Tips for using the ESC

- If you store throttle corrections as described in step 1 at the bottom of page 2, then you don't have to repeat the procedure before each flight. The ESC is ready to go (using stored EPAs) when you turn it on, and the motor will turn as soon as you move the throttle stick away from the off position.

- If you fast-charge your battery pack, wait at least 5 minutes before using it to power the ESC. This assures the ESC can properly determine the number of cells in the pack.

- After you connect your charged battery pack to the ESC and turn power on, wait about 3 seconds before advancing the throttle. This gives the ESC time to accurately determine the number of cells in the battery pack.

- If the motor cuts off in flight:
  1. Move throttle stick to off.
  2. Move throttle stick back up.
     If the battery pack is in good condition, the ESC should provide 2 restarts.

Super 30 ESC cell detect and auto low voltage cutoff specifications

For initial voltage	Pack type/size* is assumed to be	And cutoff voltage (when enabled) is
5.30 to 7.15 V	NiCd/NiMH, 5 cells	5.3 ±0.1 V
7.16 to 8.55 V	NiCd/NiMH, 6 cells; or LiPo, 2 cells	5.3 ±0.1 V
8.56 to 9.95 V	NiCd/NiMH, 7 cells	5.4 ±0.1 V
9.96 to 11.20 V	NiCd/NiMH, 8 cells	7.5 ±0.1 V
11.21 to 12.45 V	NiCd/NiMH, 9 cells; or LiPo, 3 cells	8.4 ±0.1 V
12.46 to 14.50 V	NiCd/NiMH, 10 cells	10.0 ±0.1 V
14.51 to 16.05 V	NiCd/NiMH, 11 cells	10.3 ±0.1 V
16.06 up	NiCd/NiMH, 12 cells; or LiPo, 4 cells	11.0 ±0.1 V

*number of cells connected in series

Super 30 ESC specifications

Model	ASC20
Functions	Proportional throttle, throttle end point adjustment (EPA), brake, battery eliminator circuit (BEC), low voltage cutoff (LVC, both automatic and custom voltage), restart
Input	2 to 4 Lithium Polymer cells in series, or 5 to 12 NiCd/NiMH cells in series (LVC enabled), or 3 to 12 NiCd/NiMH cells (LVC disabled)

Input operating voltage	2.1 to 18 VDC
Motor support	1 DC motor, up to 20A current draw (does not support brushless motors)
Frequency	1.5 kHz
Continuous output current	20 A
Peak output current	200 A (FET rating)
Internal resistance	5.5 milliohm
BEC output	5.0 ±0.5 VDC at 1A maximum
Dimensions	1.15" x 0.75" x 0.40" (29.2mm x 19mm x 10.2mm)

FMA limited warranty for electronic speed controls

FMA, Inc. warrants this product to be free of manufacturing defects for the term of 90 days from the date of purchase. Should any defects covered by this warranty occur, the product shall be repaired or replaced with a unit of equal performance by FMA or an authorized FMA service station.

Limits and exclusions

This warranty may be enforced only by the original purchaser, who uses this product in its original condition as purchased, in strict accordance with the product's instructions. Units returned for warranty service to an FMA service center will be accepted for service when shipped postpaid, with a copy of the original sales receipt or warranty registration form, to the service station designated by FMA.

This warranty does not apply to:
- Consequential or incidental losses resulting from the use of this product.
- Damage resulting from accident, misuse, abuse, neglect, electrical surges, reversed polarity on connectors, lightning or other acts of God.
- Damage from failure to follow instructions supplied with the product.
- Damage occurring during shipment of the product either to the customer or from the customer for service (claims must be presented to the carrier).
- Damage resulting from repair, adjustment, or any alteration of the product by anyone other than an authorized FMA technician.
- Installation or removal charges, or damage caused by improper installation or removal.

Call (301) 668-7614 for more information about service and warranty repairs.
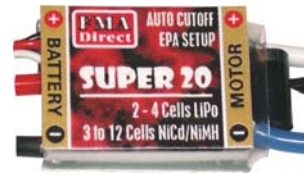
Super 20 Auto Cell Detect Electronic Speed Control

Model ASC20 for electric-powered aircraft using Lithium Polymer, NiCd or NiMH battery packs

Features

- Works with NiCd, NiMH and Lithium Polymer (LiPo) packs.
- User switchable brake.
- Two user switchable Low Voltage Cutoff (LVC) options. Auto LVC, when enabled, automatically cuts off motor at minimum voltage calculated from initial battery pack voltage. Custom LVC, when enabled, automatically cuts off motor at a minimum voltage you set.
- Throttle End Point Adjustment (EPA) for better tracking from throttle stick to motor speed.
- Battery Eliminator Circuit (BEC) powers receiver from motor battery.
- Heavy-duty diode reduces electrical noise.

> **Note:** When using LiPo batteries in fuel-powered models, use an FMA voltage regulator/LED indicator, such as the Sport VRLI.

Kokam/USA Lithium Polymer cells are the next-generation replacement for NiCd, NiMH and Lithium Ion cells. This unique power technology offers high energy density, low weight, long life, safe operation and environmentally-friendly chemistry. Order Kokam/USA cells and packs through the Kokam/USA Web site, www.kokamusa.com (or www.fmadirect.com). LiPo technical and application information is available in the Support section of the Web site.

Precautions

- Follow all instructions in this manual to assure safe operation.

- Observe frequency control. If someone else is operating a radio controlled model on the same channel as your transmitter, **do not turn on your transmitter—even for a short time.** Your transmitter has a channel number marked somewhere on its case. When a model receives signals from two transmitters on the same channel at the same time, it cannot be controlled and will crash—possibly causing personal injury or property damage. **For safety, most RC flying fields have formal frequency control rules. Follow them carefully.**

- Do not operate your radio control transmitter within 3 miles of a flying field. Even at a distance, your transmitter can cause interference.

- Make sure your LiPo packs are not fully discharged when you first connect them to the ESC and apply power. The ESC sets its Auto Low Voltage Cutoff by measuring initial pack voltage. If the LiPo pack voltage is too low, the Auto Low Voltage Cutoff may be set too low, and cells could be over-discharged. Charge state is less critical for NiCd/NiMH packs, but it's always a good idea to start with a freshly charged pack.

- The Super 20 ESC works with packs of 5 to 12 NiCd/NiMH or 2 to 4 LiPo cells in series. If Auto Low Voltage Cutoff is disabled, the ESC supports packs with 3 to 4 NiCd/NiMH cells in series (however, your receiver/servos may stop operating at the lower voltage near the end of a run). ***Never disable the Low Voltage Cutoff when using the ESC with LiPo packs.***

FMA, Inc. ● 5716A Industry Lane ● Frederick, MD 21704
Sales: (800) 343-2934 ● Technical: (301) 668-7614 ● www.fmadirect.com

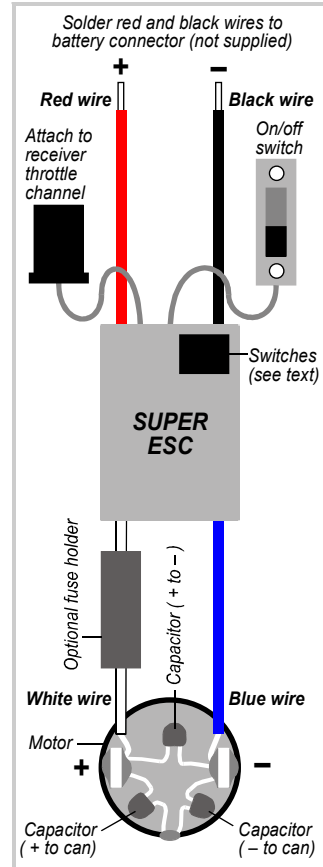**FMA Direct**

Installing the ESC

You must supply:

- Battery connector rated for expected current flow (up to 20A) from battery pack. Recommended: Deans Ultra or Sermos connector. *Don't use a servo connector, as it can't handle the high current.*
- 3 0.01µF capacitors (FMA No. C0.01UFPOLY).
- Optional: 20A fuse and inline fuse holder.

1. Cut a small opening in ESC cover so you can set switches.
2. Optional: Cut red and black battery wires, and/or blue and white motor wires, to a length appropriate for your installation.
3. Optional: Cut white (+) wire and solder in fuse holder. Insert fuse into fuse holder.
4. Solder red (+) wire to battery connector positive terminal.
5. Solder black (–) wire to battery connector negative

> **Note:** Double-check battery connector polarity. Damage caused by reversing battery polarity is not covered by the warranty!

terminal.

6. Insert blue wire into motor's negative (–) terminal.
7. Insert white wire into motor's positive (+) terminal.
8. Insert capacitors as shown at right: one between motor terminals and one from each terminal to the motor can.
9. Solder wires and capacitors to terminals, and solder capacitors to motor can.
10. Attach servo connector to throttle channel on receiver (observe polarity!).
11. Set on/off switch to **off** position.
12. Attach battery connector to battery pack.

Solder red and black wires to battery connector (not supplied)

+ —

Red wire — Black wire

Attach to receiver throttle channel

On/off switch

SUPER ESC

Switches (see text)

Optional fuse holder

Capacitor (+ to –)

White wire — Blue wire

Motor

+ —

Capacitor (+ to can) — Capacitor (– to can)

Setting up the ESC

1. Throttle **End Point Adjustment** (EPA) provides better tracking between throttle stick position and actual motor speed. With EPA correctly set, the motor is off when the throttle stick is all the way down, and reaches maximum speed when the throttle is all the way up.

> **Tip:** The ESC doesn't care whether the throttle channel is reversed or not. EPA assumes the initial throttle stick position (normally all the way down) is "motor off."

To set up EPA:
a. Set transmitter's throttle to 100%, and center throttle trim.
b. With the ESC off, set Switch 3 on (see diagram on page 3).
c. Move your transmitter's throttle stick all the way **down.**
d. Turn on your transmitter, then turn on the ESC/receiver. The motor will not rotate until step d is complete.
e. Wait 3 seconds for the ESC to determine the number of cells in the pack.
f. Move the throttle stick all the way **up** (or to the desired position for maximum motor speed) and **hold it there for at least 3 seconds.** Then move the throttle stick all the way **down.** *CAUTION: The motor is now active and will rotate if you move the throttle stick up.*

g. Test throttle operation: Hold the aircraft securely and clear of the propeller, then move the throttle stick full up. The motor should turn at maximum RPM. Move the throttle stick all the way down to turn off the motor.
h. Store EPA settings: Set Switch 3 off. The settings are now stored and will be available for future flights.

> - If you forget to set switch 3 to off in step h above, you will have to repeat the EPA setup each time you cycle power on the ESC.
> - Because the ESC is optimized for your throttle, there will be very little deadband when throttle is off (moving the throttle stick just a little causes instant response). If the motor turns unexpectedly when throttle is off, reduce throttle trim slightly.

2. **Low Voltage Cutoff** (LVC) turns off the motor when battery voltage gets low. This enables the battery to maintain radio system functions for a short time—enough time to glide the aircraft to landing. Low voltage cutoff also prevents cell damage from deep discharge. Two LVC options are provided. With **Auto Low Voltage Cutoff**, the ESC automatically determines the cutoff voltage based on initial pack voltage. With **Custom Low Voltage Cutoff**, you set the voltage at which cutoff occurs. *You must enable low voltage cutoff when using LiPo batteries, which can be permanently damaged by low voltage conditions.*

To enable Auto Low Voltage Cutoff: set Switch 2 on.
  or
To disable Auto Low Voltage Cutoff: set Switch 2 off.
To enable and set Custom Low Voltage Cutoff:

> **Note:** The ESC can be used with 3 or 4 cell NiCd/NiMH packs when Auto Low Voltage Cutoff is disabled. **CAUTION:** If you disable ALVC, the ESC cannot safeguard against depleting the battery to the point where you won't be able to control the aircraft.

a. With the ESC off, set Switch 2 off.
b. Connect a partially discharged battery pack. (Pack can be fully charged, but it will take

> **Tip:** For safety, have another person help you with this procedure.

longer to reach the target cutoff voltage).
c. Connect a voltmeter between battery + and – .
b. Move your transmitter's throttle stick all the way **down.**
d. Turn on your transmitter. Hold the aircraft securely and clear of the propeller, then move the throttle stick full **up**.
e. Watch the voltmeter. When the voltage drops to the desired cutoff point, carefully set Switch 2 on. This sets the cutoff voltage and turns the motor off.
The ESC will use this cutoff voltage until you repeat the above procedure, or you disable Custom Low Voltage Cutoff.

To disable Custom Low Voltage Cutoff and enable Auto Low Voltage Cutoff:
a. Move your transmitter's throttle stick all the way **down.**
b. Turn on your transmitter.
c. Set Switch 2 off.
d. Turn the ESC on. **Don't move the throttle stick.**
e. Set Switch 2 on.
f. Turn off the ESC.
g. Turn off your transmitter.

3. **The Brake** stops motor rotation when the throttle is off and when the Low Voltage Cutoff (see step 2, above) cuts power to the motor. Braking is often used when the aircraft is equipped with a folding propeller.

To enable the brake: set Switch 1 on.
  or
To disable the brake: set Switch 1 off.

ON

1 2 3 4

Brake — Low Voltage Cutoff — Throttle EPA — No function