

SILVER SERIES

SS-60 High Voltage Brushless Electronic Speed Control



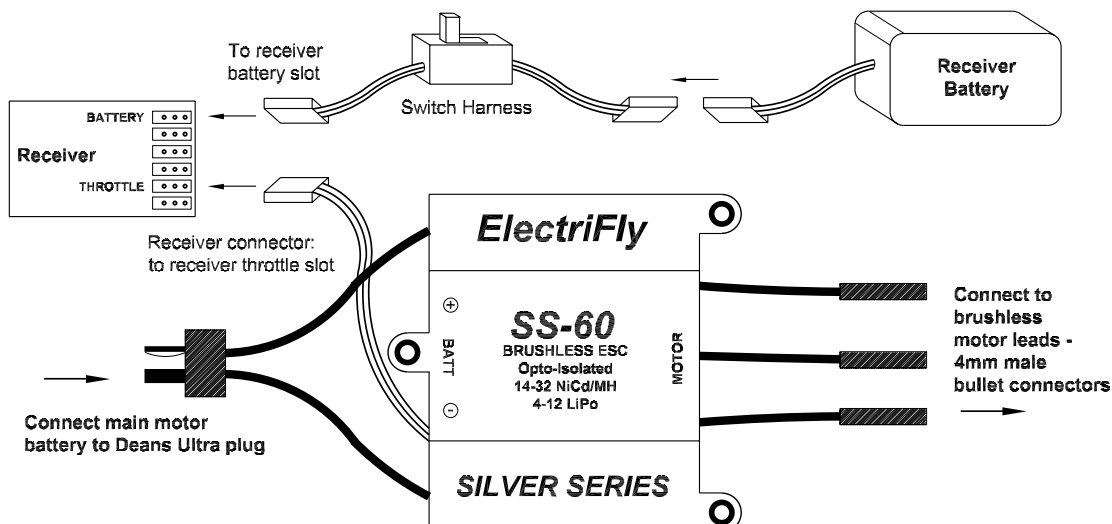
ElectriFly's™ Silver Series 60 amp ESC is designed for high power, plug-and-play convenience for controlling brushless motors for large electric aircraft. It features the Safe-Start function, which prevents accidental propeller rotation until the ESC is deliberately "armed". NiCd, NiMH, and LiPo compatibility is also included, plus a thermal protection system that will automatically stop motor rotation when ESC temperatures reach extreme levels. The control circuit is isolated from the power circuit by a custom optical circuit, to prevent unwanted motor noise from adversely affecting the radio system. A universal radio connector, Deans® Ultra™ battery connector, and 4mm gold plated bullet connectors for the motor are factory installed. The brake setting can easily be adjusted through a transmitter's stick. Additional custom features can be set with the Silver Series Programming Card available separately (GPMM1895).

IMPORTANT PRECAUTIONS

Read and follow these precautions carefully before use.

- **ALWAYS** observe that a propeller might unexpectedly rotate anytime that power is applied to the ESC, which could cause severe injury! Never get near the propeller!!

Refer to this sketch when performing Step 1.



- NEVER use more than the specified voltage on the ESC's input.
- ALWAYS mount the ESC in a position where free air can flow across it during operation.
- ALWAYS turn on the transmitter before connecting the battery to the ESC.
- ALWAYS disconnect the battery from the ESC when not in use.
- ALWAYS remove the propeller from the motor when working on the model.
- Make sure the input battery is fully charged before connecting to the ESC, so the low voltage cutoff feature can function properly.
- Do not attempt to use Silver Series ESC with brushed motors.
- Do not allow water, moisture or any foreign material onto the ESC's PC board.
- Use heat-shrink tubing to insulate any bare wires between the motor battery and ESC, and from the ESC to the motor to prevent a short circuit.
- Allow the ESC to cool before touching and between flights.
- Keep out of reach of children.
- ElectriFly is not responsible for incidental damage or personal injury as a result of misuse of this product.

STEP 1 - CONNECTING TO THE RECEIVER

1. Firmly press the "receiver connector" into the receiver's throttle slot (refer to your radio's instruction manual). The orange "signal wire" should be in the same position as would the white wire on Futaba® servos, the blue wire on Airtronics® "Z" connector, the yellow wire on Hitec® servos, or the orange wire on JR® or Spektrum® brand servos. **CAUTION:** An Airtronics Servo Adapter must be used when connecting to an old style Airtronics radio.

2. Because the SS-60 does not include a built in battery eliminator circuit (BEC), it will be **necessary** to connect a separate battery to power the receiver and other on-board equipment (servos, etc). Make sure this battery is fully charged before use. It may be desirable to install a switch harness between this battery and the receiver. For small electric planes a 300-600mAh receiver battery should work adequately. For larger airplanes, or those using larger servos or digital servos, a receiver battery with higher rated capacity is recommended.

3. To operate the receiver, first turn on the transmitter, then the receiver switch harness, then connect the motor battery to the ESC. Reverse the order to shut the receiver off.

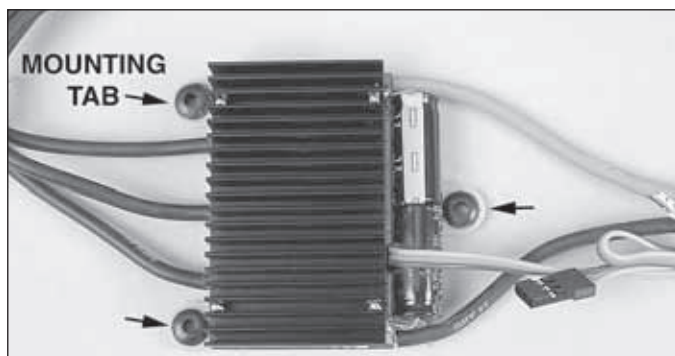
STEP 2 - MOTOR CONNECTIONS

Each of the three motor leads is made of high quality 14 gauge, silicone insulated wire with a gold plated female bullet connector on the end. These connections are not polarized, so there is no need to match the color of the ESC and motor wires. If the motor rotates backwards, simply switch **any two** of the ESC's motor connectors. Once connected, make sure all connections are insulated electrically. Failure to do so could result in permanent damage to the motor/ESC, and void all warranties.

STEP 3 - MOUNTING THE ESC

Determine the best location for the ESC, inside or outside the fuselage.

IMPORTANT! It's highly recommended to install the ESC so that air can freely flow across it during operation! The more air which can flow over the ESC, the better. This is especially important when using the maximum number of cells on the input, when ambient temperatures are very high, when using a lot of servos in the aircraft, or performing very active 3D maneuvers! If the airplane's structure doesn't naturally allow for air to flow into the fuselage, create vent holes fore and aft in the fuselage to allow air to pass through and across the ESC for cooling. Do NOT pack the ESC with foam padding as it will not allow the ESC to properly radiate heat and likely cause a thermal shutdown.



Three mounting tabs are designed onto the SS-60 which allows it to be installed firmly on the aircraft. Determine the desired location for the ESC, and mount firmly with three #4 x 5/8" [16mm] screws with #4 washers (wood screws for solid wood surfaces) If mounting to metal, use three 4-40 machine screws with #4 washers.

Another method for mounting the ESC in the aircraft is with Velcro®. If the ESC will be mounted on wood, first saturate the wood with thin CA and allow it to dry. To mount the ESC on shrink covering, first clean the surface with rubbing alcohol. Then, cut a small piece 1/2" x 1/2" [12.7 x 12.7mm] of Velcro (both hook and loop), and attach the hard hook material to the fuselage. Clean the side of the ESC with rubbing alcohol and attach the loop material.

If the wires are not long enough to make all necessary connections to the ESC yet achieve good balance in the aircraft, it's best to extend the length of the wires to the motor (not to the battery).

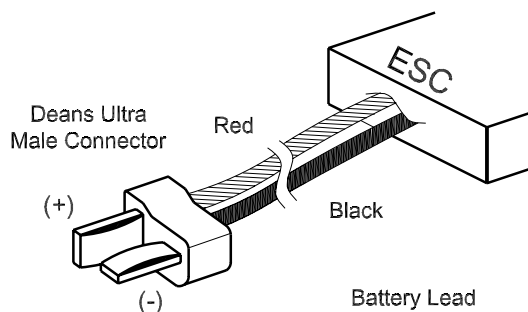
STEP 4 - NECESSARY TRANSMITTER SETTINGS

For proper ESC operation, it's very important to set the transmitter's throttle channel adjustments, as follows:

1. Set the throttle channel's travel adjustment (ATV, EPA or ATL) to 100%.
2. Set the throttle trim and sub-trim to neutral or zero.
3. Set the throttle channel's reversing switch to reverse on Futaba transmitters. Other transmitters might require you to set the throttle reversing switch to normal.

STEP 5 - CONNECTING THE BATTERY

IMPORTANT! REMOVE THE PROPELLER FROM THE MOTOR BEFORE CONNECTING THE BATTERY!



The SS-60 ESC is compatible with NiCd, NiMH, or LiPo batteries. It is not required to setup the ESC to recognize the exact battery type.

First, make sure the battery is FULLY charged before connecting it to the ESC. Failure to do so will not allow the low voltage cutoff feature to work properly (see details below). Connect the battery to the 4 inch long battery lead on the ESC which has the Deans Ultra plug. Make sure to observe proper polarity [red (+) leads go together, and black (-) leads together]. **NEVER** allow a battery's red (+) and black (-) wires to touch as permanent damage will result and void all warranties.

LOW VOLTAGE CUTOFF: All Silver Series ESCs include a low-voltage cutoff feature that stops motor rotation if the battery's voltage drops too low (but power will still be supplied to the receiver and servos so you can land the aircraft). This protects the battery from damage. When the battery is initially connected, the ESC measures the battery's voltage and automatically sets the low voltage

cutoff based on this initial battery voltage multiplied by 0.74. So, if the battery is NOT fully charged when connected to the ESC, the ESC will set a low voltage cutoff that is too low. **So make sure the battery is fully charged prior to every use.**

STEP 6 - ESC SETUP

The SS-60 will cause the brushless motor to make beeps which will aid in setting up the system. Make sure the motor is connected, but that the propeller is removed.

BRAKE FUNCTION: The factory default brake setting is "off". Skip to the "**ESC OPERATION**" section below if you want to keep this setting. To turn the brake "on":

1. Move the throttle stick to full throttle, turn on the transmitter and connect the battery to the ESC.
2. After 5 seconds the motor will beep twice.
3. Move the throttle stick to the off position (towards you). The motor will beep twice.
4. Again move the throttle stick to full power. The motor will beep twice to confirm the brake is now "on".
5. Move the throttle stick back to off. The motor will now beep four times indicating the motor is "armed".

Once set, the brake function will be stored in the ESC until changed again manually.

To turn the brake off, repeat the above process. This time the motor will only beep once with each stick movement, but will beep four times again at the end to indicate the ESC is armed.

ESC OPERATION

1. Turn the transmitter's power on.
2. Move the throttle stick to the off or brake position (towards you).
3. Turn on the Rx switch harness, then connect the battery to the ESC. The motor will beep to indicate the brake setting (once for off, twice for on).
4. Move the throttle stick to full. The motor will again beep once or twice to indicate the brake setting.
5. Move the throttle stick to off or brake and the motor will beep four times. The ESC is now "armed". **WARNING!!** Advancing the throttle stick will now cause the motor to rotate! Stay clear of the motor's shaft!

If the ESC does not operate properly or makes a low pitched beeping sound following the above setup procedure, disconnect the battery from the ESC, reverse the throttle setting on the transmitter and repeat the ESC setup.

SAFE-START: As a safety precaution to prevent the motor from rotating when the battery is first connected, you must "arm" the ESC every time you connect the battery. The

propeller will NOT rotate until the ESC is armed. To arm the ESC, move the throttle stick to full position, then back to off (or brake). **Now the motor will rotate anytime the throttle stick is advanced away from the off position! Care must be exercised when near the model's propeller!**

STEP 7 - RANGE TEST

Because electric motors generate electrical noise, it's critical to range test the airplane before flight with the motor on. With the TX antenna collapsed and a helper holding the airplane, operate the flight controls while walking away from the airplane. You should be able to get approximately 75 to 100 feet away before losing control of the airplane's surfaces. Next, check the range with the motor running at half throttle. The range should be close to the range you got with the motor off. If it is not, you may need to move the receiver, receiver antenna, servo leads or the speed control to a different location.

SPECIFICATIONS

Input voltage:	14-32 NiCd/NiMH cells, 4-12 LiPo cells (12.4 to 50V)
BEC:	no BEC circuit, opto-isolated
Max. output current:	60A continuous, 72A surge
Max. output power:	3000 watts
Brake:	ON or OFF
Rotation direction:	forward only*
Timing angle:	12°*
Operating frequency:	8kHz*
Low voltage cutoff	starting battery voltage x 0.74*
On resistance:	0.004 ohms
Thermal cutoff:	230°F [110°C]
Dimensions:	2.3 x 1.9 x 0.7 in. [58 x 48 x 18mm]
Weight:	3.13 oz. [89g, w/Deans Ultra plug, Rx plug, three 4mm bullets]

*can be adjusted with optional programming card (GPMM1895)

OPTIONAL SILVER SERIES PROGRAMMING CARD (GPMM1895)

Several features in the SS-60 can be adjusted by using an optional Silver Series Programming Card (GPMM1895), such as brake (ON or OFF), motor rotation direction (forward or reverse), timing angle (12° or 20°), operating frequency (8kHz or 16kHz), or custom setting of the low battery cutoff voltage (5.6 to 37.0V). It is not necessary to have the Programming Card in order to use the basic features of the SS-60 ESC. See your local retailer for details on how to get the Silver Series Programming Card.

TROUBLESHOOTING GUIDE

Problem - Motor and Rx do not work: Make sure the motor battery is fully charged. Make sure good contact is being made between the motor battery and ESC, and from the ESC to the receiver. Try powering the receiver directly from a separate RX battery...if the receiver now works, the problem may be the ESC and require servicing.

Problem - The ESC functions but can't be controlled: Make sure the ESC is plugged into the receiver's throttle slot. Make sure the TX is properly adjusted.

Problem - The receiver glitches or stutters while the motor is running: The receiver or its antenna is mounted too closely to the ESC, motor battery, or power wires. Make sure all electrical connections fit snugly.

Problem - The motor stops after only a few minutes of rotation, but all other surfaces in the aircraft can still be controlled: The propeller might be too large causing high current draw, and the ESC's temperature protection function is stopping motor rotation automatically. Make sure the motor is not damaged (bent shaft, tight bearing, etc.) causing high current draw. The ESC may need more cooling air flowing over it. Are too many servos being used in the model, or servos which are drawing too much power?

SERVICE PROCEDURES

ESC's that operate normally when received by Hobby Services will be charged a minimum service fee and return shipping charges. Before sending your ESC in for service, it is important that you review the "**Troubleshooting Guide**" on this instruction sheet. The ESC may appear to have failed when other problems exist in the system – such as a defective transmitter, receiver or servo, or incorrect adjustments/installation.

- Hobby dealers are not authorized to replace ESC's thought to be defective.
- Do not cut the input wires of the ESC before sending it for service. A fee will be charged for cut wires which must be replaced for testing.

180 DAY WARRANTY USA AND CANADA ONLY

Great Planes® warrants this product to be free from defects in materials and workmanship for a period of 180 days from the date of purchase. During that period, we will repair or replace, at our option, any product that does not meet these standards. You will be required to provide proof of purchase date (receipt or invoice). If, during the warranty period, your ESC shows defects caused by abuse, misuse or accident, it will be repaired or replaced at our option, at a service charge not greater than 50% of the current retail list price. Be sure to include your daytime telephone number in case we need to contact you about your repair. This warranty does not cover components worn by use, application or reverse voltage, cross connections, poor installation, subjection of components to foreign materials, any alterations to wires or tampering. In no case shall our liability exceed the original cost of the product. Your warranty is voided if:

- You apply reverse voltage to the ESC by connecting the motor battery backwards.
- You allow any wires to become frayed which could cause a short.
- You use more than the rated number of cells in the motor battery.
- You tamper with any of the electronic components.
- You allow water, moisture or any other foreign material onto the PC board.

Under no circumstances will the purchaser be entitled to consequential or incidental damages. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. **If you attempt to disassemble or repair this unit yourself it may void the warranty.**

For service to your ElectriFly ESC, either in or out of warranty, send it post paid and insured to:

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Champaign, IL 61822
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Internet Address: www.electrifly.com