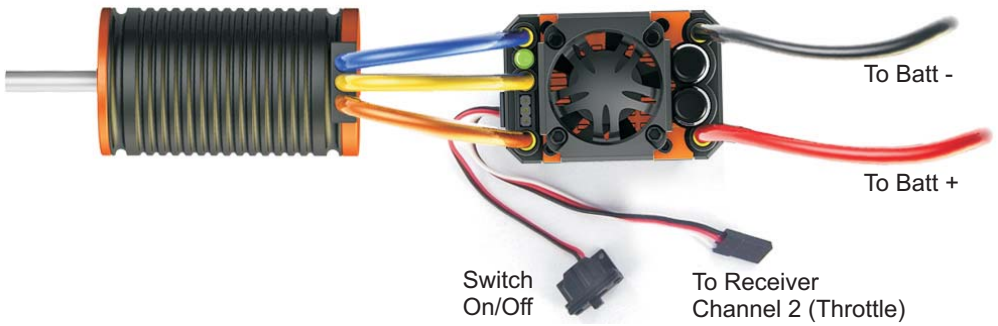
  HINT: If you are using connectors for both the battery and the motor, make sure that they are not the same or that you have a male and a female attached to the speed control wires. That way, you cannot accidentally connect the battery to the motor wires or vice versa.
- Make sure that the connector ends will be mated together correctly, male to female, and that the wire colors match red to red and black to black.

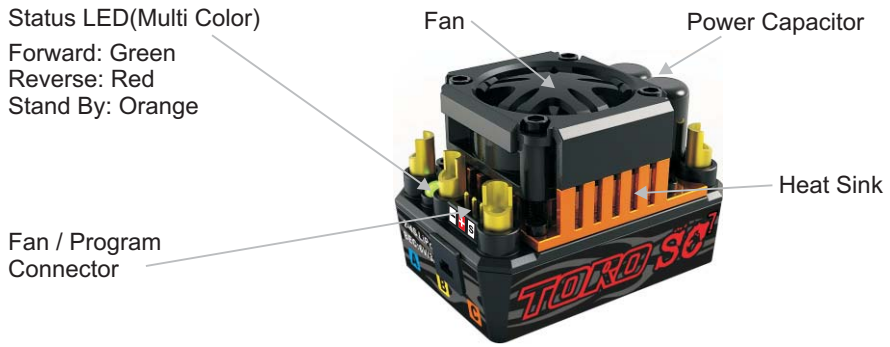
Prolonged/excessive heating of solder post (motor or ESC) will damage PCB.
Note: Make sure no wire strands have strayed to an adjacent solder post, this will result in short-circuiting & severe ESC damage, which will void the warranty.

CONNECTIONS

Brushless Motor Wiring

Connect the blue, yellow and orange motor wires to the motor. There is no polarity on the three ESC-to-motor wires, so do not worry about how you connect them initially. You may find it necessary to swap two wires if the motor runs in reverse.





ESC/TRANSMITER CALIBRATION

IMPORTANT NOTE: Calibration is necessary for the first use of the ESC, or whenever used with a new/different transmitter.

For users with a Futaba Transmitter, you must reverse the throttle channel signal on your transmitter. Please refer to your Futaba instructions.

Individual transmitter's signals for full throttle, full brake and neutral vary. You must calibrate your ESC so that it will operate more effectively with you transmitter.

How to Calibrate ESC

- ESC switch OFF.
- Turn on the Transmitter.
- Hold full throttle on your transmitter and turn the ESC's switch ON. Keep holding full throttle on the transmitter. The ESC will flashes LED and ring the initialization tones.
- Wait 2 seconds
- Green LED blinks rapidly and the motor will rings 1 second indicating full throttle measured.

- Red LED blinks whiles beeping, indicating it's time to push full brake. Move throttle trigger to full brake and wait few seconds, the ESC will blink red LED and rings 1 second indicating full brake measure.

- Orange LED blinks whiles beeping, indicating it's time for neutral. Relax trigger to neutral (center). The ESC flash the orange LED rapidly to accept the neutral position.
- ESC rings 1 second indicating neutral position measure.

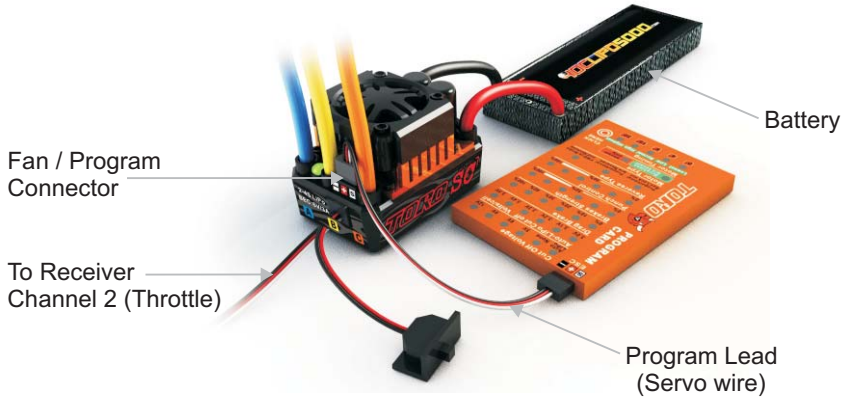
- After calibration ESC will rings 1 second indicating that it is armed.

From this point on, when you connect batteries and turn on the switch, the ESC will give the initialization tone and flash, and the arming tone will ring second or two later. If the ESC is programmed for the Auto-Lipo setting, it will beep the number of cells in you Lipo pack between the initialization tones and the arming tones. After the arming tone plays, the ESC will ACTIVE and will respond to the throttle application.

ESC PROGRAMMING

1)Programming Card(Optional Part)

Programming Card allows you to modify the most commonly used settings in your TORO SC controller all at the touch of a single button. No computer needed. Simply disconnect the Fan lead from ESC and connect program lead form program card to ESC's program connector. Power the programming card as described below. Press and release button to move between settings. Press and hold button to change the value for that setting. All the settings will show on the programming card at once. Can't get any easier!



2)Manual Programming

Manual Programming TORO SC is as simple as answering a few questions. The TORO SC asks questing by beeping a setting number, followed by the possible setting values. There are nine settings that can be programmed in the TORO SC.

Programmable Features

Question (Setting)	Value	Description
1)Brake/Reverse Type	***1)Reverse Lockout(D)****	Allow the use of reverse only after the ESC senses two seconds of neutral throttle.
	2)Forward/Brake Only	No reverse function.
	3)Forward/Brake/Reverse	Reverse or forward is accessible at any time after the ESC brakes to zero motor RPM.
2)Brake Amount	1)25%	Allow only 25% of available braking power at full brake.
	2)50%(D)*	Allow only 50% of available braking power at full brake.
	3)75%	Allow only 75% of available braking power at full brake.
	4)100%	Allow all available braking power.
3)Reverse Amount	1)25%	Allow only 25% power in reverse.
	2)50%(D)*	Allow only 50% power in reverse.
	3)75%	Allow only 75% power in reverse.
	4)100%	Allow all power in reverse.
4)Punch Control	1)High	Very Limited acceleration. Good for 2WD vehicles.
	2)Medium	Medium acceleration limiting.
	3)Low	Light acceleration limiting. Good for 4WD vehicles on soft dirt.
	4)Lowest	Very light acceleration limiting. Good for most situation.
	5)Disable(D)*	Acceleration is only limited by battery ability. This setting is good for 4WD on high traction drag racing.
5)Drag Brake	***1)Disable(D)****	Vehicle will coast with almost no resistance from the motor at neutral throttle.
	2)10%	Low amount of braking effect from the motor at neutral throttle.
	3)20%	More braking effect from the motor at neutral throttle.
	4)30%	Fairly high braking effect from the motor at neutral throttle.
	5)40%	High braking effect from the motor at neutral throttle.
6)Throttle Dead Band	1)Large	0.1500ms
	2)Normal(D)*	0.1000ms
	3)Small	0.0750ms
	4)Very Small	0.0500ms
	5)Smallest	0.0250ms
7)Voltage Cutoff	1)None	Does not cut off or limit the motor due to low voltage. Use this setting ONLY with NiCad or NiMH Packs. Do not use with any LiPo Packs!
	2)Auto-Lipo(D)*	Automatically detects the number of LiPo cells you have plugged in.
	3)5V	Cuts off/limits acceleration when the pack gets down to 5 volts.
	4)6V	Cuts off/limits acceleration when the pack gets down to 6 volts. A must use setting for 2 cells LiPo packs.
	5)9V	Cuts off/limits acceleration when the pack gets down to 9 volts. A must use setting for 3 LiPo packs
	6)12V	Cuts off/limits acceleration when the pack gets down to 12 volts. A must use setting for 4 LiPo packs.
8)Motor Timing	1)Lowest	A maximum efficiency setting giving long runtimes and cooler motor temperature.
	2)Normal(D)*	The best mix of speed, punch and efficiency for all motors.
	3)Highest	Increases ampere draw, reduces runtimes, increase motor temperatures and my increase top speed/punch slightly.
9) Motor Direction	***1) Normal(D)****	This is default motor rotation direction
	2)Reverse	Opposite default motor rotation direction

Note: Factory Defaults are indicated by asterisk (D)*

You must answer "yes" or "no" to the setting values as they are presented by TORO SC. When you enter programming mode the ESC will emit a sequence of beeps and LED flashes that tell you which programming step you are in. There are two parts to the beep sequence. The first set of beeps indicates the 'Setting Number (Question), e.g. Brake/Reverse Type, and the second set of beeps indicates a Setting Value, e.g. Reverse Lockout. Answering "No" to a Setting value will cause the ESC to ask for the next value in that section. After a "Yes" answer is accepted, the ESC knows you aren't interested in any other option in that section, so it skips to the first option in the next section.

Note: If you answer "no" to all Setting Values for a particular Setting Number, the ESC will keep whatever value had been previously programmed. Only by answering "Yes" to a Setting Value will the ESC store/change that value.

How to Enter Programming Mode

- Plug Battery into the TORO SC
- Hold full throttle on your transmitter
- Turn the ESC switch ON
- TORO SC flashes LED and rings once
- Wait few seconds.
- TORO SC flashes LED and rings 1 second indicating that it is ready for CALIBRATION mode
- Continue to hold full throttle
- TORO SC flashes LED while beeping
- Wait another few seconds
- TORO SC flashes LED and rings 1 second
- TORO SC flashes LED while beeping indication that you are in PROGRAMMING mode
- Let trigger go neutral (Centre)

At this point the TORO SC will be flashing/beeping the following sequence:
Beep-Pause-Beep... and then repeats
This indicates that you are at Question 1 and it is asking to accept/reject value 1.

When answering a question, you will need to move the trigger to yes (full throttle) position or the no (full brake) position and keep it there for about 3 seconds. When the ESC has accepted your answer it will confirm your reply by flashing the LED and emitting a beeping tone. Release the trigger allowing it to go to Neutral to confirm that you are ready for ESC to ask you next question. You are not required to continue through all nine programming options. For example, if you wish only to change the Brake/Reverse Type (Option 1) then after programming that setting you can disconnect power from the ESC and you're ready to run. Disconnecting the controller in the middle of programming simply retains the values for the remaining programming options that were previously set up.

FAN REPLACEMENT

The TORO SC comes with a 30mm x 30mm x 10mm 5V Brushless fan. Should the fan need replacement, simply unplug the fans power wire from the TORO SC, remove the 4 screws that secure the fan and remove the fan cover.

SPEED CONTROL SPECIFICATION

Controls, TORO SC	Rev/Brk/Brk or Fwd/Fwd
Motor Limits,TORO SC	Input Power (Cells)
Brushless KV ⩽ 6000	Up to 2S(8.4Volt), ideal for 1/10 short course
Brushless KV ⩽ 4000	Up to 3S(12.6Volt), for 1/10 buggies and short course
Brushless KV ⩽ 3000	Up to 4S(16.8Volt), ideal for 1/8 buggies
On Resistance,Brushless	0.0004 Ohms per phase at 25℃(77℉)Trans.Temp
Continuous /Burst Current	120Amp / 760Amp
Switching BEC	6V 5Amp
Status LED	1 with 3 color (Red, Green & Orange)
Thermal Overload Protection	Yes
Dimensions(LxWxH)	55x37.6x38.4mm (2.17x1.47x1.51in)
Weight (Without wires)	87g (3.07oz)

TROUBLE SHOOTING

***Problem**: My TORO ESC may or may not arm, but it will not calibrate to my transmitter*

Solution: Most calibration issues can be solved by changing settings on the transmitter. Make sure you have both your throttle and brake endpoints (called EPA or ATV on your radio) on the throttle channel out to between 100 to 120%. Make sure if you have a Futaba or Futaba made transmitter to have the throttle channel set to the reversed position.

***Problem**: My ESC calibrates for the full throttle and full brake positions but won't calibrate to the neutral throttle position. (Orange LED keeps flashing)*

Solution: Try moving the throttle trim one way, then the other (usually towards the throttle side is best). If your transmitter has a 50/50 and 70/30 setting for the throttle, set it for 50/50 and retry calibration. Also, if you have changed the dead band to a narrower band you may want to try going back to the "normal" setting.

***Problem**: My vehicle acts like it has "turbo lag" (poor acceleration/punch for the first few feet or yards)*

Solution: Make sure you're using high quality batteries and a battery connector capable of high amp flow (40-100 amps). This behavior is very typical of a battery pack that is having difficulty providing the power your vehicle/system requires for top performance. Use copper bars to connect cells rather than welded tabs. Copper bars have a much lower resistance.

***Problem**: My battery pack is plugged into the ESC and nothing is working*

Solution: Make sure the ESC's receiver plug is plugged into channel 2 on the receiver, and that it's plugged in with the correct orientation. Double check your solder connections on the battery plug, and make sure the battery is showing good voltage.

PRODUCT WARRANTY

The TORO SC Brushless ESC is guaranteed to be free from defects in materials or workmanship for a period of 120 days from the original date of purchase *(verified by dated, itemized sales receipt)*. Warranty does not cover incorrect installation, components worn by use, damage to case or exposed circuit boards, damage due to timing, damage from using more than 4S Li-Po cells input voltage, cross-connection of battery/motor power wires, overheating solder tabs, reverse voltage application, improper use or installation of external BEC, damage resulting from thermal overload or short-circuiting motor, damage from incorrect installation of FET servo or receiver battery pack, tampering with internal electronics, allowing water, moisture, or any other foreign material to enter ESC or get onto the PC board, incorrect installation/wiring of input plug plastic, allowing exposed wiring or solder tabs to short-circuit, or any damage caused by a crash, flooding or natural disaster. Because SKYRC has no control over the connection & use of the speed control or other related electronics, no liability may be assumed nor will be accepted for any damage resulting from the use of this product. Every SKYRC speed control & motor is thoroughly tested & cycled before leaving our facility and is, therefore, considered operational. By the act of connecting/operating speed control, user accepts all resulting liability. In no case shall our liability exceed the product's original cost. We reserve the right to modify warranty provisions without notice. This product is not intended for use by children under 14 years of age without the strict supervision of an adult. Use of this product in an uncontrolled manner may result in physical damage or injurise take extra care when operating any remote control vehicle.

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Manufactured by
SKYRC TECHNOLOGY CO., LTD.
www.skyrc.com

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