eLim Energy Limiter

User Guide

mlm

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User Guide

Version 1.5

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Contents

History

V1.1 1 Jan 2018 -Default settings changed to Naviga values as of Jan 2018

V1.2 1 Jan 2019 -Default settings changed to Naviga values as of Jan 2019

V1.3 2 Jul 2019 – Note regarding BEC 0V added

V1.4 22 Jul 2019 – Max voltage updated.

V1.5 21 Aug 2019 – Connection diagram added

CHAPTER 1

Introduction

Thank you for choosing the **eLim** energy limiter

What does it do?

The **eLim** energy limiter is an electronic device which is used in R/C model boat racing to provide a calibrated amount of energy from a battery power source.

Why is it needed?

The quest for ever greater performance leads to competitors pushing the battery packs to their limits by charging to maximum voltage and discharging to or below their minimum voltage.

The result is that the life of packs can be short and the cost of racing has become a concern.

Also, despite what it may say on the label, not all batteries deliver their rated capacity and if they do, they don't do it for long. This means that not all racers are competing with the same amount of energy.

How does the eLim help?

The **eLim** is connected to a larger more robust battery but only allows a pre-determined amount of energy to be used. Because the battery is not fully discharged, it will now last much longer and they will now deliver exactly the same amount of energy each time to all competitors.

How does it do this?

The **eLim** constantly monitors the instantaneous voltage and current so that the power (watts) can be calculated. This power when logged over time is deducted from a pre-programmed amount of energy. When the limit is reached, the throttle demand to the ESC is reduced to a configurable value (can be zero) over a configurable period.

Is the model now dead?

Only if the race organisers configure it to have 0% throttle when the energy limit is reached. It will re-enable in a configurable time so that it can be recovered.

Will it work with any radio gear?

If the receiver outputs the standard 1-2mS PWM signal then yes. The **eLim** automatically senses the pulse width at zero throttle and so will adjust to any gear, even pistol grip transmitters.

How can it be programmed?

The **eLim** can be calibrated and configured with an associated programming device (not supplied) which is obtained from mlm Solutions.

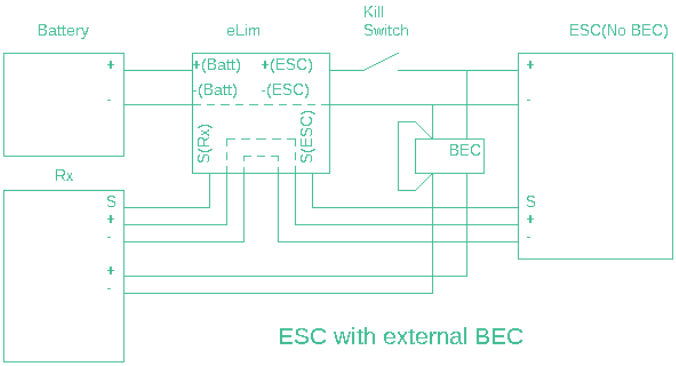
The voltage and current can calibrated independently. The four energy levels, Ramp Down time, Min Throttle percentage and Limit Time can be configured.

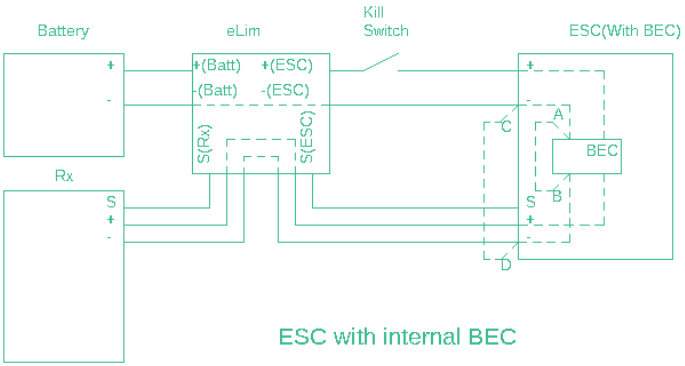
Without the programmer, only 1 of 4 pre-programmed energy levels can be selected by means of the energy level selector button (supplied).

CHAPTER 2

How to use

Connection





The red and black power cables (10 AWG) marked “BAT” should be connected directly to the battery supply.

The red and black cables marked “ESC” should of course go to the ESC. The race organisers may require that the red cable should go via the safety loop. In this way, even when the safety loop has been removed, the **eLim** remains powered and the LED will indicated both the energy level selected and if the limit has been exceeded.

The receiver throttle output (PWM) should be connected to the input marked “RCVR” using the cable provided.

The ESC input cable is connected to the output marked “ESC”.

As is shown in the diagram above, the positive and negative wires from the ESC signal cable pass straight through the eLim but are not electrically connected to it. However, it is necessary for reliable operation that the voltage difference between the battery negative (0V) and the ESC signal negative (0V) be at the same voltage (within about 0.2V).

If an external BEC is used, connect together the BEC’s input and output negative (0V).

If an ESC with an internal BEC is used, it is normal that the signal negative is connected to the battery negative internally (connection A-B in the diagram). It has been observed however, that some ESC’s do not provide this internal connection and therefore this must be provided externally (connection C-D in the diagram).

If the ESC doesn’t provide this internal connection, you may observe intermittent or hesitant throttle control. If you experience this problem, then an easy way to test if you need to provide this external connection is to use a servo extension cable (Male to Female). Plug the female end of this cable into an unused port of your receiver. From the other (male) end of the cable, remove the negative wire (black or brown) from the connector and plug it into the most negative pin of your batteries balance connector (usually black).

If this solves your problem, then make a more permanent connection (C-D in the diagram).

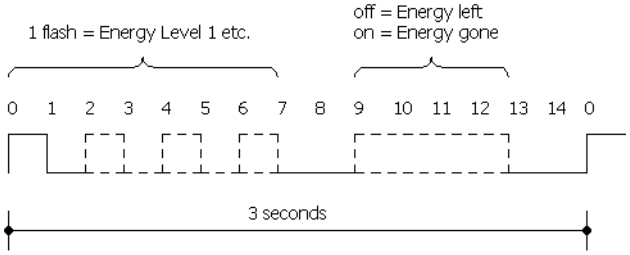
Energy level selection

The **eLim** stores four preset energy levels. Each one can store a value between 0-65535 WattMinutes but it is recommended that the lowest limit is stored in location 1 increasing up to the highest in location 4.

The values stored as factory defaults are:-

Level	Value WattHrs(WattMins)	Class
1	21(1200)	Mini mono/hydro
2	60(3600)	Mono1/Hydro1/Eco
3	120(7200)	Mono2/Hydro2
4	180(10800)	FSRE

The **eLim** indicates which level has been selected via the LED which flashes as shown in the diagram below.



As can be seen, if level 1 is selected, the LED will flash once, if level 2 is selected it will flash twice etc.

The second half of the 3 second cycle indicates the energy used state. If the energy limit has been exceeded, the LED will be on for 800mS otherwise it will be off during this phase.

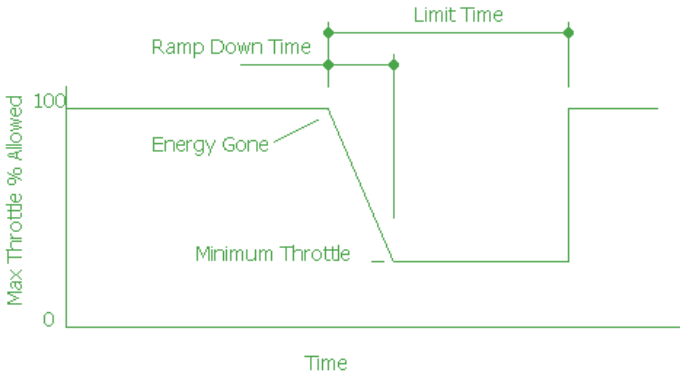
To change the level that is selected:-

- Disconnect the eLim.
- Plug the energy level selector button (supplied) into the PROG connector. Polarity not important.
- Connect the battery to the eLim BATT input.
- Click the button until the required level is indicated by the LED.
- Unplug the button. The eLim is now ready to use.

Operation

As soon as the **eLim** is connected to the battery the energy used will be set to zero and the throttle signal from the receiver is passed through to the ESC unaltered. The energy consumed is constantly accumulated and compared to the limit selected.

When the limit is reached, the behavior depends upon how the **eLim** has been configured. The diagram below will help to explain this.



The following values can only be changed via the **eLim** Programmer (separate purchase).

Ramp Down Time – (default 5 Secs) This value can be set between 0-9 seconds. It is the time it will take to ramp down to the "Minimum Throttle" value.

Minimum Throttle – (default 0%) This value can be set between 0-99 %. After power on and before the race start, the **eLim** detects the zero throttle value. During the race it detects the full throttle value. The "Minimum Throttle" value is the percentage of this range that the **eLim** will restrict the throttle demand to during "Limit Time". i.e. if set to 0 it will ramp down to zero throttle. If set to 10 it will ramp down to 10% throttle.

Limit Time – (default 60 secs) This value can be set between 0-999 seconds. It is the number of seconds after the time that the energy limit was reached before the throttle restriction is removed.

CHAPTER 3

Specifications

Throttle input and output are industry standard PWM signals which are approximately 1000-2000mS positive going.

The power from an ESC based BEC is passed through to the receiver but is not used by the **eLim**.

Specifications	
Max input voltage	45V
Max current (continuous)	100A
Max current (peak)	160A
Voltage resolution	4mV
Current resolution	20mA
Energy Accuracy	+/- 1%
Weight (14 AWG)	14 gm
Weight (10 AWG)	25 gm