# eLim Programmer

*User Guide*

mlm

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## *User Guide*

*Version 1.1*

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# Contents

# Getting Started

Thank you for choosing the **eLim** Programmer

It is a device to allow the calibration and configuration of the mlm Solutions '**eLim**' energy limiter.

This programmer communicates with the **eLim** via a simple three wire cable using a proprietary protocol.

The programmer is powered with a 9V PP3 style battery or via an external 9VDC power supply (not supplied).

Before connecting the two devices, power both of them up and then plug the cable into the programing socket of the **eLim** with the brown cable nearest to the power cables (or black cable if it is a Black/Red/White cable).

*Note: also disconnect the two devices before powering either of them down.*

The two devices should now be talking to each other and this is indicated by the Communications Link Indicator (CLI) flashing at a 1Hz rate. The CLI is either a '*' or a '!' character. (See Configure Security Code). You may also notice that data from the **eLim** is now being displayed on the programmer screen.

The next section will discuss how to use the keys and menu system.

# Menu System

## Keys

There are only five keys which allow access to all features. They are UP, DOWN, LEFT, RIGHT & SELECT.
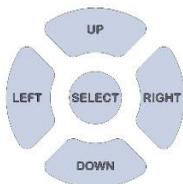


The UP & DOWN key function depends upon whether you are in EDIT mode or SCROLL mode. If in SCROLL mode, they move up or down the menu options. If in EDIT mode, they increment or decrement the number.

The LEFT & RIGHT keys have no function in SCROLL mode but when in EDIT mode, they move the cursor to the left or right.

The SELECT key functions as follows:-

| Mode | Press | Function |
|------|-------|----------|
| Scroll | Short | Enters EDIT mode (if relevant) |
| Scroll | Long | If the **eLim** Data screen is selected, ALL configuration data is transmitted. If a calibration or configuration screen is selected, ONLY that value is transmitted. |
| Edit | Short | Exits EDIT mode. |
| Edit | Long | No function. |

*Note: A long press is >600milliSeconds.*

# Navigating the menu screens

The menu screens are as follows:-

eLim Data
Calibrate Voltage
Calibrate Current
Configure WattMinutes 1
Configure WattMinutes 2
Configure WattMinutes 3
Configure WattMinutes 4
Configure Ramp Down (RD)
Configure Limit Time (LT)
Configure Minimum Throttle (MT)
Configure Security Code (SC)
Set backlight brightness


The 'eLim Data' screen is the default screen at power on and you are in SCROLL mode. You can move up or down the menus by using the UP or DOWN keys.

All of the screens with the exception of the 'eLim Data' screen have an EDIT mode.

To enter the EDIT mode, short click the SELECT key.

When you enter EDIT mode, the left most digit will flash to indicate that this is the digit that will be edited.

Use the LEFT or RIGHT keys to move to the digit that you wish to edit.

Use the UP or DOWN keys to increment or decrement this digit.

To exit the EDIT mode, short click the SELECT key.

# Screen Functions

## eLim Data

This is the default screen at power up. It shows the instantaneous values of voltage and current that the **eLim** is measuring and also the energy (in WattMinutes) that have been recorded by the **eLim** since it was powered up.

In order to quickly set the configuration values of an **eLim**, set up all values as required and navigate back to this screen. Doing a long press on SELECT will now configure all values in a single press.

## Calibrate Voltage

This screen allows you to calibrate the voltage measurement of the **eLim**. It shows the actual voltage that the **eLim** 'thinks' it is registering and allows you to set the voltage that it 'should' be reading.

To use this feature you will need to have access to an accurate and calibrated voltmeter.

It is suggested that you connect the **eLim** to a voltage source that is not too small a voltage. A higher voltage will cause less error. A value of around 24V should be fine. A 6S LiPo would be a good choice.

The maximum voltage that the **eLim** will tolerate before damage may occur is 60V.

The resolution of the **eLim** is 4mV.

To calibrate:-

- Connect the voltmeter across the battery that the **eLim** is monitoring and register the voltage reading.

- Enter EDIT mode.

- Set the voltage value to be the same as the voltmeter reading.

- Exit EDIT mode.

- Do a long press on SELECT.

The actual voltage read by the **eLim** should now read the same as the voltmeter within 4mV.

# Calibrate Current

This screen allows you to calibrate the current measurement of the **eLim**. It shows the actual current that the **eLim** 'thinks' it is registering and allows you to set the current that it 'should' be reading.

To use this feature you will need to have access to

- An accurate and calibrated ammeter of sufficient capacity

- A dummy load that can dissipate the power at the voltage and current at which you wish to calibrate.

- A power supply that can supply the power at the voltage and current at which you wish to calibrate. A Lipo is a good choice.

It is suggested that you connect the **eLim** to a power supply that is not too big a voltage. A higher voltage will mean you need a dummy load that can dissipated more power. A value of around 12V should be fine. The dummy load should be chosen to draw sufficient current to be realistic but not too big or the dummy load and power supply will need to be much larger. A value of around 30A is suggested.

For example, if you were to have a 12V power source and have a dummy load that drew 30A, it would need to:-

- Have a resistance of $12/30 = 0.4$ ohms

- Able to dissipate $12*30 = 360$ Watts

The maximum voltage that the **eLim** will tolerate before damage may occur is 60V. The maximum continuous current that the **eLim** will tolerate is 100A (160A peak).

The resolution of the **eLim** is 20mA.

To calibrate:-

- Connect the ammeter and dummy load in series with the **eLim** and register the current reading.

- Enter EDIT mode.

- Set the current value to be the same as the ammeter reading.

- Exit EDIT mode.

- Do a long press on SELECT.

The actual current read by the **eLim** should now read the same as the ammeter within 20mV.

# Configure WattMinutes 1

This is the energy band that corresponds with 1 flash on the **eLim**. It is suggested that for consistency across international races that this is the lowest energy limit as used in the mini classes. Can be set 0-65535.

# Configure WattMinutes 2

This is the energy band that corresponds with 2 flashes on the **eLim**. It is suggested that for consistency across international races that this is the limit as used in the Eco, Mono1, Hydro1 classes. Can be set 0-65535.

# Configure WattMinutes 3

This is the energy band that corresponds with 3 flashes on the **eLim**. It is suggested that for consistency across international races that this is the limit as used in the Mono2, Hydro2 classes. Can be set 0-65535.

# Configure WattMinutes 4

This is the energy band that corresponds with 4 flashes on the **eLim**. It is suggested that for consistency across international races that this is the highest energy limit as used in the FSRE classes. Can be set 0-65535.

# Configure Ramp-Down (RD)

When the **eLim** senses that the selected energy limit has been reached, it will ramp down the throttle setting over a period of time to the 'minimum throttle' value. This screen allows you to set this ramp down time. Can be set 0-9 seconds.
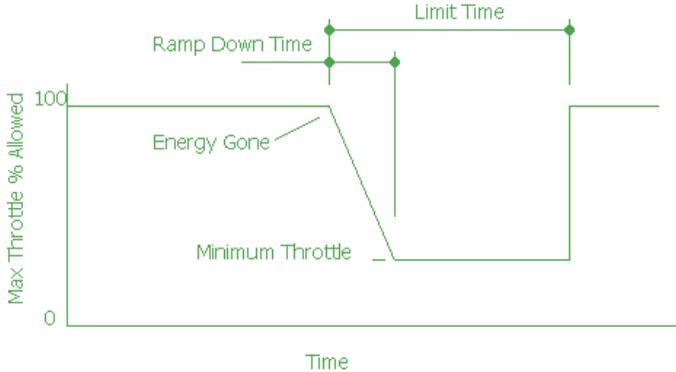


# Configure Limit Time (LT)

When the **eLim** has sensed that the energy limit has been reached, it will restrict the maximum throttle to the 'minimum throttle %' value for a 'Limit Time'. This screen allows you to set this limit time. Can be set 0-999 seconds.

# Configure Minimum Throttle (MT)

During operation, the **eLim** senses the pulse width for zero throttle and also the pulse width for maximum throttle. The value entered here is the percentage of this range that the

throttle will ramp down to when the energy is gone. I.e. if set to 0 it will ramp down to zero throttle. If set to 10 it will ramp down to 10% throttle. Can be set 0-99%.

# Configure Security Code (SC)

In a race environment, the race organisers need to be confident that everyone that is using an energy limiter has them set up identically. It is assumed that at the beginning of a meeting, the organisers will configure (and optionally calibrate) all competitors energy limiters.

There will however potentially be other programmers at the meeting and the organisers need to know that these are not used to change the **eLim** configuration. This feature should provide the organisers with that confidence.

To use this feature:-

Set a 4 digit code 0-9999 which is not shared with anyone.

For security reasons, the editing of this option is slightly different. When you display this option, the current security code is not displayed but rather "****". You can enter edit mode and if you only click the LEFT or RIGHT keys before exiting edit mode, the security code will not be altered.

However if you click the UP or DOWN keys, the display will show "0000". You now enter the security code in the normal way. Once you exit edit mode the new code will be saved and never displayed again.

When the programmer is used to either configure or calibrate an **eLim**, this security code is transmitted to and stored on the **eLim**. This value is always echoed back to the programmer and so you will see the Communications Link Indicator (CLI) in the top right of the display, flashing a '*' character which indicates a security code match.

If the **eLim** has been modified by another programmer, when the 'official' programmer is connected the CLI will now be flashing '!' as the codes no longer match.

# Set backlight brightness

This allows the screen backlight to be set at one of ten brightness levels.

In order to conserve battery life, it is recommended that the backlight brightness is kept as low as possible. The programmer backlight will be switched off after 60 seconds with no key press. A press on any key will return the backlight to its previous setting.