Free Flight Timer v4

Warning: The max voltage is 5.5V
The min reliable voltage is 3.0V although it will still operate at > 2.2V

Hopefully these instructions make some kind of sense!!!!!!!! If not please get in touch and I will try and sort anything out. My email is dansrans@hotmail.co.uk

Overview:

The timer can be programmed to control a ESC and a servo to activate up to 5 positions during a flight. There is a start button that needs to be held for approx 2 seconds to start the timing and a led for indication. Both the timings for motor run and servo operation start when the button is released, so it needs to be located in a suitable position on the model to allow it to be pressed and held until launch. Once started the motor will run at the programmed throttle position until the model is released, if it is decided to cancel the launch at this stage then the button should be released and then pressed again within 3 seconds to enter into the holding mode, if the timer has run more than 3 seconds after release it will shut down and will need to be restarted by cycling the power off and on again. There is no possibility of the motor restarting once its run time has elapsed without cycling the power to prevent any injuries to people retrieving models. If the power is left connected for more than 2 minutes after the DT time has elapsed then the throttle and servo signals are completely switched off, most ESC's, if applicable will activate an alarm tone that could help to locate a model that has landed in long grass or behind a hedge, it also serves as a reminder if its forgotten about and left plugged in. The timer also incorporates a 'stuck' down button safety feature so if the button is held down for more than 10 seconds it will enter failsafe mode, shutdown the motor and activate the DT. This is to prevent a model continuing to climb under power if the button has become damaged/stuck down.

It can also be used as a flight profiler by selecting sport mode and plugging the esc into the servo output instead of the throttle output. This then allows the timer to control the throttle with 4 independent settings and each with its own time period. Using this option also changes the motor run time setting to a start delay setting to allow time after the start button is released before the motor starts.

The programmer unit consists of a 16 character 2 line led display, 2 buttons to increase or decrease each setting value and an enter button to move down the list. It uses power from the timer battery and when plugged in tells the timer to enter programming mode. The Supply Voltage to the timer chip is briefly displayed for reference. Once all the settings have been entered the display then enters a summary mode and scrolls back through each setting so they can be reviewed before sending to the timer, if a setting needs to be changed, holding the increase button will jump back to the beginning so changes can be made. When the programmer is plugged in and powered up the current settings are loaded from the timer so they can be checked through before a flight, and when programming is finished the settings are saved in the timers memory so they can be re used each time on start up without needing reprogramming. During testing the programmer only used approx 12mAh with less than 20mAh being the highest value so there isn't a problem running it from a 30mAh lipo if weight is a premium.

The following is a list of settings that can be adjusted in the order they appear:

Text:	Values:	Description:
Reset:	at the start/end/sport mode	Servo reset position or select sport mode
Throttle:	1-120%	Throttle value
Run/Delay time:	0.1-25.0secs	Motor run time or start delay
Time 1:	0.1-25.0secs	Time for first servo move
Time 2:	1-250secs	Time for second servo move
Time 3:	1-999secs	Time for third servo move
Time 4:	1-999secs	Time for DT position
Position 1:	1-120%	Servo start position
Position 2:	1-120%	Servo first position
Position 3:	1-120%	Servo second position
Position 4:	1-120%	Servo third position
Position 5:	1-120%	Servo DT position
Failsafe:	0.1-12V	Failsafe voltage setting
Cal:	1-31	Calibration setting

Holding the increase button at this point will loop back to the start
Pressing the enter button at this point will send the settings to the timer


LED indications:

1) When first powered up or after programming the led gives 2 short flashes to indicate its ready
2) After the 2 short flashes a solid led indicates the supply voltage is good
3) After the 2 short flashes a slow flashing led indicates the supply voltage is becoming low
4) 2 short flashes and a pause indicates the supply voltage is too low and the timer has shut down
5) Rapid flashing indicates the timer is running
6) Flashing a … --- … sequence indicates the timer is in holding mode and can be reset if required.

Installation:

The timer may be fixed using the 2 x 2mm holes. One method would be to screw it to the back of a thin ply plate that includes a hole for the led to shine through; this is then mounted into the model. (Small squares cut from thin plastic make ideal 'nuts' for screwing small self tapping screws into) The programming lead, if applicable needs to be readily accessible to make any changes and the start button needs to be in a suitable position so it can be pressed and held with the model in the launch position.

The standard timers are fitted with angled pins that are spaced for normal 'rc' servo connectors, the row of pins nearest the pcb are for the servo and the row furthest from the pcb are for the esc. The Negative pin for both channels is nearest the board edge. For any other pin configuration or if soldering direct to the provided pads please refer to the attached diagrams.
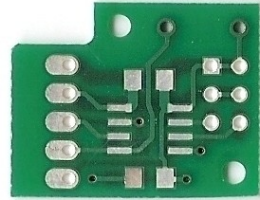
Auxiliary input
Remote start button
Programmer signal and LED +
Positive +
Negative –
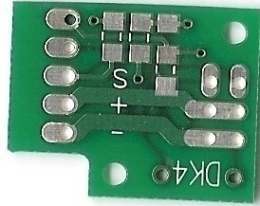
S1/S2
Positive +
Negative -

Position for PCB mounted
start switch

Negative -
Positive +
Programmer signal and LED +
Remote start button
Auxiliary input

S1 = Servo Signal Output
S2 = ESC Signal Output

Where servo leads are used they will be standard 'rc' colours as follows:

Positive =   red
Negative=   black/brown
Signal   =   white/orange/yellow

Failsafe voltage:

Note: This feature is mostly aimed at using small single lipo operation in say a rubber model or glider
and not when the unit is being supplied by the b.e.c of an ESC. If the model is electric and powered by
the same single lipo then consideration must be given to voltage drop when the motor is running.

A failsafe voltage level can be selected to prevent a model fly away due to a flat battery. During
operation the supply voltage to the chip is checked continuously and if it drops below this level then
the servo is forced to the final DT position regardless of any time remaining. When the unit is first
powered up it checks the supply voltage, if it is below the set level then the timer shuts down and the
led has a flash-flash-pause sequence. If this feature is not desired then the set point can be lowered to
0.1V which effectively disables it.

Low Battery Warning:

If the battery voltage is less than 0.3V greater than the failsafe voltage AT START UP, instead of a solid LED it will flash slowly warning that the battery needs charging although the timer will still function as normal.

Eg;

Battery volts   = 3.5v

Failsafe setting   = 4v   Timer shuts down, LED has a flash-flash-pause sequence
Failsafe setting   = 3.3v   Timer is ready, LED has a slow flash sequence
Failsafe setting   = 3.0v   Timer is ready, LED is on continuous

Servo Reset Position:

After the dt time has finished the servo can be programmed to either return straight back to the starting position or remain at the last position, and then only move to the start upon the next power up to allow the trip wires / arms to be relocated. In this mode the servo reverses sequentially back though each position with a 2 sec pause at each. If this feature is selected and the timer is cancelled before the dt time has operated, ie the model lands early, it is preferable to cancel the time with the button before unplugging the power, this then stores the current servo position so upon next start up the servo resets from there otherwise it will travel to the last position and release any remaining functions by mistake.

Sport mode:

Selecting sport mode introduces a ramping time delay between each of the selected servo positions to allow a gradual increase/decrease in power, a ramp from 0 to 100% takes approx 6secs and the timer pauses the run times whilst ramping and resumes again once at the new position. The LED is extinguished during ramping to indicate that timing has been paused. Therefore the times that are entered are the times at each throttle setting and the total run time will be longer depending on the differences between each.

As MOST esc's only control the motor rpm between 1.1 and 1.9 ms using servo positions above approx 90% won't have any affect on the motor rpm, which means entering a position of 115% then 105% won't slow down the motor rpm as expected although using a servo would work perfectly normal.

Eg
With position settings of 100%, 50%, 100%, 50%, 1% and 10seconds at each the total time is nearly 60seconds total from start to finish.

This mode also changes the run time setting to a delay before start setting to allow time after the start button is released until the motor starts. This time DOES NOT run sequentially with the other times, it is a separate time that delays the start of the timed sequence.

Note: In this mode Position 5 must always equal the low throttle setting required as this is the setting the timer will go to when finished or jump too if the cancel button is pressed, this is usually 1% for an esc but could be any value if using a servo to move a throttle on an ic engine.

Calibrate: (only available on version 3 and above)

This setting is used to fine tune the running time of each timer. A lower value slows the timer and a higher value increases the speed of the timer.

Quick Restart: (only available on version 3.1 and above)

This feature allows the timer to be reset back to the start without cycling the power off and on again, but is only available if the timer is cancelled within 3 secs of the button being released.

Eg:

The model is ready to be launched with the button held down so the timer is 'armed' waiting for release, if applicable the motor is running at the selected power level, but it is decided to cancel the launch for some reason then releasing the button will start the timer running as normal. If the button is then pressed again within 3 secs of release then it enters into a holding mode, if applicable the motor shuts down and the led flashes a … --- … sequence. If the button isn't pressed within this time then the timer shuts down completely and will need to be powered off and back on again. The timer will now stay in this holding mode indefinitely until cancelled. When ready to restart press and hold the button for 5 secs until the led rapidly flashes indicating the timer has reset. Operation will now continue as normal.
If using sport mode then the 3 sec reset limit starts from when the motor first starts and not from when the button is released so it can be reset at any time during the delay period.

Servo Positions:

As can be seen from the settings list the servo direction can be reversed simply by swapping the values over and the end points adjusted to suit each installation without concerns about the servo binding or travelling the wrong way.
Once the timer is running the servo will stay at the first position until the first time expires, then it will move to the second position until the second time expires and so on. The servo positions don't need to be sequential; it could go from one end to the other and back to the middle if required.
If only the DT time is to be used then the first, second, third and fourth positions should be made the same as the start position so the servo only moves to the last position after the DT time has finished and all other times / positions will be ignored.

E.g.:

Position 1 = 1%
Position 2 = 1%
Position 3 = 1%
Position 4 = 1%
Position 5 = 100%

While familiarising yourself with the operation of the timer it may be a good idea to use 2 servos so there is no chance of any fingers getting caught in rotating props (a Y lead would be required to supply power to the timer)

Using the timer without changing settings

When first connected the timer waits briefly to check for a signal from the programmer, if it's not detected then the settings from the previous flight are loaded from the memory, if the servo is set to 'reset at the start' then it will move back to its start position. The timer then gives 2 short flashes to indicate it is ready and the led will now indicate the current battery voltage. Holding the start button for approx 2 secs will start the ** motor (if applicable) which will ramp up to full throttle, during this ramp time the led will be on (if its not already on) and will go out as soon as the throttle is at the programmed level. As long as the button continues to be held the timer will wait at this point and the times will only start when released. If the button is held down for more than 10 seconds the timer will assume the button is stuck down and will go to failsafe mode. If the launch needs to be delayed it would be preferable to cancel the timer and use the quick restart mode to reset ready for the next launch. The model should only be launched after the led is extinguished otherwise the throttle will still be ramping up.

** If using sport mode then the start will be delayed by the Delay setting then it will ramp up to the position 1 setting and then continue through the sequence until the end.

Using the timer and changing settings:

The programmer must be connected before connecting the power as it is only checked for at the beginning. Depending on the options the programmer either plugs into a flying lead or onto straight pins coming from the timer. If it is detected then the settings from the previous flight are loaded into it, during data transfer the led flashes to indicate activity.
Once the welcome screens and timer supply voltage indication have cleared the Mode setting screen comes on and the type can be increased or decreased with the buttons.
Once the required mode has been set then pressing the enter button will move on to the motor run time or start delay setting screen and the value can be increased or decreased with the buttons.
Continue on through the menus adjusting each as required.
The last setting is the Cal: setting, after that the programmer enters the summary mode where it continuously scrolls through each of the settings so they can be reviewed. If a setting is found that requires changing then holding the increase button jumps back to the beginning so adjustments can be made.
When the settings are correct then pressing the enter button will send them to the timer, again the led will flash to indicate activity, Once transfer is complete, indicated by a short flash every 2 secs the programmer lead can be unplugged and then the timer will start as above.

DO NOT unplug the power or programmer until the timer gives the short flash every 2 seconds indicating the settings have been accepted and saved otherwise the new settings will be lost.

During programming there is no signal sent to the ESC so there is no chance of it starting accidentally although most will go into alarm due to no valid signal.

It is strongly recommended to check any setting changes before flying the model. Once the times have been selected they have proven to be very repeatable during testing.

Assembling the programmer:

The programmer is supplied finished and tested but will need to be installed into a suitable enclosure. The led display has mounting holes in the corners that can be used for fixing screws or it can be fixed with blobs of epoxy. Mount the 3 buttons in a suitable place to allow easy access while entering settings and thread the lead/socket outside. A simple method is to cut a notch out of the enclosure and lay the lead in it, and then close the lid over the top. A method of strain relief is recommended on the lead to prevent it being accidentally torn out.
It is recommended to leave the chip on the display accessible for future software updates.