DT FREE-FLIGHT TIMER (FFT2)

INTRODUCTION

The timer has five time periods and a servo can be made to move to five positions.
Time periods, servo positions and a low voltage warning are all configured with the built-in joystick.
Dethermalisation can be triggered by radio.
The timer switches itself off completely at the end of a timed sequence.

BASIC PRINCIPLES

The 14 leds across the top row represent the following:

S1,2,3,4,5	-	servo positions
H1	-	hook fully forward (line under max tension)
H2	-	hook fully back (hook released)
T0	-	abort time period (can be reset/stretched with H1)
T1,2,3,4	-	normal time periods (the sequence triggered with H2)
R	-	radio dethermaliser
V	-	battery voltage

The 4 leds down the left represent time (in seconds) or volts.

The 5-way navigation joystick is referred to as 'NAV' and can be pressed UP, DOWN, LEFT, RIGHT and IN.

POWER-UP

To switch the timer on, press NAV IN briefly:
- S1 will come ON and the servo will go to its associated position
- H1 or H2 will flash if a Hook switch is on.
- R will flash if the Radio DT trigger signal is being received.
- V will flash if the battery voltage is below its threshold.

To switch the timer off:
- press NAV LEFT or RIGHT on the top row to select H1.
- press and hold NAV UP for >2s and power to the timer and servo will be completely disconnected.

START

To start a time sequence, ensure that only S1 is ON.
- A low voltage condition (V flashing) will not inhibit use of the timer but could damage a lipo if severe.

Press NAV DOWN for 2 seconds or more.
S1 will start flashing once the timer is armed.
Timing starts as soon as NAV is released.
There will be a beep, S1 will go solid again and T0 will come on until its time period expires.
The timer is supplied with all time periods set to 5 seconds.

In summary, preconditions to start are:
- S1 is ON (servo in 1st position)
- H1 and H2 are OFF (neither switch engaged; ie: hook latched and held forward)
- R is OFF (Radio DT is not engaged)

SERVO POSITION S1

Position S1 is 'special' relative to other positions on the top row:
- a timing sequence can only be started from S1
- if a timing sequence has not been initiated yet, the state the hook switches (H1/H2), radio DT signal (R)
  and low voltage warning (V) are also displayed (as flashes once per second) when S1 is on.

As soon as you 'move off' S1, only one led will be illuminated on the top row.

MOVE SERVO/CHANGE POSITIONS

To move the servo, simply press NAV LEFT or RIGHT until S1, S2, S3, S4 or S5 are illuminated.
The servo will move to the position associated with the illuminated led.

To change the servo position:
- press NAV DOWN to enter change mode (one beep and 60S led will come on).
- press NAV LEFT or RIGHT to move the servo in small steps.
- press NAV DOWN again to save the new position (five beeps).
- press NAV UP to cancel a change (the led on the top row will flash briefly).

TIMERS T1-5

These are the timers for phases of flight once off the tow line.
The release of the line needs to close hook switch H2 to allow timer T1 to start.
Timers T2, T3 and T4 follow automatically.
Upon expiry of each timer, the servo is advanced to the next position to release a line.
All timers can be set to 0.1s resolution and up to a max of 100 minutes.

To change a time duration:
- press NAV LEFT or RIGHT on the top row to select T0, T1, T2, T3 or T4.
- press NAV DOWN to enter change mode (single beep on 60S, double beep on 10S, etc).
- press NAV LEFT or RIGHT on each time row (60S, 10S, 1S, 0.1S) to decrement or increment durations (count flashes).
- press NAV DOWN again to save the new position (five beeps).
- press NAV UP to cancel a change (the led on the top row will flash briefly).

TIMER T0

T0 is used to abort a flight.
Hook switch H2 must close (go ON) before T0 expires for the timed sequence to proceed.
If hook switch H2 is not closed before T0 expires, dethermalise (S5) is activated and the timer switches off.

T0 can be stretched/reset while on the line.
T0 is reset and restarts its countdown every time H1 is activated (hook fully forward for at least 0.1s).

T0 can be 'disabled' by setting it to a long duration.
Its duration is changed as described for T1-5 above.

NORMAL TIMING SEQUENCE

Start timer by pressing NAV DOWN >2s from S1 as described above.
If H2 is activated (hook released/fully back) before T0 expires, the normal timing sequence (T1,S2,T2,S2,etc) will follow.
If T0 expires before H2 is activated, the timer will Abort.

One of T0,1,2,3,4 will be on if the timer is currently active.
One of S1,2,3,4,5 will be on to indicate current servo position.
H1 and H2 will be on if their switches are closed.
The sequence ends at S5 (dethermalise position).
The timer switches itself off after three seconds.

To prepare for restart, press NAV IN to power up the timer (refer to POWER-UP section).

ABORT

On ground:
- Press NAV in any direction to cancel a timing sequence.
- The buzzer will beep.
- The servo and associated led will stay at the position where cancelled.
- All other leds will go off.
- To prepare for restart, press NAV LEFT or RIGHT to move servo as required until S1 is selected.

In flight:
- If T0 (abort timer) expires before H2 is activated (hook release), S5 will be activated (dethermalise).

RADIO DETHERMALISE

If a Radio dethermalise signal (RDT) is received during a timed sequence, S5 will be activated.
The timer will then switch itself off.

The R led has two states:
- OFF when no Radio signal or Radio dethermalise command is being received.
- Flashing while a Radio dethermalise command is being received (only displayed when S1 is on or the timer is running).

The timer converts the pulse from the radio into a number which will normally be between 111 and 255.
RDT is active (R flashing) above a threshold and not active below it.
The threshold defaults to '188' but can be changed between 111 and 255 if not suitable.

To change the threshold:
- press NAV LEFT or RIGHT on the top row to select R.
- press NAV DOWN to enter change mode (single beep on 60, double beep on 10, etc).
- press NAV LEFT or RIGHT on each of the three rows 60, 10 and 1 to decrement or increment each of the three digits (the 60 row represents hundreds).
- press NAV DOWN again to save the new position (five beeps).
- press NAV UP to cancel a change (the led on the top row will flash briefly).

HOOK SWITCHES

If S1 is on, the state of the 2 hook switches will be revealed with the H1 and H2 leds.
The associated led will flash every second if the switch is on.
This is used to check their operation and to set them up in a new model.
Hook switches have no configurable settings; they are expected to be either on or off.

The H1 led position is used to switch the timer off.
- press NAV LEFT or RIGHT on the top row to select H1.
- press and hold NAV UP for >2s and power to the timer will be disconnected.

VOLTAGE

The V led will flash if the voltage falls below its threshold.
This is only displayed if S1 is on or the timer is running.
The default as supplied is 3.2v.

To change the low voltage threshold:
- press NAV LEFT or RIGHT on the top row to select V.
- press NAV DOWN to enter change mode (three beeps on 1, four beeps on 0.1).
- press NAV LEFT or RIGHT on each row to decrement or increment each of the two digits.
- press NAV DOWN again to save the new position (five beeps).
- press NAV UP to cancel a change (the led on the top row will flash briefly).

The V position is also used to reveal the current battery voltage:
- press NAV LEFT or RIGHT on the top row to select V.

- press and hold NAV UP for >2s and count 1v and 0.1v flashes.
- the sequence repeats for as long as NAV is pressed UP.
- the measurement should be accurate to about 0.1v.

CONFIGURATION

Changes to the Servo (S1,2,3,4,5), Timers (T0,1,2,3,4) RDT threshold (R) and Voltage low voltage threshold (V)
have been described above but are described in more detail below:

When the timer is powered up S1 will be on and H1, H2, R and V may be flashing.
This is a 'standby' mode and changes are made from this state.
To make changes, press NAV LEFT or RIGHT until the led for the function to be changed is ON.
As soon as you 'move off' S1, only one led will be illuminated on the top row.
(if H1, H2, R or V were flashing they will stop until S1 is on again).

If by some chance you try to make changes while a timed sequence is in progress, the first press of NAV will abort that.
The current 'S' led will then become the only led on and you will be in the same ' standby' mode as mentioned above.
To now make changes, press NAV LEFT or RIGHT until the led for the chosen function is ON.

Once the chosen function to be changed has been selected on the top row:
- Press NAV DOWN briefly and the buzzer will beep once for the 60 time period, twice for the 10, etc.
- Each led will flash to represent multiples of that time period (followed by a brief pause).
- If a time period is '0' there will be no flashes while on that row.
- Press NAV LEFT or RIGHT to decrement or increment.
- Previous flash sequences are abandoned (they are not completed) as soon as changes are made.

Press NAV DOWN four times to consider all four time periods.
It is perfectly acceptable to go up and down the time periods any number of times before saving them.

When ready to save changes, press NAV DOWN a fifth time ('past' the 0.1 led).
The buzzer will beep 5 times and the led on the top will flash briefly to indicate that is the current 'positition'.

To cancel without saving changes, press NAV UP until the timer period leds are no longer flashing.
More than one UP press may be needed to reach the top row.
The led on the top will flash briefly when you 'reach' the top row.
All changes will be lost and previously saved settings continue to be used.

All four led's are used to set timer periods.
The 60s row can be set 0-99, 10s 0-5, 1s 0-9 and 0.1 0-9.

Only the 60 led is used to make the servo position changes.
- The first press DOWN allows you to change servo positions on the 60 row (one beep).
- The 60 led will come on to indicate that you are in change mode.
- The servo will move a small amount each time you press NAV LEFT or RIGHT.
- A second press DOWN saves changes (five beeps).

Only the 60, 10 and 1 leds are used to set the radio dethermalise threshold.
60 represents hundreds, 10 tens, 1 ones.
They can all be set 0-9 but will be changed when saved if outside the 111 to 255 range.

Only the 1 and 0.1 leds are used for setting the low voltage threshold.
- The first press DOWN allows you to change 1v on the '1' row (three beeps).
- The second press DOWN allows you to change 0.1v on the '0.1' row (four beeps).
- The third press DOWN saves changes (five beeps).
- Both rows can all be set 0-9 but will be changed when saved if greater than 7.2v (max voltage that can be measured).

Remember: when in doubt, press UP to cancel.
- UP needs to be pressed enough times to 'reach' the top row (whose led will then flash briefly).
- UP can be pressed any number of times (too many UPs will not cause any problems).

INSTALLATION

The timer needs to be powered with 3-6v (1S lipo and 3-4 cell NIMH batteries are the main choices).
The main constraint is the voltage range that your servo requires/can accept.
Configure the low voltage threshold (V) to provide useful early warnings (eg: 3.2v for 1S lipo (as supplied), 4.6v for 4 cell Nimh).
An ON/OFF switch is not normally needed because the timer disconnects the battery completely when off.
The battery must be plugged onto the pins marked 'B' (polarities are marked on the timer).
A lead connected to the contacts marked 'C' can be used to charge the battery remotely.

If radio dethermalise is to be used, the receiver and timer are expected to be powered by the same battery.
This allows the timer, servo and receiver to be completely powered down after dethermalisation has been triggered.
The servo-type lead coming from the position marked 'R' must be used to connect the receiver to the timer.
If the receiver and timer are to be powered by separate batteries, only negative and signal wires must be connected.

The timer is intended to drive a single servo.
This must be connected to the three pin plug marked 'S' (polarities are marked near the edge of the timer).
Servo arms are on splined shafts and should normally be 'centered' to give equal movements in both directions.
Servo position S3 would normally be center.
Take care when setting up the servo that it does not bind at its extremes.
The servo always goes to position S1 on startup so ensure it can do this without constraint.

Two microswitches are provided to detect extremes of hook movement.
Any normally open ON/OFF switch may be used if those supplied are not suitable.
These are plugged onto the two pairs of pins marked 'H1' and 'H2'; the orientation is not important.
H1 is expected to close (switch ON) when the line is under max tension (fully forward).
H2 is expected to close (switch ON) when the line is released (fully back).

If the timer is to be exposed to moisture, the board may be sealed with a varnish.

The unused part of the timer may be used for mounting the servo or line release mechanism.

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