

Flight Manager/Timer FM-Hornet

Description

This device provides timed throttle signals to a Hornet 40A Electronic Speed Control (ESC) that is powering an electric motor for control-line, competition Stunt flight, in the RPM-governed (helicopter) mode.

Flight time

The flight time is adjustable from 1'45" to 6'00" in seconds by turning the "FLT" potentiometer ("pot") from fully counterclockwise to fully clockwise, about 270°. Based on the outer marks, an approximate calibration is as follows:

0	1'45"	6	4'06"
1	1'50"	7	4'43"
2	2'14"	8	5'11"
3	2'40"	9	5'41"
4	3'10"	10	6'00"
5	3'37"		

Delay time

The time between *momentarily* pushing the remote Start button and when flight power is produced is adjustable between about 2 seconds and 31 seconds, in steps of one second, from fully counterclockwise to fully clockwise, with the "DLY" pot.

Flight RPM

This timer is designed to work with the specially-programmed Hornet 40A ESC. (It will generate too-high RPMs if used with a Castle Creations ESC.) If you choose an RPM close to 75% of the no-load RPM (= kV of motor × # of cells × 3.7 volts) and within the motor/battery capabilities, the ESC will maintain that RPM throughout the flight, compensating for differing prop loads and the normal decrease of battery voltage during the flight.

Connection

The FM-Hornet is powered through the middle (+5 volt) wire and the ground wire (one of the two outer wires) of the 3-wire connection to the ESC. The other outer wire carries the throttle information from the FM-Hornet to the ESC. The timer is powered through the 5.0 volt center lead from the ESC

The **ground** wire from the ESC (brown or black wire) **must** be connected to the pin indicated by the "G" (see also the picture below). If the connection is switched so that the other outer wire is connected to this pin, no damage will occur but the motor will not start. However, if you should accidentally connect just two leads to the three-pin connector, it is possible to reverse the power connections and destroy the timer.

Operation

When the battery is connected to the ESC and the ESC is connected to the FM-Hornet, the FM-Hornet sends a "throttle off" signal to the ESC and the ESC responds with (typically) a long beep and then short beeps corresponding to the number of LiPo cells detected. After three seconds or more, the **Start** pushbutton on the FM-Hornet may be *momentarily* depressed, starting the timing sequence for flight.

To confirm for you that the timing sequence has begun, the FM-2 Hornet **blips** the motor one second after the button push. After the 2 to 31 second delay determined by the "DLY" pot, the FM-Hornet increases the RPM to the one requested by the "RPM" and "FINE" pots. Importantly, you may change the selected RPM during the first minute of "flight" time, which is very useful in setting the power level during initial tests of a new

plane. The "FINE" pot allows RPM changes as little as 75 RPM over the approximately 7500 to 13,000 RPM range.

If the power *decreases* during the flight time, the probable cause is that the ESC has detected a minimum voltage for the battery pack (normally set to 3.0 volts/cell or 12.0 volts for a 4S LiPo battery) and it is trying to save your battery from being depleted too much, thereby reducing its useful lifetime. This could happen, for example, if the battery wasn't fully charged at the beginning, if the propeller has too much diameter or pitch, or if the proper propeller was used but the plane wasn't allowed to fly (the propeller loads up in a static situation because the angle of attack of the blades is so high).

End of flight time warning: When the programmed flight time is reached, the power is reduced for one (1) second as a warning, then power is returned to the flight RPM for five (5) seconds, and then the power is shut off for landing.

Safety features

During the programmed "flight" time, you may **stop** the motor at any time by momentarily depressing the Start button. This is useful when first testing the power unit in a plane. It is also important to remember to do this if the propeller should try to cultivate some grass—but only the ESC can actually detect and automatically shut down the motor under this condition, hopefully by detecting a current overload or the motor overheating. (Let the motor and ESC cool down before attempting a restart.)

Thirty seconds after the power is shut off for landing, the signal to the ESC is changed from "throttle off" to zero volts, an additional insurance that the motor will not restart accidentally. In any case, plan to disconnect the battery from the ESC soon after landing, to minimize unnecessary current consumption.

If your battery is capable of providing two flights without drawing down more than **80%** of its mAh capacity (based on the charge you put back into it), you may make a second flight with the same battery but you will have to momentarily remove the connection to the battery to allow the FM-Hornet's processor to reboot, leading then to a repeat of the beeps from the ESC.

Mounting

Two good ways to attach the FM-Hornet to the fuselage are to use (a) hook and loop material (e.g., Velcro®) or (b) #2 wood screws.

(Note that the **bottom** quadrants of the pots are blackened, to aid in visually detecting the fully counterclockwise position as well as the degree of rotation.)

