



## Maxwell Propulsion Systems, Inc.

*Super Novo Vias*

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### Voltage Monitor Overview

Maxwell Propulsion's new over/under voltage monitor provides protection of the electrical system of the aircraft, specifically the radios, along with warning the pilot if an over or under voltage situation arises. Following recent discussions on the monitor's available features, we have added another output. The current version runs off the alternator field circuit and has three outputs:

- one controls the alternator field,
- one controls a solenoid, and
- one goes to a 12 volt LED mounted on the instrument panel.

The monitor consists of two precision voltage comparators built with 0.1% parts.

The under-voltage circuit compares the incoming voltage against 13 volts. If the voltage is lower, the monitor turns the LED to solid on to warn the pilot that the alternator has failed.

The over-voltage circuit compares the incoming voltage against 16.5 volts. When the voltage is exceeded, the unit first turns off the voltage to the alternator field thereby shutting down the alternator. Next, the unit turns off a solenoid in the output path after a delay to allow the alternator to shutdown. This delay is designed to allow for a *graceful* shutdown, however, should the alternator not shutdown, the solenoid will turn off the alternator output. We believe this technique is an improvement over the typical shunt that shorts out either the alternator field or the alternator output, until a breaker blows. It is possible that the latter may destroy the alternator and possibly create a fire hazard.

The LED flashes to indicate that an over-voltage event has occurred and the alternator has been shut down. The flashing LED is turned off by turning off the alternator field switch. When the switch is again turned on, the monitor resets itself and the monitoring will restart. In reviewing other monitors available, we identified devices that only monitored over-voltage, ones that only monitored under-voltage, ones that work by shorting out the alternator output, and one that actually turned off the alternator field. While there may be one available, none of the units we identified did a truly *graceful* shutdown of the alternator. The following table shows the results of our review.

Feature	MPS	Perhelion Design	ACS 07-06830	Aeroelectric	Lamar
Under Volt	13	NO	12.5		N/A
Over Volt	16.5	16.2	15.5		
Tolerance %	0.2	N/A			
Max Volts	32	18	20		
A Lead Shutdown	YES	YES	LOW VOLT ONLY	NO	NO
B Lead Shutdown	YES	NO	NO	YES	NO
Proper B Lead Shutdown	YES	NO	NO	NO	NO
A Lead Crowbar	NO	NO	NO	NO	NO
Cost	\$289	\$52	\$86	NO LONGER AVAILABLE	\$144

## **CAUTIONS/RECOMMENDATIONS**

1. When an over or under voltage situation occurs, the pilot should head to the nearest airport for landing. In addition, the pilot should reduce the electrical load by turning off non-essential equipment to maximize the time the plane can stay airborne. This is important because the engine will only run while the electrical system provides adequate voltage to the ignition.
2. Current FAA regulations for certified aircraft require adequate battery power for two hours of flight following an alternator failure. For those using the MPS ignition system, it draws 11 amps. In any event, the batteries should be sized for maintaining the total electrical load required.