Flight Manager/Timer FM-2SR

Description

This device provides timed throttle signals to an Electronic Speed Control (**ESC**) that is powering an electric motor for control-line flight. It is intended for competition stunt planes.

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 3 seconds and 18 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 **Set RPM** CL mode of Castle Creations Phoenix or Phoenix ICE ESCs (electronic speed controls). This mode requires you to give the ESC three different RPMs and then this timer allows you to easily select from among those three RPMs. The ESC then maintains that RPM throughout the flight, compensating for differing prop loads and the normal decrease of battery voltage during the flight. Fully counterclockwise on the "**RPM**" pot gives you **RPM #1**, anywhere in the middle gives you **RPM #2**, and fully clockwise gives you **RPM #3**.

Connection

The FM-2SR 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-2SR to the ESC. (The ESC you use must include a **BEC** [Battery Eliminator Circuit] to provide this 5 volts, as most do.)

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-2SR, the FM-2SR 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, plus possibly additional information (melody?). After three seconds or more, the **Start** pushbutton on the FM-2SR may be *momentarily* depressed, starting the timing sequence for flight.

To confirm for you that the timing sequence has begun, the FM-2SR **blips** the motor one second after the button push. After the 3 to 18 second delay determined by the "DLY" pot, the FM-2SR increases the RPM to the one requested by the "RPM" pot. Importantly, you may change the selected RPM during the first minute of "flight" time, which is very useful in setting the power level initially.

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 changed for one (**1**) second as a warning (to RPM #1 if that is not the flight RPM and to RPM #3 if it is), then power is returned to the flight RPM for five (**5**) seconds, and then the power is shut off for landing. (To make a detectable power change for the warning, there should be at least a 500 RPM difference, so choose your RPMs with that in mind.)

Safety features

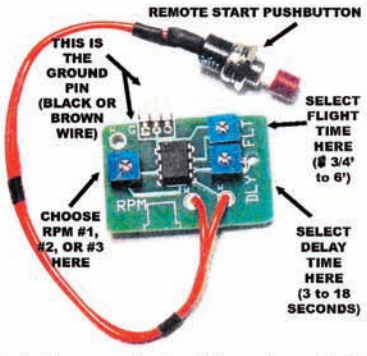
During the programmed "flight" time, you may **stop** the motor at any time by momentarily depressing the Start button. This is useful when first testing the power unit in a plane. It is also important to remember to do this if the propeller should try to cultivate some grass—but only the ESC can actually 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-2SR's processor to reboot, leading then to a repeat of the beeps from the ESC.

Mounting

Two good ways to attach the FM-2SR 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.)