

LiPo packs must not be discharged below approx. 3 volts per cell. Even a single deep discharge may permanently damage your pack. The tiny LiPo Voltage Guard operates in parallel with your Electric Speed Controller. It will sound a buzzer when your pack drops below a pre-programmed voltage threshold.



with audible warning, from

## LiPo Voltage Guard

### Specifications:

Microprocessor controlled, auto-calibrating, 10-bit A/D converter with digital signal processing.

Operating voltage: 5V – 45 V

Minimum threshold: 5V (2 cells, 2.5V/cell)

Maximum threshold: 34V (10 cells, 3.4V/cell)

Precision: 1% or better

Current draw: 35mA max. during alarm, <10mA otherwise

Weight: 4g

Size: 28mm x 20mm x 10mm

**Designed by Jochen Guther. © 2003**

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### Installing the LiPo Voltage Guard in your model:

Connect the LiPo Voltage Guard in parallel to your Electronic Speed Controller (not directly across the battery). In helicopters, use servo tape to hold the Voltage Guard in place with the sounder outermost, but do not mount directly onto aluminium, carbon fibre or other conducting surfaces. In fixed wing aircraft, drill a 4mm hole through the fuselage to line up with the hole in the sounder - attach the sounder to the fuselage with 'Evostick' or silicone rubber without occluding the sounder hole.

The factory setting is for 3 cells, 3.0V/cell, with 'timed minimum hold'. If you plan to re-program these while the LiPo Voltage Guard is installed in your model, please make sure that the programming connector is easily accessible. During normal operation of your model, the programming connector is not needed and must be left unconnected from receiver.

On turning on, the Voltage Guard will buzz four times to show it is active.

### Programming the LiPo Voltage Guard for your application:

If the factory setting is not suitable for your application, you can re-program the LiPo Voltage Guard from your transmitter.

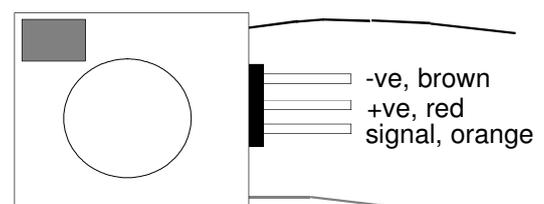
You will need:

- your transmitter
- a receiver and receiver battery.
- a flight pack or other power supply (anything between 5 and 45 volts will do)

Power up your transmitter and move the throttle stick to the centre.

Connect the receiver battery to the receiver  
Connect the LiPo Voltage Guard to the flight pack or power supply

Connect the programming connector of the LiPo Voltage Guard to the throttle channel of your receiver with the supplied cable.



Sounder underneath board

As soon as the LiPo Voltage Guard receives a valid throttle signal, the sounder will buzz, indicating that the device is ready to learn **the number of LiPo cells** that you are using.

Move the throttle stick slowly up or down to a position where the sounder pattern matches the number of cells in the pack. Eg for a three cell LiPo pack, you want three buzzes followed by a pause. For a ten cell LiPo pack, you want 10 buzzes, followed by a short pause, etc.

for a 2-cell pack: . . . . .

for a 3-cell pack: . . . . .

for a 4-cell pack: . . . . .

etc.

When the desired pattern appears, hold the throttle stick steady until the sounder goes on permanently. This indicates that the device has stored the number of cells and is now ready to learn the **threshold voltage per cell**.

The voltage threshold is user programmable from 2.5 to 3.4 volts per cell. It is recommended that you start with a conservative setting of 3.2 volts/cell.

Move the stick to a new position to select the threshold voltage per cell. The sounder will buzz once followed by a pause for 2.5V/cell, up to 10 buzzes followed by a pause for 3.4V/cell.

When the required pattern appears, hold the throttle stick steady until the sounder goes on permanently. This indicates that the device has stored the threshold and is now ready to learn the setting for the **minimum hold feature**.

Move the stick to a new position to select 'timed minimum hold' or 'indefinite minimum hold' The display patterns and their meanings are:

Timed minimum hold : . . . . .

Indefinite minimum hold: . . . . .

When you see the required pattern, hold the stick steady until the device returns to normal operating mode (sounder off). At this point, disconnect the receiver battery from the receiver, disconnect the programming cable from the LiPo Voltage Guard, disconnect the Lipo Voltage Guard from your flight pack, and turn off your transmitter. The LiPo Voltage Guard will remember the new settings.

## Using the LiPo Voltage Guard:

When the voltage in your LiPo battery pack drops below the selected voltage per cell, the LiPo Voltage Guard starts to sound. There are three possible patterns:

voltage per cell lower than threshold:

. . . . .

voltage per cell lower than threshold-0.1V:

. . . . .

voltage per cell lower than threshold-0.2V:

. . . . .

Example: If the LiPo Voltage monitor is set for 3 cells and 3.0V/cell, it will begin to sound when the pack voltage drops below 9.0V. Below 8.7V, you will hear a double sound, and below 8.4V a triple sound.

## How to find the correct cut-off voltage for your application:

The output voltage of your pack depends not only on the state of charge, but also on the current draw. Therefore the correct cut-off setting is different for each application. For a very high current draw, a cut-off voltage of 2.5 volts / cell may be appropriate,

while for a slow/park flyer with very low current consumption, 3.2 volts / cell may be more appropriate. You want to use a setting that leaves a certain safety margin for a missed approach or a slightly unbalanced pack.

Start with a conservative setting such as 3.2 volts / cell (= threshold code 8 when programming). Land your model as soon as the low voltage alarm goes off. Recharge your pack and check your charger to see how much capacity you have used. If you have used less than 80% of the available capacity of your pack, you may want to set the threshold a little bit lower the next time.

## Minimum Hold feature

If the 'timed minimum hold' is used, the low voltage pattern will be heard for up to 20 seconds before changing to the present voltage. If the 'indefinite minimum hold' feature is active, the device will remember the lowest voltage reached since power up, and will sound the pattern based on this minimum voltage, not on the present voltage (which may have recovered). This is a useful feature in case you cannot hear the sounder all the time. It can also be used in a helicopter to help you find the maximum allowable pitch range without overloading your pack.