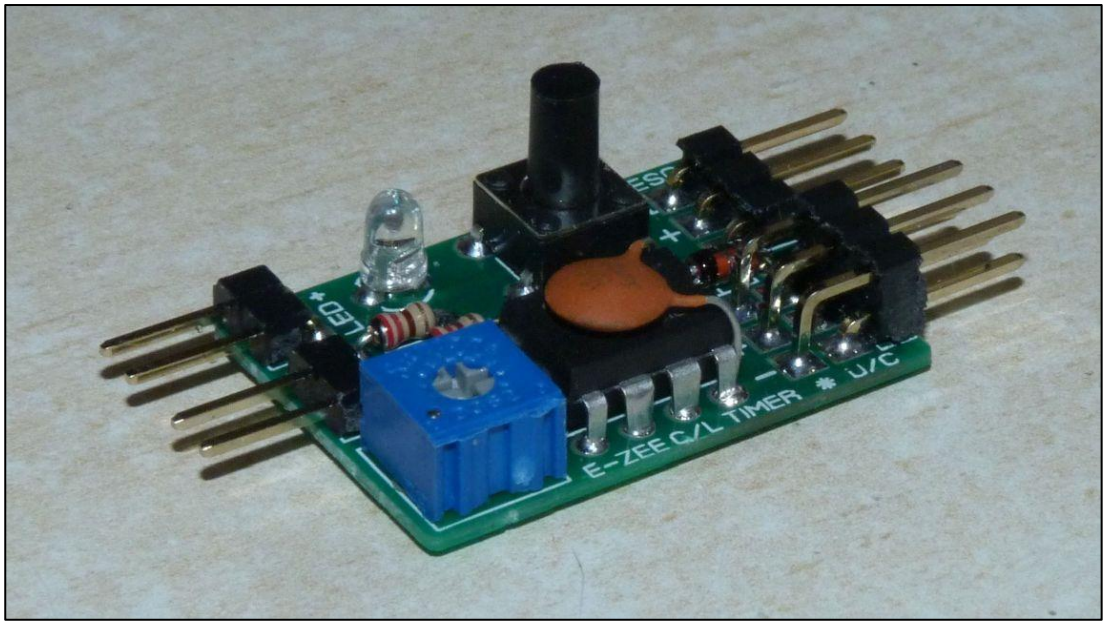
E-ZEE ECL7 – Electric Control Line Timer Mk7



In response to customer feedback the MK6 features have been increased to include ON/OFF selection of the 'warning burp' that occurs 3 secs before the end of the motor run……with this additional feature the MK6 now becomes the MK7……..we have made a couple of instructional videos…..they are titled ECL 6 but are applicable to the ECL7……The videos showed that the flashing of the LED's was strobing with the camera frame-rate and so the MK7 has been modified to improve LED visibility for future videos……here are the links for the existing videos:-

ECL6 Vid 1 Quick Start **https://youtu.be/Vrx8-TyFPGg**

ECL6 Vid 2 Feature Selection & Data Entry **https://youtu.be/dfx3_EtPXS0**

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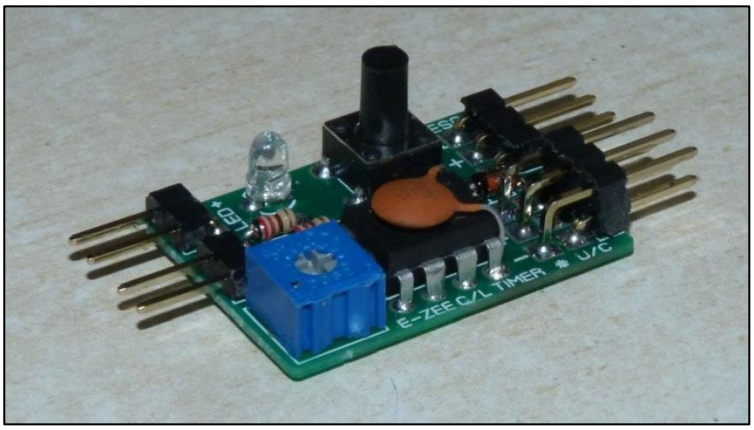
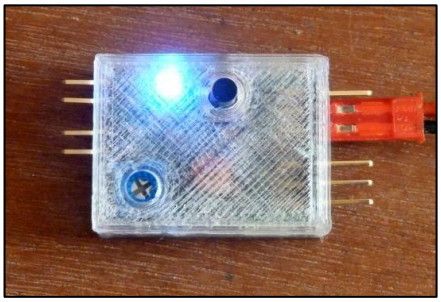
INTRODUCTION



Electric Control Line (ECL) is clean and quiet, ideal for the 21st century environment. The huge Electric RC market ensures that components such as motors and ESC's for Control Line are available at very attractive prices and are totally reliable. Battery technology has progressed such that the weight of an electric power train can be similar or better than conventional glow or diesel power.

World class aerobatic Control Line pilots have been quick to use the technology as it ensures the perfect motor run every time. The competition ECL avionics are often too sophisticated for the sports flyers needs. The E-ZEE Control Line timer has been designed and developed so that sports flyers can enjoy all these advantages at a realistic price.

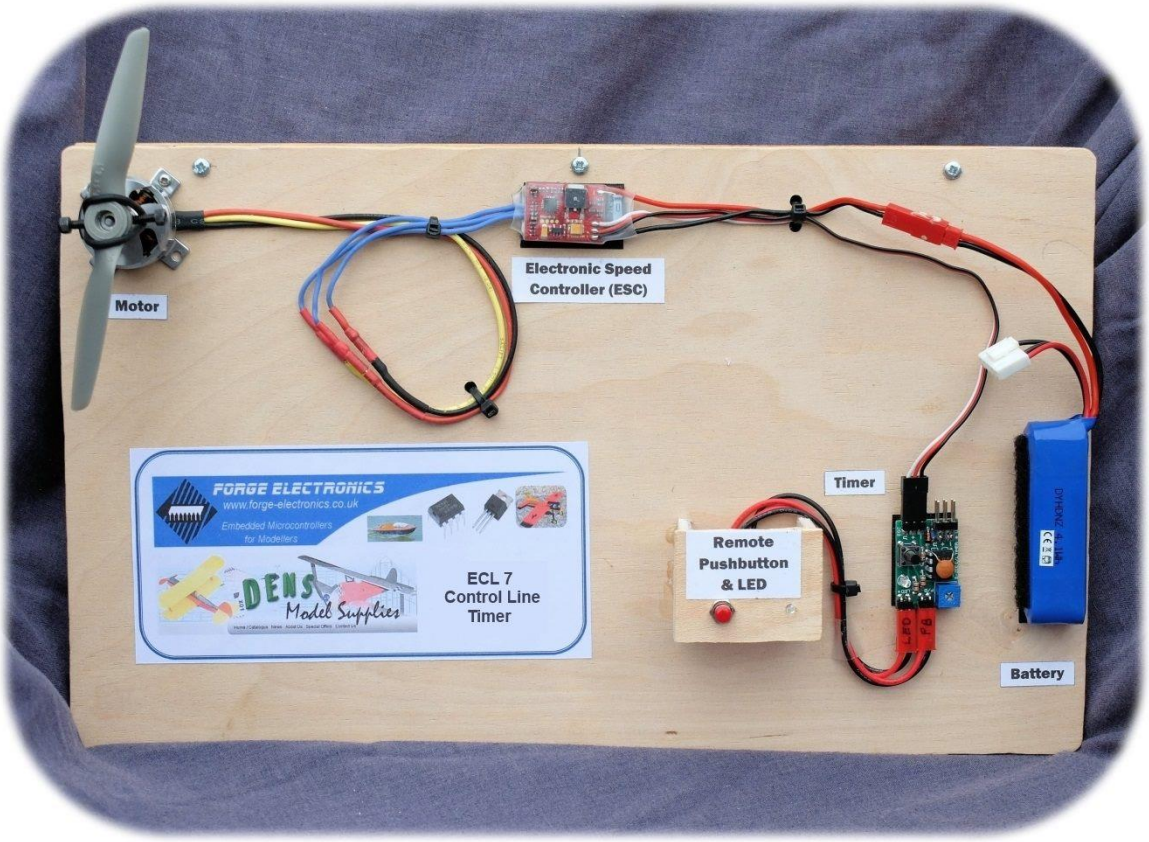
As an optional extra, a 3D printed case in clear PETG (Polyethylene Terephthalate Glycol-modified!) is available. This provides mechanical protection for the timer and may make mounting considerably easier. The LED is enclosed but easily visible through the casing.



Key Features

- motor run duration:- adjustable 10 to 600 seconds, set in 10 second increments
- end of flight warnings - visual (high intensity LED) and motor power 'burps'
- motor power:- adjustable at all times from zero to full throttle (by potentiometer)
- motor soft start:- adjustable 0 to 10 seconds
- motor run down:- adjustable 0 to 10 seconds
- programmable start delay (for solo operation) – 0 to 90 seconds
- undercarriage servo (if used) - retracts 10 secs after flight commences and deploys 10 secs before the flight terminates – only available for flights of one minute plus
- take off power boost option (3 secs of maximum power)
- push button immediately stops the motor at any point during the flight profile
- duration settings saved in memory – so a single button push can repeat the flight.
- provision to fit remote pushbutton and remote LED
- ESC configuration capability

INSTALLATION

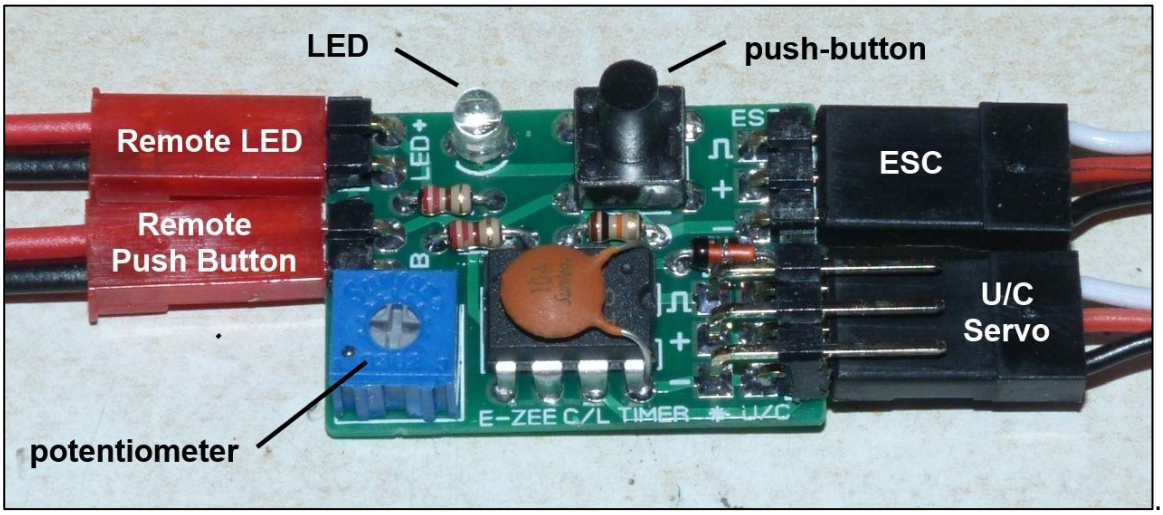


This image shows the system components, note that power does not flow through the timer. The timer is fed from BEC (Battery Eliminator Circuit) provided by the ESC and in turn sends signals to the ESC.

So the timer can be used with any size of motor/ESC/battery combination subject to the following warning

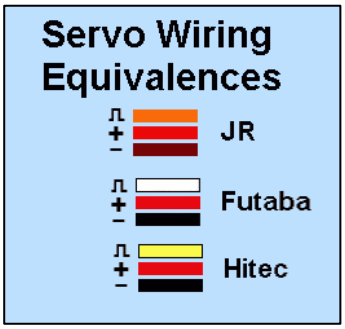
The chip used in the timer has a maximum rating of 5.5v, so ESCs with a 6v BEC must NOT be used.

The remote pushbutton & LED are used if the timer is inaccessible…..they mimic the same items provided on the timer….when connected either pushbutton can be used and both LED's indicate simultaneously



The previous image above shows the various leads connected to the timer in close up.

If used, the polarity of the remote LED must be observed as shown, but no damage will occur if the polarity is reversed, it simply won't work. Note the PCB has a silk screen marking '+' to assist with correctly connecting the read lead of the remote LED. The pushbutton can be connected either way round.



As orientated in the close up the ESC connects to the pins of the upper connector. Note the PCB has silk screen markings of plus, minus and signal to assist with correctly connecting the ESC lead.

The undercarriage servo (if used) connects to the bottom layer pins of the lower connector and again the silk screen markings assist with correctly connecting the servo lead.

The unused set of 3 pins on the top of the lower connector is reserved for future developments.

QUICK START

Having connected and checked the system components it's time to power up and simulate a flight.

As received your timer will be set as follows:-

Motor Speed 100% **(best to remove the prop before testing)**

Motor Run Time 20secs

Ramp Down Time 5sec

Ramp times are added to the Motor Run time….. so the factory settings will cause the motor to run for 20 secs and then Ramp Down over the next 5 secs

Step 1: Standby Mode

Connect the battery; there is a five second delay at power up.

Most ESC's will enter their setup routine if they detect full throttle at start. Thus without the enforced five second delay, trying to start a flight immediately after power up could cause the ESC to enter its set-up routine.

During the start delay the LED will flash at 1 sec intervals and after 5 seconds settle in to a continuous flicker….. ***LED in continuous flicker indicates 'Standby Mode'***

Step 2: Simulating a flight

Briefly press the button (must be less than two seconds or the subsequent set-up routines will be entered instead) and upon release the motor will start…….. ….the motor will run at full power for 20 secs and then ramp down over the next 5 secs…. the LED will flash at 1 sec intervals for the first 10 secs…for the last 10 secs the flash will be much longer and 3 secs before the motor run time finishes the motor will 'burp' to announce end of flight is imminent….the LED will revert to a 1 sec flash during the 5 sec ramp down time. It will be appreciated that locating the LED so that the pilot can observe it is a great help to flight management

During flight a long LED flash indicates remaining flight time 10 secs or less

For safety the pushbutton is disabled at the end of the timed period so that an inadvertent start will not occur on retrieval…..this situation will continue until the system is reset…. At the end of the timed period the LED will stop flashing and remain ON permanently….***LED ON permanently indicates 'End of Flight Mode'***

The timed period may be aborted by a brief press of the button at any time and the unit will indicate end of flight and require resetting.

Step 3: Resetting the system after a flight

To reset the system press and hold the button….the LED will flash five times then go on permanently …..release the button and this will take you back to ***LED in continuous flicker indicates 'Standby Mode'***

The five second manual reset is to guard against inadvertent motor start when retrieving the model.

Simulate a flight a number of times until you are familiar with the routine and LED indications…..you can also try adjusting the motor speed during the motor run….use the pot on the timer……it's the small blue cube on the timer with a white dot in the centre….the white dot has slots and can be rotated with a small screwdriver.

Step 4: Adjusting Motor Speed

Motor speed is adjustable from 0 to 100% and may set by the potentiometer at any time. If carried out whilst ground handling in Flight Mode, the motor will be running and its speed will respond directly to the potentiometer, allowing the user to judge the thrust being delivered. Once the power has been set, the timed period may be aborted by a brief press of the button and the unit returns to standby. A non-linear adjustment curve is employed to give finer control of the motor power at the levels likely to be used for flying – thus, the first 50% of the power is reached in the first quarter turn of the potentiometer whilst the final 50% of the power is adjusted over the remaining three quarters of a turn

UNDERCARRIAGE

If an undercarriage retract servo is fitted, this will operate 10 seconds after the time that user set power is finally attained. The servo operates again at 10 seconds before the end of the flight to lower the undercarriage. The transit time of the servo is two seconds.

The undercarriage parameters are not adjustable and this function only works when the motor run time is set to 1 minute or greater

START DELAY

Motor start can be delayed for an adjustable time period allowing the pilot to walk to the handle and await the start of a flight. This feature is very useful for 'solo' flying as it does not require a helper to launch the model.

When the start delay is ON and button is pressed to start a flight, the motor gives a short kick to signal that start delay is activated. Thereafter the LED counts down the delay seconds by giving a brief flash. With five seconds to go, the LED is ON as a warning of impending take-off, just briefly going OFF to count down the remaining seconds.

When a start delay is in operation the 'standby mode' flicker rate increases

CHANGING THE TIMER SETTINGS

The timer has four adjustable features that govern the flight and three useful features relevant to the setup of the model….these are shown in the chart below:-

Feature Number	Parameter	Data Input & Reporting	Increment	Range
1	motor run	short	10 sec	10-600 secs
		long	1 minute	
		none	report	
2	start delay	short	10 sec	0-90 secs
		long	1 minute	
		none	disable	
3	take-off boost	short/long	enable	3 secs max power
		none	disable	
4	ramp up	short	1 sec	0-10 secs
		long	10 sec	
		none	disable	
5	ramp down	short	1 sec	0-10secs
		long	10 sec	
		none	disable	
6	end of flight warning	short/long	enable	~
		none	disable	
7	configure ESC	~	~	~

Feature 1 is self-explanatory…..used frequently

Feature 2 is used to set an adjustable delay before the motor starts…..this allows time to walk to the handle and fly solo…..used to allow solo flying

Feature 3 is used if the motor speed is set less than 100% e.g. for slower lap times…..to encourage a lively take off, when ON it gives a 3 sec 100% boost at the start of the motor run before settling back to the user pre-set speed…..generally used for training

Features 4 & 5 allow the motor to ramp up to speed at start or ramp down at the end of the motor run…..the former could be useful to tame a large power system at start……the latter mimics the normal run down of an IC motor……pilot preference - used occasionally

Feature 6 allows the user to choose whether or not to receive an impending end-of-flight warning by the motor giving three short 'burps'

Feature 7 allows your ESC to calibrate the throttle range…. used infrequently
The chart also shows the range available for the adjustable features and the increments available. **Features 3, 6 &7** do not require a range or increment.

Data Input is entered by pressing the pushbutton for long or short periods.

Reporting is indicated by LED flashes ….solid for long increment….flashing for short increment.
Feature Selection to alter any of the settings a feature must be selected first.

The feature selection cycle

1. From standby mode hold the button down continuously
2. LED ON and
3. Two seconds later LED OFF
4. Continue to hold the button down….LED remains OFF
5. Release the pushbutton
6. **LED ON but dimmer….this is the 2 sec feature selection period**
7. Two seconds later the LED reverts to the 'Standby' mode flicker

In the above example because no feature was selected the timer returned to the 'standby' mode……try this cycle a few times to familiarise yourself to recognise the two second 'feature selection' period.

Data Entry
Go to the feature selection 2 sec period.

1. Select a feature by making a number of brisk button presses as follows (the LED lights for each press)
   [1 Press] set motor run
   [2 Presses] set start delay
   [3 Presses] set take off boost off or on
   [4 Presses] set ramp up
   [5 Presses] set ramp down
   [6 Presses] set end-of-flight warning
   [7 Presses] ESC configuration
   You have two seconds upon entering this stage to press the button….. if the button is not pressed during this time, the timer reverts to standby mode. The length of time the button is held pressed is not critical and the two second timeout is reset each time the button is released to give a further 2 sec period to make the next button press if necessary These timeouts allow the timer to ascertain when the user has finished pressing the button.

2. Having selected the feature by the required number of presses, 2 secs after the last data entry button press the dimly glowing LED goes OFF to signal the start of a 2 sec ***data entry period*** for the selected feature.

3. During the ***data entry period*** short or a long button presses are made to alter the various timer features using the increments shown in the table.

To make a **long press** hold the button down until the LED stops flashing and goes ON.

To make a **short press** release the button before the LED stops flashing.

Short and long presses may be made in any order and the overall time is accumulated and stored in memory.

If the number of presses exceeds the feature range the highest feature setting is stored.

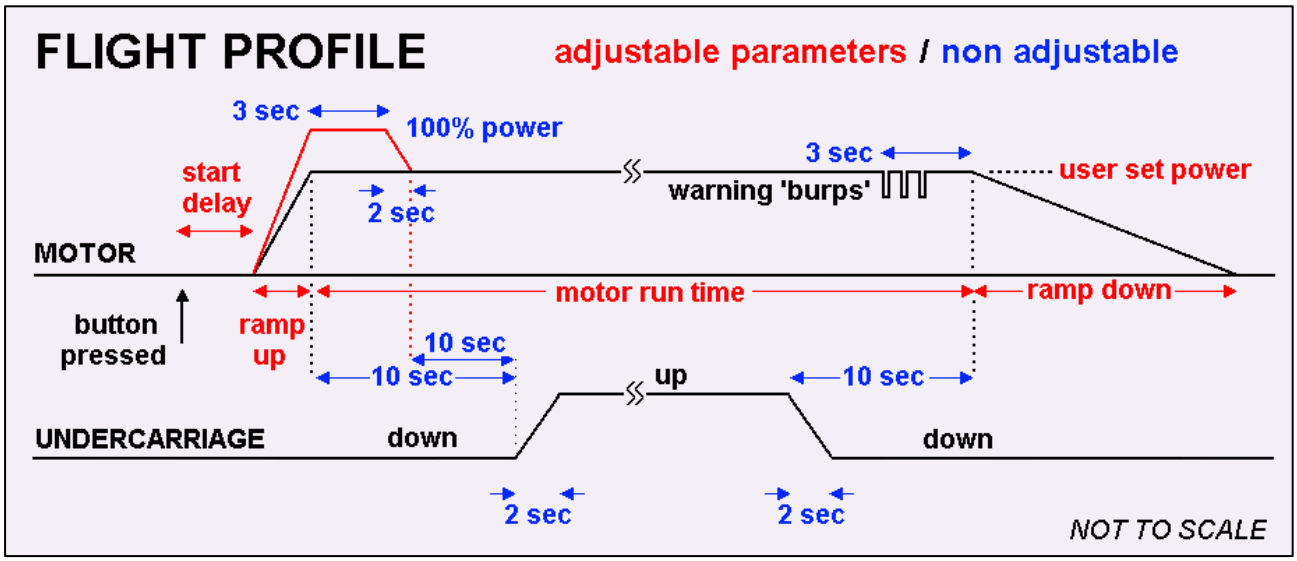
As before each data entry button press starts a 2 sec period awaiting the next data entry button press.

Reporting

When data entry is complete, after a brief pause the LED reports the settings entered for motor run period by a series of flashes and then by a series of flickers as follows.

- LED flashes - units of one minute
- LED flickers - units of ten seconds

The less critical and infrequently adjusted ramp up and ramp down periods are not reported after setting. If no presses are made during the ramp adjustment periods the data entered is zero seconds. Note that using the Ramp settings extends the overall running time of the motor as shown in this diagram:-



ESC CONFIGURATION

ESC configuration is a special case and for those not familiar with this term a brief description follows.

ESCs generally have a number of parameters which need to be configured for optimum performance and/or user preferences - such as battery type (Li-Po/NiMh), Li-Po cut off voltage, signal span, brake on/off, motor timing etc. In particular, if the ESC's signal span is not set to match that of the timer (the latter being set to the industry standard of 1 mSec to 2 mSec), the motor may not respond to the timer's power setting pot at it's extreme of

rotation (thereby coarsening the user's power setting adjustment) or worse still the user may not be able to get the motor to achieve full speed.

The ESC manufacturer expects as a minimum that users have access to a RC transmitter and receiver in order to set up these parameters. However, the majority of settings can be more easily configured with the manufacturer's programming card for the appropriate ESC (if available) *but with the exception of signal span which requires to be matched to the transmitter itself (or in this case, the timer).*
The timer's ESC configuration mode allows the user to implement the ESC manufacturer's set-up instructions by using the button as though it were the throttle joystick of a transmitter (ie to assert zero or full throttle as required in the instructions).

Typically, an ESC requires to see a full throttle signal immediately at power up in order to enter its configuration routine(s) – usually for a short period to set signal span or for a longer period to access the remaining parameters. Now an ordinary timer would of course be putting out a closed throttle signal at power up whilst awaiting a button press to commence a flight. The E-ZEE timer offers this special ESC configuration mode in the event that the user does not possess a programming card and/or RC transmitter/receiver or does not have access to them in the field.

Following the six button presses to select this mode, after the two second time out the LED will be permanently ON and further timer operation is inhibited. The power must now be cycled, whereupon the timer now enters an endless loop where the ESC output may be repeatedly toggled between full and zero power by successive presses of the button in order to configure the ESC in accordance with the ESC manufacturer's instructions. Full power is indicated by a bright LED, zero power by a dim LED. Disconnect power to exit this endless loop.

SAFETY

The motor must be considered 'live' whenever the propulsion battery is connected. Be careful not to inadvertently press the start button during handling the model as the prop may begin to turn as soon as the button is pressed.

Whilst familiarising yourself with the timer operation, for greater safety a standard servo may be used in place of the ESC – its arm position indicating the throttle setting. In this instance a battery box can be connected to the spare pins above the undercarriage servo connector to supply (5v) power to the timer.

*Be aware that electric motors behave differently to IC engines. With the latter your straying fingers might get anything from a smart whack to a nasty gash depending on the size of the engine, but nine times out of ten the engine will stop instantly. With electric motors, no matter what the size of the motor, as long as the battery remains connected, it will attempt to turn, and continue doing so - even if it becomes so overloaded that it melts itself, the ESC or the battery in the process. So, an encounter with a spinning prop can result in your fingers being continually slashed, until the power is cut. A few high-end ESCs **do** feature a safety cut-out if the prop is stalled or the governed revs drop below a predetermined threshold but you should not rely on this. YOU WERE WARNED!*

Note that the blue LED used is a high brightness type to ensure good visibility outdoors in bright sunlight. If the timer is operated in the workshop under poor lighting conditions avoid looking directly at the LED to avoid potential damage to your eyes.