



## FLASH MAGIC LIGHT CONTROLLER/BATTERY MONITOR

### OVERVIEW

#### AIRCRAFT LIGHTING -

Flash Magic gives you remote control of your R/C airplane's LED lighting. Flash Magic allows you to separately control your navigation lights, flashing beacon and landing lights from your transmitter using an unused switch and spare channel. Simply flip the switch to the opposite position and the navigation lights will light up. Flip it again and the beacon will begin to flash. Flip it a third time, and the landing lights come on. Flip the switch once more and all of the lights will go off. Flash Magic will sense the position of the switch so it does not matter what position the switch starts in. If you are using the momentary switch on the Futaba transmitter, bump the switch briefly to activate the lights (momentary version only).

#### BATTERY MONITORING -

Flash Magic is powered by your main propulsion battery. It will monitor your airplane's battery condition and warn you of a low voltage (low battery charge) condition by flashing the exterior lights at two flashes per second and sounding a horn (if used) at a rate of 2 beeps per second.

Flash Magic allows you to use aircraft propulsion batteries of up to 30VDC (8S). Do not exceed 30V or Flash Magic will be damaged and the warranty voided.

### INSTALLATION AND OPERATION

#### CONFIGURING THE TRANSMITTER AND RECEIVER -

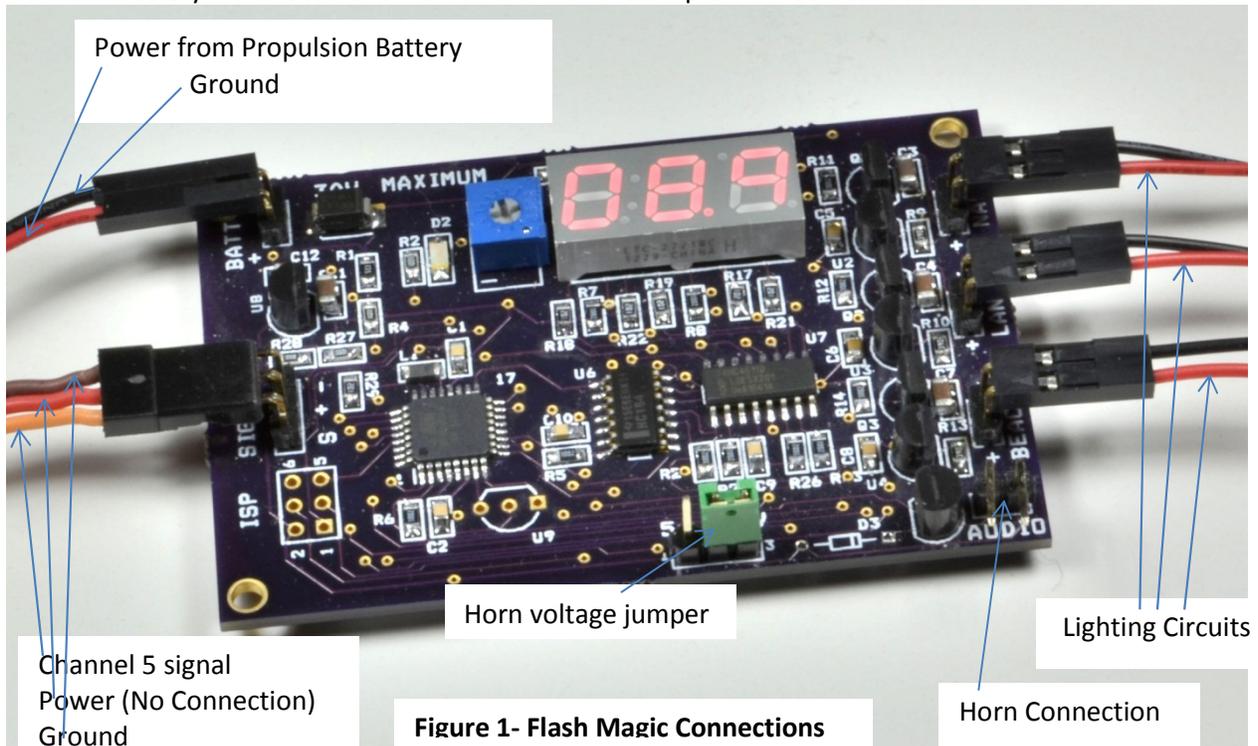
You must configure your transmitter and receiver to allow Flash Magic to work. Following the instructions in the transmitter operator's manual, configure a two position switch to use an unused auxiliary channel. Channel 5 or Channel 7 are the most commonly used. You can use any two position toggle switch that you can assign to a spare channel. It does not matter what position the switch is in when you turn on the transmitter, Flash Magic will sense the position of the switch. Flipping the switch to the opposite position will activate the lights, in sequence. If you have the momentary version of Flash Magic (look for a green dot on the back of the board) you must assign the spare channel to the momentary switch (on the Futaba, switch F is the trainer switch on the top left of the transmitter). It is a spring loaded momentary switch. Operate the switch by bumping it on briefly.

#### OPERATION -

Flash Magic continually monitors the condition of your main battery by measuring its voltage and comparing that voltage with a LOW BATTERY voltage that you set when you install the battery in the R/C airplane. When Flash Magic detects that your main battery voltage is equal to or below the LOW

BATTERY voltage, it will flash all of the lights at 2 flashes per second and it will trigger a horn or buzzer connected to the "AUDIO" output. The lights will continue to flash until the battery power is exhausted. When the lights flash continuously, you have sufficient battery remaining to safely recover and land the airplane. Depending upon your low battery set point, the lights may flash briefly when you apply full throttle when you are low on battery charge. This is normal as a hard throttle application can cause a transient voltage drop. If the lights will flash and the horn sound momentarily, Flash Magic is indicating that you are approaching the LOW BATTERY condition.

Since minimum operating voltage depends upon the characteristics of each individual battery, you must determine the appropriate LOW BATTERY voltage for a particular battery. You can determine the voltage from the battery manufacturer's literature or use the simple method described below.



**Figure 1- Flash Magic Connections**

**CONNECTION-** You must install the wiring connection between your propulsion battery and Flash Magic. Use a flexible two conductor #28 gauge stranded wire with a 2 position 0.1 inch header connector. Connect one end of the wire into the main motor power supply of the R/C airplane, as shown in Figure 1. Be sure to observe the correct polarity. Connect the red wire to the battery positive (+) terminal and the black wire to the battery negative (-) terminal. Be sure to make the connection to the battery between the battery and the motor ESC (electronic speed controller). Most users prefer to solder a permanent connection right to the battery terminal connection wiring. Be sure that the connection is securely soldered and insulated to prevent short circuits. Maximum battery voltage is 30VDC (8S). If you connect a battery with voltage higher than 30 VDC, Flash Magic will be damaged. If you inadvertently connect Flash Magic backwards (reverse polarity) its protection circuitry will protect it from damage, but it will not work.

Connect the channel you have selected on the receiver to the SIGNAL header on Flash Magic (Figure 1). Use a three conductor wire with a three position female header. Be sure to observe correct polarity. The black/brown wire connects to the (-) post, the red wire to the (+) post, and the orange/white wire connects to the (S) post.

When you connect a battery to the Flash Magic, the display will light up and show you the current LOW BATTERY set point voltage for 5 seconds. After 5 seconds, the display will switch to show the voltage of the battery you just connected. It will continue to show the battery voltage for as long as the battery is connected, unless you adjust the set point.

SETTING LOW BATTERY VOLTAGE - When you have determined the correct LOW BATTERY voltage for your battery, set it on the Flash Magic front panel by inserting a small screwdriver in the blue trimmer potentiometer on the left of the voltage display. Turn the trimmer till the LOW BATTERY voltage you have chosen appears on the display. After five (5) seconds the display will change back to show the voltage on your main battery. The LOW BATTERY voltage will remain set until you change it.

HOW TO DETERMINE LOW BATTERY VOLTAGE – There are three simple ways to determine the LOW BATTERY voltage for a particular battery: (1) if you are using standard series wired lithium batteries in good condition, use the recommended values in the chart below, (2) if you have access to a voltmeter or a digital multi meter (DMM), use the battery until its charge drops to the lowest point where you have sufficient charge to safely land the airplane. Measure the battery voltage with the DMM and set that voltage on Flash Magic using the blue trim pot; (3) use the battery for a few minutes and then check its remaining charge by dropping it into the charger. Repeat this until the charge drops to approximately 25%, or the lowest charge which will allow you to safely land and recover the airplane. Install the battery and read the voltage from the display. Set that voltage by rotating the trim pot until the display shows the same voltage you read when you installed the battery. Once the LOW BATTERY voltage is set, it will stay set. You may set any LOW BATTERY voltage that is lower than the battery voltage, however, it must be more than 9V for the lights to operate correctly. If the battery voltage decays below 9V during operation, the lights will dim or go out. Set point values for common lithium battery packs are set forth below:

Lithium Battery Pack	Recommended LOW BATTERY Set Point(volts)
3S	9.9
4S	13.3
5S	16.5
6S	19.9

CHANGING BATTERIES – You may “hot swap” batteries with Flash Magic, however, if the batteries have a different number of cells or are of significantly different condition, you may have to reset the LOW BATTERY voltage. **If you do not insure that the appropriate LOW BATTERY voltage is set, Flash Magic will not provide a reliable low battery warning.**

BATTERY USAGE - Remember, Flash Magic uses the main propulsion battery to operate the lights. Lights use electrical energy so, depending on the number of LEDs, your main battery will be depleted faster than it would if you have no lights. In the usual installation, navigation lights, flashing beacon and landing lights will consume approximately 70 milliamps of current. This is normally only about 5% of the energy consumed by the motor, but it will decrease the amount of time you can fly after reaching a low battery condition. Experimenting with the system while the R/C airplane is safely on the ground will assist in determining the right timing and battery reserve required.

WIRING YOUR LED'S- If you use Lake Microsystems LED sets for the navigation lights, flashing beacon and landing lights, each set of LED's is wired in series and should be connected to the labeled connector

header on Flash Magic. Power for each led string is supplied by a separate constant current controller which has been factory set to provide 25 milliamps of current. This insures that each LED is supplied with the amount of current that is optimal for its operation. The navigation light LED's require a minimum battery voltage of 9VDC to operate correctly. Therefore, when setting the LOW BATTERY voltage, be sure that it is set sufficiently in excess of 9V to insure that the battery voltage does not drop below 9V before the R/C airplane has been recovered.

You may decide to build your own LED sets. Flash Magic will operate other LED configurations as long as all LED's are rated for continuous current greater than 25milliamps. The constant current controllers on Flash Magic are designed to drive LED's wired in series without current limiting resistors, as shown on Figure 2. The number of LED's that each output on the unit can drive is dependent on the forward voltage drops of the individual LED's in the string. The voltage available from the battery should be 1.5 volts higher than the sum of the forward voltage drops of the all LED's on a string of LED's. Since Flash Magic uses constant current outputs, there is no need to incorporate current limiting resistors in the LED strings, if the LED's are rated for 25 milliamps (superbright LEDs). If LEDs with lower current limits are used, you must use appropriate current limiting resistors.

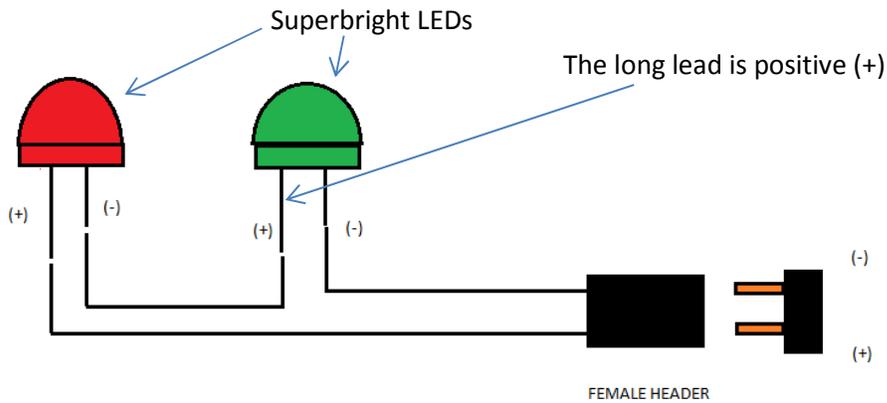


Figure 2.

#### HORN-

Flash Magic comes from the factory configured to drive a horn or buzzer with battery voltage (30v maximum). If your horn or buzzer is intended for low voltage only (5 volts or less), switch the horn voltage jumper from the center pin and the "BV" pin to the center pin and the 5v pin so that the horn will not be exposed to voltages greater than 5 volts.

#### TROUBLESHOOTING:

No display:

1. No power to board. When you first power up Flash Magic, the on board LED will flash twice indicating that the board has successfully powered up. If the LED does not flash twice, there is a problem with the power supply to the board.

Possible Causes:

- a. Wiring incorrect, no continuity between battery and board
- b. Low battery voltage

c. Battery polarity reversed

Display shows battery voltage, but cannot set low voltage:

1. When setting the low battery voltage, it is necessary to turn the trimmer pot at least  $\frac{1}{2}$  turn before setting the voltage. The voltage you set will remain on the display for 5 seconds and then the display will return to show the battery voltage. To adjust the low voltage setting, firmly turn the trimmer pot until the display changes and then set the low voltage.

Lights will not turn ON/OFF:

1. No signal from the transmitter or the signal has not received by receiver. When Flash Magic receives the correct signal from the transmitter, it flashes the on board led once for every switch activation. If the led does not flash when the switch is activated, the board has not received a signal from the transmitter.

Possible Causes:

- a. Transmitter is not ON.
  - b. Transmitter not correctly programmed to send the signal from the switch to the channel you have chosen.
  - c. No power to the receiver or the receiver is wired incorrectly. The green led on the receiver must ON. Check the receiver wiring to assure that the receiver is getting the proper voltage and polarity.
  - d. Signal wiring to Flash Magic SIGNAL pins not connected or incorrectly connected. Insure that the 3 pin connector from the receiver is on the channel you have selected, and that the connector is correctly placed on the SIGNAL pins (See Figure 2).
2. Wrong signal received. Review the transmitter operator's manual to make sure that you have programmed the transmitter correctly. Also, insure that the signal wire from Flash Magic is inserted into the correct channel on the receiver.
  3. LED's wired incorrectly. The LED's must be wired such that the (+) side of the LED connector on the board connects to the anode of the first LED. Subsequent LED's are in series with the first LED, as shown in Figure 1.
  4. LED's failed. An LED that is exposed to current in excess of 25mA will fail permanently. Actions such as testing an LED with a battery will kill the LED unless there is a current limiting resistor in the battery circuit.