AEROTECH®
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AVIONICS

EFC-1™

Electronic Forward Closure™

Patent Pending • Electronics by PerfectFlite

WARNING: NEVER POINT THE EJECTION END OF THE EFC™ TOWARD ANYONE WHEN LOADED. ACCIDENTAL ACTIVATION MAY CAUSE SERIOUS INJURY. TREAT LIKE A LOADED GUN!

Features/Benefits:

• Reusable ejection charge ignition device (standard type model airplane engine glow plug)
• No consumable government-regulated initiators necessary
• Forward burn-through failure mode eliminated
• Integrated ejection charge holder
• Time delay is calculated from rocket motor burnout
• Time delay selectable in one-second increments
• Virtually unlimited time delay range...no compromising delay times
• Short-circuit protection (deliberately short-circuiting the output is not recommended).
• Light weight, small size
• Long battery life
• Built-in continuity check
• Accidental activation protection
• Reverse polarity protection (inserting the battery backward will not harm the EFC or fire the glow plug)
• Motor closure adapters available to fit a wide variety of Aero-Tech, Dr. Rocket™ and Rouse-Tech™ RMS™ motors...new simpler design eliminates the need for two parts (forward delay spacer and delay o-ring)

Operating Instructions

Chapter 1. Programming

1-1. WARNING: Ensure that the ejection closure is not loaded with black powder at this point. Unscrew the ejection closure and EFC PC board assembly from the EFC housing.

1-2. Hold down the program button next to the green LED as you insert the battery. The LED will light to confirm battery insertion. When it does, release the button. At that point the EFC is waiting to be programmed.

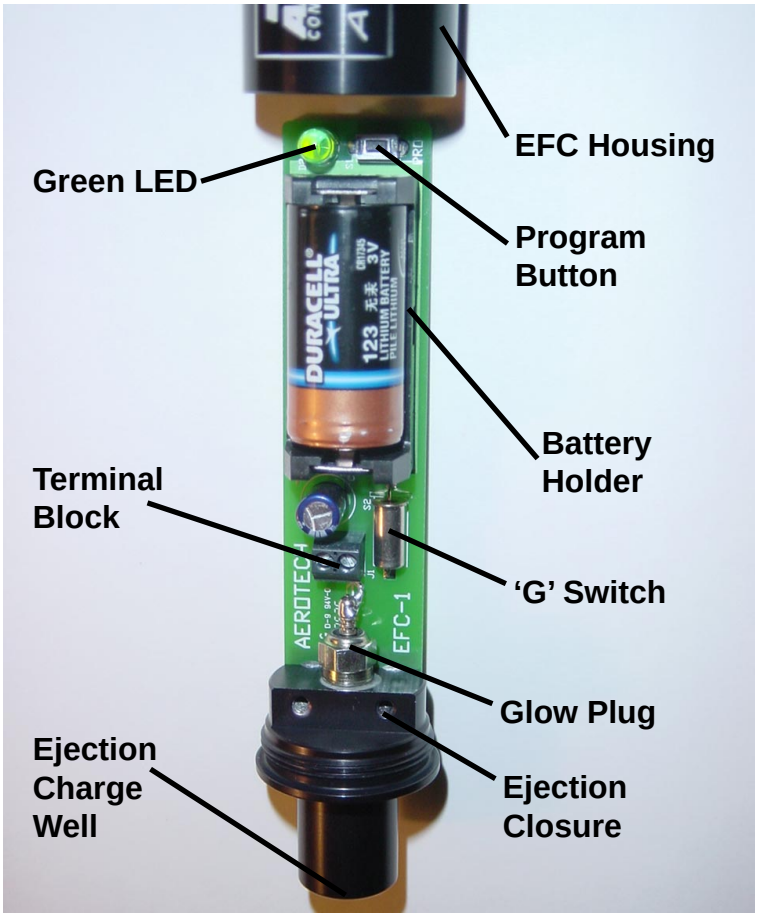

Fig.-1. EFC™ System Components

1-3. Press the button again and hold it for the duration you want the time delay set to (i.e. for a 12 second delay, hold it down for 12 seconds and then release it). The LED will light again while you are holding the button down.

1-4. Release the button. The LED will flash to indicate the number of seconds that you programmed to confirm the delay time. The 12 second delay, for example, would report as a single flash for the digit '1', a pause, and then two flashes for the digit '2'. A 10 second delay, however, would be reported as a single flash for the digit '1', a pause, and then ten flashes for the digit '0'. This report repeats periodically until you turn the timer off by removing the battery. The time delay is retained in non-volatile memory so it is maintained even with the power off, until you reassign a new time delay value.

1-5. Remove the battery from the holder for at least 5 seconds.

Chapter 2. Arming and Testing the EFC

2-1. Insert the battery into the holder (**DO NOT** hold the button down this time). The EFC is now in flight ready mode. The LED will blink out the time delay once (as in step 1-4 above), and then the LED will illuminate dimly to indicate continuity. **CAUTION:** If the LED doesn't light after blinking out the time delay, you don't have continuity and the ejection charge will **NOT** fire. If continuity is not present, remove the glow plug, test it, and replace if necessary. **DO NOT** launch if continuity is not reported.

2-2. NOTE: It is suggested that you function test the EFC **without ejection charge** before each flight. Simulate acceleration by **briskly** swinging the EFC in about a 1/3 circumference arc with the glow plug end facing toward you. When the acceleration is discontinued (i.e., motor burnout is detected), the EFC timer will count down for the pre-programmed delay time and then fire the glow plug **brightly** for 1 second. After the plug is fired, the LED will blink slowly to indicate that a "launch" was detected and the firing sequence was executed. If the glow plug appears to glow dimly or not at all, replace the battery with a fresh battery of the type specified at the end of this document and re-test.

Chapter 3. Preparation for Flight

NOTE: To comply with safety requirements at Tripoli and NAR ranges, it is recommended that you follow the following flight preparation procedure.

3-1. Load your RMS™ rocket motor for flight. Screw the EFC housing onto the forward threads of the EFC motor closure.

3-2. Ensure that the battery is removed from the EFC battery holder.

3-3. WARNING: It is strongly recommended that you wear eye protection such as safety glasses, and keep the ejection end of the EFC pointed away from you and others at all times during this step and until the motor is installed in the rocket. Dispense the required amount of FFFFG black powder into the ejection charge well of the EFC ejection closure. Typical amounts vary from 0.7 grams for 1.8"-2.6" diameter rockets, to 1.4 grams for 3"-4" diameter rockets, to 2.1 grams for 5"-6" diameter rockets.

3-4. Insert a 3/4"-1" diameter paper disc or 1/2" diameter plastic ejection charge cap (available from AeroTech, part no. 0406-4) into the ejection charge well of the EFC ejection closure and push it in until it stops against the ejection charge.

3-5. At the launch pad, arm the EFC as specified in step 2-1. Verify the EFC LED is glowing **steadily** before proceeding.

3-6. Screw the EFC ejection closure and PC board assembly into the open end of the EFC housing.

3-7. Install the completed rocket motor and EFC assembly into the rocket vehicle. Ensure that the rocket motor is secured within the rocket's motor mount tube using positive mechanical means of retention, to prevent the motor from being ejected from the rocket during recovery system deployment.

3-8. Keeping the rocket's nose cone pointed away from yourself and others, install the rocket on the launch pad and then launch the rocket in a manner conforming to the Tripoli Rocketry Association (TRA) and/or National Association of Rocketry (NAR) safety codes.

Chapter 4. Post-Flight & Maintenance

4-1. Remove the battery from the EFC batter holder as soon as possible after flight and store the battery in a cool, dry location.

4-2. Clean the ejection charge well of the EFC ejection closure using a wet wipe or paper towel dampened with water or denatured alcohol.

4-3. After 4 or 5 flights, fill the ejection charge well of the EFC closure about 1/3 full of denatured alcohol and shake briskly with your finger held securely over the top of the well. Shake out the alcohol and allow the closure to dry completely before using the EFC again.

4-4. Store the EFC in a cool, dry location.

Troubleshooting

If the EFC-1 does not function as described, check for the following:
- Burned-out glow plug
- Dead battery, wrong brand battery or battery in backwards
- Flying in program mode instead of flight mode

Precautions

- Avoid static discharge
- Do not drop conductive objects on the PCB
- Do not gouge the PCB traces or damage components
- Do not spill liquids on the circuit
- Do not use a battery other than the specified battery
- Do not short circuit the output
- Follow all warnings described herein when handling black powder and when handling the EFC-1 when loaded with black powder

Specifications:

Battery type required.....Duracell or Sanyo CR123
Glow plug type.....Fox Standard Long 2 volt or Fox Pro 8 Long
Diameter.....29mm (1.125")
Overall length (ejection closure and housing).....4.82"
Weight with battery (without motor closure).....83 grams
Current drain in armed mode.....1.5 milliamps
Current drain after firing.....< 1 milliamp
Battery life in armed mode.....500 hours
Launch detect acceleration.....2.1 G
Launch detect minimum duration.....0.2 seconds
Minimum delay time.....1.0 seconds
Maximum delay time.....over 6000 seconds
Glow plug power duration.....1.0 seconds
Firing current.....3 amps
Firing voltage.....1.5 volts
Estimated firings per battery.....200
Continuity check threshold.....2000 ohms
Typical glow plug resistance.....<0.5 ohms

NOTE: Features and specifications subject to change without notice.