

# Magic Timers Tech Note – 17-4

## Use of LiPo Batteries

### **Background**

We are currently in a technology transition period. Traditionally R/C model equipment has been powered by 4 cell NiCad and later 5 cell NiCad or NiMH battery packs. This means that all servos will work off 4.8 volts and most will work of 6 volts. We use those servos with electronic timers in our Free Flight models.

The LiPo battery chemistry is fast becoming the dominate battery type for consumer electronics. This is affecting the R/C hobby industry and Free Flight as well. This means that whereas several years ago it was easy to get quality NiCad and NiMH in a wide variety of small sizes this is becoming increasingly difficult. There is no question that LiPo batteries are the best for electronic free flight models as this type of battery has many advantages, such as light weight for the capacity and the ability to deliver high currents.

The downside this that a single LiPo cell has a nominal voltage of 3.7 volts but can be as high as 4.2 volts. This does not match what is traditionally used in the hobby industry. This means that a single cell is below what is normally used to drive a servo and 2 cells are too much. The servo providers are starting to adapt to this as is seen by servos designed to work on 3 volts for single cell LiPo operation and servos that will work on up to 9 volts for 2 cell operation.

### **Magic Timers**

You may power a Magic Timer with a LiPo battery of either one or two cells. There are a number of things to consider:

All Magic Timers will run on One LiPo cell. – That is 4.2 volts at full charge. LiPo cells have the advantage over other chemistries that they will deliver quite high current. That means that the effective voltage delivered to the model control system [timer, servos and RDT] is more likely to remain high under load than if you used a battery of higher internal resistance such as NiMH...

If you are running a model where the timer operates levers like a mechanical timer you can easily use just one cell.

One cell will work for many F1A or F1H flyers; it depends on your personal flying style. This is because LiPo cell have a very low internal resistance so the voltage will not drop so much under load like it does with NiMH batteries so the actual voltage getting to the servos might well be higher with the single cell LiPo than with the 4 or 5 cell NiMH pack.

You cannot use 2 LiPo cells with a Magic Timer that does not have a Voltage regulator. Most Magic Timers, in particular the Black Magic and Universal timers have voltage regulators. The Micro Magic, Single cell LiPo timers and Little Magic do not have a voltage regulator.

If you wish to use 2 cells and with a standard Universal Timer or 3 servo timer then the voltage to the timer will be regulated but NOT the voltage to the servos. This means that the servos will get 8.4 volts when the battery is fully charged. This will damage some servos. You have 3 choices at this time:

- Choose servos that will take 8.4 volts, such as some Dymond R/C models.

- Put an external voltage regulator outside of the timer in the battery pack to drop the voltage to 5 or 6 volts. Most voltage regulators draw some current, even when not powering the timer. This may require an extra switch between the battery and the external voltage regulator to make sure the battery is not drained while the model is at rest.
- Use the VR model Magic Timer that includes a heavier duty voltage regulator that also regulates the voltage to the servos.

The 2 and 3 servo VR voltage regulator will take 1.5 amps. It was designed for 1 and 2 servo timer. There is a 3 servo version that can be used if you do not exceed the recommended current.

The 4/5 servo VR Extended Magic Timer will take 5 Amps and must be used with a 2 cell LiPo pack [one that has a voltage 1.2 volts or more above 5 volts]

The voltage regulators will generate some heat so they will get warm with normal use. Most include an over current and over temperature cutout so may turn off if severely over stressed.

Care must be taken in the choice of external voltage regulator to make sure that it has adequate capacity to handle the load and remember that a voltage regulator can draw power when the timer is not running so it may require an extra switch on the battery.

### **Battery Pack Size**

A quick rule of thumb is to use 100-150mah battery capacity per servo for a F1A model. This assumes that the battery has 10C; this means that it can deliver 10 times that value as maximum current. So a 100ma battery could deliver 1 amp.

Of possible interest is that the Hitec 65 servo that is popular in some circles can draw over an amp in some circumstances. Some servo manufacturers do publish the current draw of their servos, including a max value when the servo is stalled.

We do not need to deliver this current throughout the entire flight. In fact with an F1A model there will only be a high current draw for a second or so around bunt time. However the consequence of not being able to deliver the current is that the battery voltage will drop and this will cause the servo to stop working, the RDT to reset and the timer to brown out and reset, probably in that sequence. In most cases the servo will stop working before the timer resets as Magic Timer will generally run with the voltage under 3 volts [depending on the timer model].

## **F1Q**

For F1Q models the power is provided to the timer via the BEC [battery Elimination Circuit] on the motor controller, getting the power from the electric motor battery. The motor controller's Note does not apply to F1Q timers.

## **Safety**

Note that the use of LiPo batteries has safety and special charging considerations. Always use LiPo chargers and follow the manufacturer's instructions. There can be special requirements for getting the optimum charge into a 2 cell pack.

## **Future**

As we said at the beginning of this Technical Note we are in a transition period where the Hobby industry is adapting to the availability of new technologies. As Free Flighters we need to

Hobby industry support to bring us some of the parts we need at reasonable prices. At Magic Timers we make an effort to up with technology and include that in our products.

**Table showing recommended Magic Timer and Battery combinations**

	<b>4/5 cell NiMH or NICAD</b>	<b>1 Cell LiPo</b>	<b>2 cell LiPo</b>
Black Magic Universal timer and 3 servo (blue, older timers are green)	OK	OK	OK 8.4 Volts to servo
Black Magic 2 and 3 servo VR timer (Yellow)	OK	OK but may have a higher voltage drop	OK 5 Volts to Servo
Black Magic 4/5 Servo Timer (green)	OK	OK	OK 8.4 Volts to servo
Black Magic 4/5 Servo VR Timer (Yellow)	5 Cells OK	No	OK 5 Volts to Servo
Little Magic (green)	Not Recommended	OK	No
Micro Magic (red)	Not Recommended	OK	No
Universal Single cell Black Magic (green)	4 cells OK	OK	No

You can ask us if you have additional questions.

To e-mail Magic Timer write to [magictimers@yahoo.com](mailto:magictimers@yahoo.com)

***“We count the seconds, the rest is up to you.”***