

Z TRON CL ESC Controller and Timer

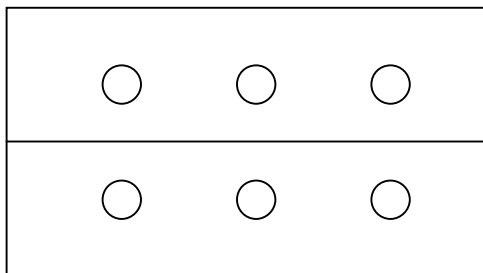
Model CLT3, rev 1.0

The CL timer/ESC controller is a small lightweight board (1" x 3/4", 2 grams), with the following features,

1. ESC (Electronic Speed Controller) controller and timer for your CL flights to a selected duration from 10 seconds to 10.5 minutes in 10 second steps. It will work with brushed or brushless ESC motor controllers.
2. Programmable starting and ending speeds, from full-off to full-on and anywhere in between.
3. Landing Gear servo output for slow realistic motion (active only for selected flight duration over 2 minutes).
4. In addition to the landing gear, three motor blips warning the pilot about the end of duration can be enabled.
5. Programmable motor starting time, from 0 to 10 minutes.
6. Timer shipped with default (standard) parameters. Default parameters can also be programmed in 1 step.
7. Soft motor speed ramp up and ramp down to conserve the motor gears and avoid excessive current spikes.

The top 3-pin header connector is for the ESC connection and the bottom (close to the edge of the board) 3-pin header connector is for the Landing Gear servo connection (see diagram below).

GND + Signal



ESC Connector

Landing Gear
Connector

Note: Since the servo connector is on the opposite side of the board, make sure the negative (GND) cable is the one close to the edge of the board

Programming mode

The parameters to be programmed include the starting and ending motor speeds, the flight duration, the 3-motor blips that will warn you about the end of duration, and the motor start time. The duration itself is done at the end by setting the DIP switches #1 to #6 for the desired duration before power on. The Timer will read in the DIP switches after power on and determine the time duration. This way you can change the time duration from one flight to another, without reprogramming the Timer.

To enter programming mode turn power on while you press the push button (PB) switch. After a couple of seconds release the PB. Now you are in programming mode.

While in programming mode you can program one or all parameters, one at a time.

To program all the default parameters in one step, set the DIP switches (#1 to #6) to off position and press the PB switch momentarily. That will program the full-on (100%) starting and ending speeds, enable the 3 motor blips 15 seconds before the time ending, and select immediate motor start after power on. After you've programmed the default parameters in one step, turn power off because you cannot program any more in this mode. If you need to change a parameter now, turn power on again, while pressing the PB switch.

After you are done with programming turn power off.

DP switch values

The values you enter on the DIP switches #1 to #6 are entered in binary form. If you are not familiar with the binary code, the easiest way of calculating the value is by individual switch addition. Switch #1 adds 1 unit if on, switch #2 adds 2 units, switch #3, adds 4 units, switch #4 adds 8 units, switch #5 adds 16 units and switch #6 adds 32 units. If switch is off, adds nothing.

For example, to select 25 units, turn on switches 5, 4 and 1 ($16 + 8 + 1 = 25$). All other switches should be off.

All switches on will give you the maximum ($32 + 16 + 8 + 4 + 2 + 1 = 63$). All switches off will give you 0.

Program the starting motor speed

First select on the DIP switches the parameter (ID) you want to program, which in this case is starting speed. The ID for starting speed is 1 (only sw#1 on, all others off). Press momentarily the PB switch to select the starting speed.

Then set the switches to the desired starting speed. The starting motor speed values can be 0 to 50. Higher selections or 0, will default to 50. Those values represent motor speed percentages. For example, to program 80% motor speed, select 40 on the DIP switches. To select 100%, select 50 and so on. Once the DIP switches are set, press momentarily the PB switch. Now the starting speed has been programmed and saved till you change it again. You can turn power off or continue programming the next parameter.

Program the ending motor speed

First select on the DIP switches the parameter (ID) you want to program which in this case is ending speed. The ID for ending speed is 2 (only sw#2 on, all others off). Press momentarily the PB switch to select the starting speed.

Then set the switches to the desired ending speed. The ending motor speed values can be 0 to 50. Higher selections or 0, will default to 50. Those values represent motor speed percentages. For example, to program 80% motor speed, select 40 on the DIP switches. To select 100%, select 50 and so on. Once the DIP switches are set, press momentarily the PB switch. Now the ending speed has been programmed and saved till you change it again. You can turn power off or continue programming the next parameter.

Program the 3 motor blips

First select on the DIP switches the parameter (ID) you want to program which in this case is 3-motor-blips. The ID for motor blips is 33 (only sw#6 and sw#1 on, all others off). Press momentarily the PB switch to select the 3-blips.

Then set the switches to enable or disable the 3-motor-blips. To enable the 3 motor blips, set the DIP switches to all off. To disable the 3-motor-blips, set sw#1 to on. Once the DIP switches are set, press momentarily the PB switch. Now the 3-motor-blip selection has been programmed and saved till you change it again. You can turn power off or continue programming the next parameter.

Program the Motor starting time

First select on the DIP switches the parameter (ID) you want to program which in this case is motor starting time. The ID for Motor starting time is 34 (only sw#6 and sw#2 on, all others off). Press momentarily the PB switch to select the Motor starting time.

Then set the switches to the desired Motor starting time value, from 0 seconds to 10 minutes and 20 seconds. Don't select 10 minutes and 30 seconds (all switches on) because it is reserved for default saved memory ID. Each DIP switch value represents 10 seconds delay. All switches off (0), selects immediate motor on, after power on. For 10 seconds delay you only set sw#1 on, all others off. For 1 minute delay you set the DIP switches to 6 (6 times 10 seconds = 60 = 1 minute). That is sw#2 and sw#3 on, all others off. Once the DIP switches are set, press momentarily the PB switch. Now the Motor starting time has been programmed and saved till you change it again. You can turn power off or continue programming the next parameter.

If you change your mind while in programming mode, you can reprogram any of the above parameters again. The last programmed parameter is the one that it is saved. When you are done with programming, turn power off. The programmed values have been saved in non-volatile memory.

Program the Duration

The duration does not need the two-step programming sequence. While the power is off, you set the DIP switches to the desired duration which will be sampled in, after power on. This way you can change the time duration from one flight to another, without reprogramming the Timer.

Set the switches to the desired duration time value, from 10 seconds to 10.5 minutes (see DIP switch values section above). Each DIP switch value represents 10 seconds time. That means for 10 seconds duration you only set sw#1 on, all others off. For 1 minute time you set the DIP switches to 6 (6 times 10 seconds = 60 = 1 minute). That is sw#2 and sw#3 on, all others off. For 6 minutes set the DIP switches to 36 (6 minutes times 6, 10-second periods). That translates to sw#6 and sw#3 on, all others off. All switches off will select the default value, which is 6 minutes.

Setup Instructions for Flight

With the power off (battery disconnected), connect the 3 pin ESC cable to the 3 pin ESC Timer connector. Observe the wire colors. Black (GND, negative, close to the edge of the board) on the left, and red (+, positive) in the middle.

Plug-in the landing gear servo, if you have a retractable landing gear.

As soon as you power up the system, the Timer will send a full off pulse to the ESC for about 2 seconds. Some ESCs need that in order to operate normally. If you have selected the immediate motor start time (default parameter), the Timer will ramp up to the selected starting motor speed. If you have programmed some delay time (10 seconds to 10 minutes, see programming), the motor ramping will be delayed by that time. The ramping up of the speed that takes 10 seconds for a 100% speed and less than that for a partial speed, decreases the motor/gear stress and avoids a large battery spike that could have otherwise been produced. The 2 seconds for ESC sync and the ramping up time are extra and are not included in the selected time duration.

After the motor ramping to the programmed starting motor speed the Timer will update the speed continuously in small, undetected steps, towards the programmed ending speed. The Timer divides the total duration time by the difference of the starting and ending speeds and updates the motor speed accordingly. The end result is that you start at the programmed starting speed and end at the programmed ending speed without even noticing the small speed updates. Please note, the starting and ending speeds can be anything from 1 to 50 which translates to 2% to 100% in terms of speed percentages. The starting and ending speeds could be programmed to be the same, or any desired combination. That means the ending speed could be lower than the starting speed, if you wanted it that way.

At the end of the duration, the motor speed will ramp down and proceed to a full stop. The ramping down is much faster than the ramping up to comply with the rule of the propeller being stopped before landing. The Timer continues communication with the ESC to keep the motor off, till the power is turned off.

If a retractable Landing Gear is connected, the output will retract the gear 50 seconds after the beginning of the time and activate the gear down 15 seconds before the end of the time duration. If the motor 3 blips are selected, they will alert the pilot 15 seconds before the end of the time duration.

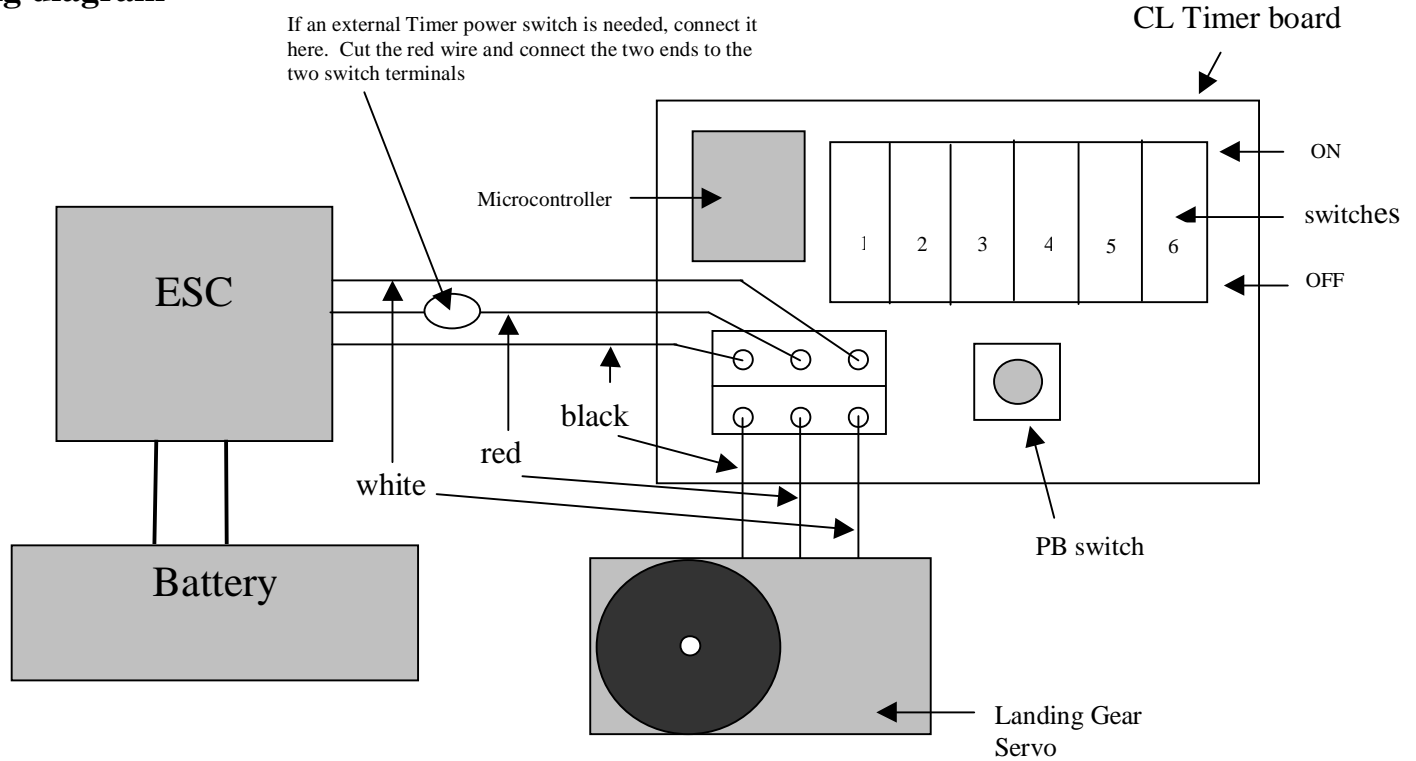
The Motor starting time is also programmable. The default is immediate but the Timer could be programmed to delay the Motor start by 10 seconds to over 10 minutes (see programming).

If you need to control that time externally, set the Motor start time to 0 (immediately) and power the Timer via an external power on-off switch. That external switch will interrupt the + line of the ESC cable to the Timer. This way, the ESC can be turned ON but the motor will not go on till the external switch is turned ON.

Please make sure you disconnect the battery from the system after flying.

For the ESCs that have the little enable switch, make sure you disconnect the battery after the flight because even with the switch off the ESC still draws power for its circuits. This is absolutely critical when you use Lithium Polymer cells that will be destroyed if they are drained below their minimum voltage (below 2.7V per cell).

Wiring diagram



Use the table below to save your parameter selection and as a guide to new parameter programming. Do that in pencil so you can overwrite old selections with new ones.

Parameters	Address, ID						Data									
	Sw#	1	2	3	4	5	6	Sw#	1	2	3	4	5	6	Decimal	
Starting Speed		1	0	0	0	0	0									
Ending Speed		0	1	0	0	0	0									
Duration		See Programming the duration														
3-Motor Blips		1	0	0	0	0	1									
Motor Starting Time		0	1	0	0	0	1									
Example (Ending speed)		0	1	0	0	0	0		1	2	4	8	16	32	(binary addition) 40 (80%)	

