



XH and PQ balance boards are provided, and a pair of heavy-duty croc-clips for connection to car/leisure battery terminals



Fusion Emperor L712B Pro

Mark Danek takes a close look at a powerful charger from Logic RC

The Fusion Emperor L712B Pro sits fairly and squarely at the top of Logic RC's charger range. I'll be looking at the features on offer to see if the Emperor really is as powerful as its name suggests.

Déjà Vu?

Regular Q&EFI readers might recall a review of the original Emperor L702B Pro almost two years ago. At the time, it was well-specified and, consequently, well-received. Externally, the new Emperor looks very much like the previous version, as the changes are all internal. The greatest (though not obviously visible) enhancements are power handling component upgrades and control firmware changes, giving a significant boost in output power.

A sturdy and attractive box contains the charger, a manual, a selection of LiPo 7S balance boards (JST XH and PQ) and a pair of heavy-duty croc-clips to allow the use of a vehicle battery in the field. High-end batteries requiring this charger's performance will require high-performance connectors so this choice is left up to the purchaser and no charging leads are supplied.

Looks The Business

The Emperor is a businesslike device without any embellishments and the sturdy black metal case has a nice substantial feel to it.

The front of the charger presents the battery charging connections. Each channel provides: 4 mm charging lead sockets, a 7S balance lead connector (JST EH) and, very usefully, a temperature sensor port.

The rear of the case is home to three temperature-controlled fans (drawing air through the case from slots at the front), which keep everything cool as the Emperor can discharge up to 100 W. Usefully, The fans stop when not needed, to save on noise and to prolong their life. Also at the rear are power input cables and a standard mini-USB port allowing the charger to connect to a PC for data logging or firmware upgrades.

On top of the case is a backlit LCD, which is nicely angled towards the user to make reading the crisp display even easier. As the charger has two channels, the LCD is shared: top for channel 1 and

bottom for channel 2.

Six easy-to-use buttons are situated below the LCD screen. These are covered by a plastic membrane, which is printed with the functions provided. One is used for output channel selection and the other five are used for menu navigation and item selection and editing. The buttons are pleasant to use.

Plenty Of Power

Originally, the Emperor was capable of a respectable 300 W per channel, but now the latest Emperor can deliver a simultaneous 500 W per channel!

As the top level of power is not appropriate for NiMH or NiCad cells (which have relatively limited capacities and charging rates) I think it's fair to say that the Emperor upgrade is specifically intended to take advantage of the latest 5C charge-rate LiPo packs – even at higher capacities. It's clear that this charger is a significant development for the serious electric flyer.

I decided to concentrate on this aspect in the review and, in order to obtain this level of performance, I arranged to get hold of Logic RC's 35C 4200 mAh and 25C 5000 mAh Fusion Storm LiPo packs, either of which can be charged at up to 5C and give the Emperor a suitable workload.

Power Demands

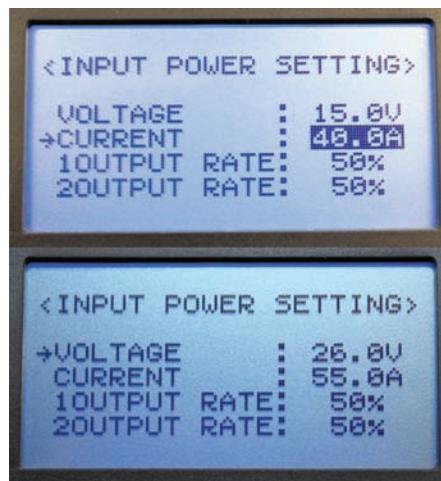
The Emperor's strong power-delivery has to come from somewhere and the maximum input power requirement is now around 1 kW. In order to get the full benefit of the power upgrade, you will need a Power Supply Unit (PSU) capable of providing up to 28 V or a large capacity lead-acid battery delivering 24 V.

For this review I used a Fusion 600W adjustable, as well as the Fusion 2000W (2 kW) PSU, both available from Logic RC, to ensure that I could test the Emperor to its full potential. The 2 kW PSU is more than a match for the Emperor and, at a pinch, could just about run two Emperors flat-out.

Even so, the Emperor will make do with far less if required, though it won't provide its full performance. However, this has also been considered and when using a low-power PSU (200 W/20 A, say),



Switching between outputs is done by pressing the channel button. Now active, channel 2 uses the lower half of the screen while the inactive channel 1 is at the top



After the start-up screen, you can confirm the PSU specification to prevent an overload. Lower spec PSUs can have up to 90% of available power allocated to one channel

the Emperor can allocate up to 90% of the available power to one channel, allowing fast-charging on one output and less demanding tasks on the other.

What's On The Menu?

The Emperor's menu system is straightforward and a pleasure to use. If you already know a bit about batteries and chargers then the menus will present you with the options you are expecting and let you get on with the task you have in mind. If you're not so sure, then the menus and the manual will help you get to grips with charging and do their best to stop you making an error.

Please bear in mind that this is a very powerful charger and, experienced or otherwise, do yourself a big favour and read the manual before connecting a battery!

The Emperor's manual has been produced by Logic RC in the UK. It is a clear and concise A5-sized booklet with plenty of diagrams showing the menu structure and explaining the operation of the charger for each battery type with appropriate safety information. There is also a PDF version of the manual available online, with the advantage of being in colour and 'zoom-able'.

Got It All Covered

Now, even if you are buying this charger primarily for its performance with LiPos, there is no reason why it shouldn't earn its keep dealing with every other battery you own. As expected the Emperor can cope with all currently available battery chemistries: Nickel (NiCad and NiMH); Lithium (LiPo, Lilo and LiFe); Lead-

Acid (Pb). Each of these types requires a particular approach and the charger will take care of this automatically as well as allowing additional manual fine-tuning.

Lead-Acid Batteries

EP flyers have been known to use quite large leisure batteries in the field and these will need recharging for the next outing. A valuable feature of the Emperor is that it will genuinely charge a 24 V battery or two identical 12 V batteries in series if you have been using those for input.

Nickel Batteries

Ever since the general ban on NiCad some years ago, I've had a constant battle on my hands trying to stop the newer, less robust, NiMHs from expiring when not in regular use. As always, prevention is much better than cure and the Emperor offers three functions for nickel batteries: Charge, Discharge and Cycle.

Cycle is a great maintenance feature and can alternate charge and discharge up to 10 times with automatic current handling. This is used to condition new packs and may help to refresh older packs. At the end of the operation the results are held in a table and a decision can be made about the viability of the pack.

Charging or discharging can be specified as Automatic, Linear or Normal with an additional charge type of Reflex to help counter memory effect.

Charge termination conditions can use peak-detect, pack capacity or charge duration. On charge completion the pack can be provided

ABOVE LEFT: All charging connections are on the front, out of the way. Crisp, backlit LCD and nice buttons make for a pleasant user experience. Three temp controlled fans occupy the rear of the case, along with the power input leads and a mini-USB connector for data-logging

ABOVE RIGHT: Optional low-cost temperature sensor is a must – get a pair. Logic also sell a mini-USB lead, if you don't already have one



Charging Fusion Storm 3S and 4S 25C 5000 LiPos with the optional temperature sensors fitted. The lower pack voltages allow around 4C and 3C charging respectively with the 600 W PSU



Emperor will cope easily with large capacity NiCad and NiMH packs up to 18 cells. It's equally at home charging and cycling smaller Rx and Tx packs to keep them in peak condition



My trusty Fusion 600W PSU running nearly flat-out! At around the same time the Emperor's screen shows over 480 W flowing into the LiPos

with a trickle charge to keep it topped-up and ready to go.

Possibly the clearest charge termination parameter is pack temperature and with the optional temperature sensor fitted the charger can monitor the pack for a charge termination temperature and add a significant level of safety. These sensors (which stick magnetically to metal cells) only cost £4.99 each – so don't hesitate to get a pair when you buy the charger.

Lithium Batteries

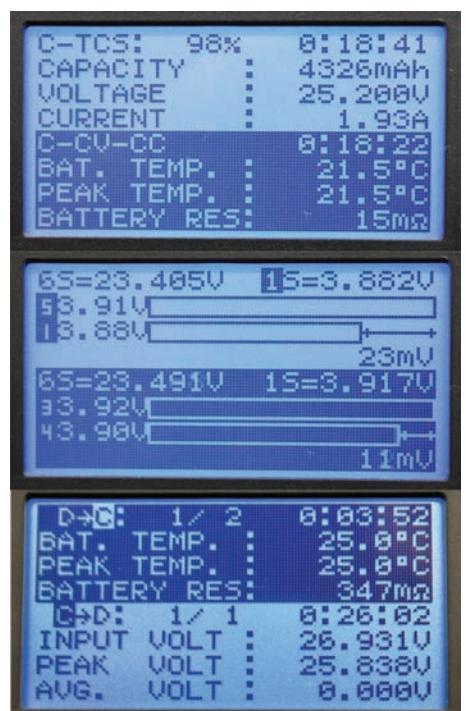
I'm sure we can still remember the time when the only charge rate for a LiPo was 1C. These days, packs such as the high-quality Fusion Storm can be charged at 2C (or even 3C) and will safely accept a 5C (21 Amp!) charge with an acceptable reduction in pack life.

A quick calculation shows that 6S 4200 mAh packs charging at 5C can require a peak power of around 525 W, though it should be noted that this power level isn't required for the entire charge cycle. All in all, perfect for the Emperor.

Lithium batteries get three functions: Charge, Discharge and Store. As well as setting the charge or discharge rate, the user can also set termination conditions such as final cell voltage, pack temperature, charge duration, or charge capacity. Also of note here is the ability to set a voltage value to a resolution of 0.01 V/10 mV (rather than the more usually seen 0.1 V/100 mV) giving the



Oh yes! Fusion 2000W PSU hits 1.152 kW (26.8 V x 43 A) putting 21 amps each into a pair of Fusion Storm 6S 35C 4200 mAh LiPos. This is at the LiPo and charger limit but only about half the rated power of this mighty PSU



A variety of status screens: Top – LiPo charging information; Middle – balance screen, showing the highest/lowest cell voltages as bar graphs (individual cells can be viewed via the top line); Bottom – NiMH packs being cycled

ability to accurately under-charge or terminate a discharge early for Lithium batteries, so helping to extend pack life.

The store function is a great help when preparing packs for storage and requires the balancer board to be used to ensure that the pack is correctly balanced as well as discharged.

High Cell Count

With increasing LiPo cell-counts, relying on the total pack voltage to distinguish between 5S (fully charged 21 V), 6S ('stored' 22.8 V) or 7S (fully-discharged 21 V) is no longer viable. As a result of this overlap, an input error by the user may go undetected. For this reason the supplied balancer boards should always be used to confirm cell-count.

Memories

During the review I initially entered the battery parameters manually each time as I went along but as time went on I found that



Individual cell voltages are recorded by a laptop using the powerful LogView software. Available as a table of values or configurable graphs, this information can give early warning of problems and prevent costly incidents

it was far easier to store the battery type in memory so that I could call it up repeatedly. The Emperor has 20 memories per channel allowing the details of a large number of batteries to be stored and quickly recalled.

Data Logging

I suspect that opinion may be divided over the value of the data-logging feature. I feel that it is something that will eventually become indispensable to those people who like to know how their battery capacity and individual cell balance behave over time and keep a record as a diagnostic tool. In any event, it's there if you need it and whenever the charger is powered up it constantly reports its state via the USB port on the back.

In order for your PC to recognise the charger a driver program must be installed and Windows Vista did this for me automatically when I plugged in the charger. Once connected, the charger appears as a standard serial port.

Logic RC don't provide software for displaying data because the Emperor is supported by a widely used German program (LogView) which is free to download and very powerful. LogView and the driver software can be obtained using links on Logic RC's website.

Using The Emperor

Please note that the charging set-up in the photos was only used for photographic clarity and you should observe safe charging practices at all times.

Discharge, Store and Cycling

As the Emperor has a respectable discharge rate per channel, discharging can be carried out relatively quickly, though cycling Nickel cells can take a bit longer as this is performed using an automatic current limiter. The store function for LiPos benefits from the 50 W limit and can adjust the voltage of large capacity packs up or down quite quickly. I managed to 'store' over a dozen decent size mostly-charged packs in an afternoon, though it should be borne in mind that a fully-charged 6S 5000 mAh LiPo may take over two hours to completely discharge.

Fast Charging

At present only LiPos are capable of accepting the Emperor's full output power. Using the Fusion 2000W PSU I charged a pair of 6S 4200 packs at 5C, then a combined set of 25C 5000 packs (3S + 4S), giving a maximum 7S pack on a single channel. I also charged the 3S and 4S packs on separate channels.

Now, you might think a 5C charge would take 12 minutes (60/5) but the reality is that the start and end of the charge cycle have to

be performed at a lower current so it does actually take a bit longer. Still, from empty the 4200 mAh packs were practically fully charged in less than 20 minutes and it took a bit longer for the final amount to be slowly trickled in. If you are not after the absolute maximum capacity, terminating the charge at a slightly lower voltage will save some time.

To be on the safe side at these charge rates, I used temperature sensors on both packs but, despite the continuous 20 amp charge, neither one showed any increase in temperature, although my home-made charging-leads got warm! Using the combination of Emperor charger and 2 kW PSU for charging 5C cells, you get a taste of life in the fast lane!

Support

During the review I spoke to a number of people at Logic RC, from reception to tech support and, without exception, they were friendly, helpful, enthusiastic and knowledgeable. Importantly, the charger is firmware upgradeable and enhancements or fixes can be applied via the USB lead. I reported a very minor menu navigation issue to Logic RC and they had a firmware fix out to me in less than a week. Now, that's impressive!

Conclusion

The Emperor L712B Pro has a lot going for it: good ergonomics, a nice user interface, configurability, data logging and plenty of power. It is pretty much future-proof for most EP flyers. If you aren't ready for 5C charge packs yet, no problem. The Emperor is flexible enough to make the most of what you have now and will be ready when you are.

So, what will these power upgrades cost you? Well, surprisingly, the new Emperor is the same price as two years ago – still under £200. Given the rate at which everything else has gone up, I'd say that was a bit of a bargain. **Q&EFI**

Quiet & Electric Flight International

Specification

INFORMATION

Name: Fusion Emperor L712B Pro
Distributor: Logic RC, www.logicrc.com
Price: £199.99

OPTIONAL ACCESSORY

Name: Fusion Temperature Sensor
Distributor: Logic RC
Price UK: £4.99

CHARGER SPEC

Input source: 11-28 V DC
Charge power: 500 W per channel
Discharge power: 50 W per channel
Memories: 20 per channel
Battery types:
 LiPo, LiFe, Lilo, (1-7S)
 NiCad, NiMH (1-18 cells),
 Pb (1-12 cells)
PC Interface: Yes

TEST

DISLIKES
 None

LIKES

Configurability
 High output power
 Upgradable firmware
 Good customer support
 PC interface

Quiet & Electric Flight International Contacts

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