Loong LiPos.

I mentioned these batteries which originate from GiantCod RC last month and promised you some test results. I had already received some data from Wayne Giles which hinted that these were of better than average performance so I was keen to see if I could get similar results from my testing. This testing also gave me the opportunity to try out my latest piece of test bench equipment so I will describe this unit in a bit more detail to start with.

More Load.

I stated back in QEFI 69 (November 2007) that the escalation of manufacturers' continuous discharge rates for LiPo (30C and rising) has created a need to use much heavier discharge test loads. A 3000 mAh pack rated at 30C needs 90 amps to check the maximum discharge rate, and if the pack is a 4S then we are talking about 1.25 kilowatts. To be honest, I have some doubts about bench testing at such loadings, partly because of the safety aspects, but mainly because there can be very few modellers who are involved in using such packs at these discharge levels. The fact remains, however, that if I am to assess the viability of a manufacturer's published specification then I need to test at the maximum stated discharge.

The original load unit that Wayne Giles designed and made for me was set up to operate at a maximum of around 60 amps, and when we discussed my problem, Wayne came up with a rather sophisticated solution. He offered to make me an add-on unit which was based on the same principle as the original but which could be operated in two modes. Firstly it would be capable of use as a stand-alone unit with a capacity of 40 amps which would be very useful in its own right. Secondly it would be capable of attaching it in series to the existing load unit in a purely slave mode, and here it would lift the total load to a maximum of 100 amps. I have been using the unit for a few weeks now and, as with all of the equipment Wayne has built for me, it has been operating faultlessly. The first testing I have concluded using the new unit in its stand-alone mode was the Loong LiPo work I am covering this month and you will see that I have included some photos of the unit operating in both modes.

Testing.

These packs were purchased for use in my models and so I was not intending to test them in any way that might damage them. I simply wanted to see how they performed in use so the procedure was quite simple. The packs were cycled twice; first charging using the balanced mode of the Bantam BC6 charger and then discharging on the new load unit with the Medusa Power Analyser Plus as a data logger. The first cycle was at a low 5C load, the second at the rated maximum continuous load of 15 or 20C.

The packs I was testing were as follows :-

1. A 3S 1000 mAh pack rated at 15C continuous
2. A 3S 1600 mAh pack rated at 20C continuous
3. A 3S 2250 mAh pack rated at 15C continuous.

The testing results are shown in graphs 1, 2, and 3, and you will see that the voltage curves for the three packs are very consistent.

Analysis.

Interpretation of these test results is not, at first sight, easy. It is true that the packs have all achieved close to the specified capacity with 97% of the nominal rating at 5C (all 3 packs), 95% at 15C (both packs), and 93% at 20C (one pack). What is not so obvious is the indication given by the shape of the curves for the higher loadings. In many previous tests the voltage curve for discharge at high loading involves a significant initial drop (often approaching the 9-volt threshold for a 3S pack) followed by a degree of recovery as the packs begin to self-heat.

The interpretation of this feature is linked to internal resistance. The higher the internal resistance of the cells in the pack, the greater is the voltage drop, particularly under high loading. The higher resistance also creates more heat so that as the pack temperature rises, the resistance drops, and the pack voltage recovers. This is OK to a point, but we also know that higher temperatures cause more accumulative damage to the pack so that this kind of behaviour does not bode well for the cyclic life of this battery. The converse of this, which is true for the Loong packs, is that a low internal resistance of the cells in a pack allows the voltage to remain higher at high loads and minimises the temperature rise of the battery, and we believe that this helps to extend the cyclic life of the pack.

It is interesting that Wayne had also tested some Loong packs using his Battery Performance Meter (the Modelec 2000). There is a full description on this unit back in QEFI 50 (May 2006) but the unit uses a high current pulse to check batteries and determines their ESR (Equivalent Series Resistance) directly. His results for the Loong packs also showed relatively low resistance values (compared to certain other makes of cells), so my results appear to be consistent with his. At least we agree that these Loong batteries are amongst the best available, certainly in some respects.

The Multiplex LN6015EQU MultiCharger.

Multiplex are a major supplier of high class modelling equipment and their electric flight products are up with the best. They have a number of chargers in their range of products but this unit is the latest and most sophisticated in the range. The MPX description of the unit says it is a high-performance micro-processor controlled 12 volt digital automatic charger/discharger with integral Equaliser. The use of the term "Equaliser" may be a bit strange but effectively it is an internal balancer and the instructions switch back and forwards between the two terms in a random sort of way.

The Specification for this charger is as follows:-

1.	Supply voltage	11 – 15V
2.	Battery types and counts	LiPo, LiFe, LiIo, (1 to 6S)

		NiCd, NiMH, (1 to 15 cells)
		Pb (1 to 6 cells)
3.	Charge current	0.1 to 6 amps (70 W max.)
4.	Discharge current	0.1 to 1.0 amp (5 W max.)
5.	Equaliser/balancer	up to 6S LiXX
6.	Integral screen	LCD 2 lines x 16 characters.
7.	Dimensions	140 x 80 x 30 mm.
8.	Weight	285 gms.
9.	Case	Brushed aluminium.
10.	Controls	4 x press buttons.

You will see that the charger does not have an interface to allow the operation to be displayed and recorded on a PC and for this reason I would classify it as an intermediate unit (rather like the Thunder Power TP610C from a couple of months back) but this is not a criticism of the unit as I know that a lot of flyers prefer a straightforward and reliable approach to their flying. This unit is actually quite versatile and there is every facility to ensure that your batteries are charged, discharged, or cycled, in a safe and predictable way which will extend their working lives as far as any other charger. Added to this is the complexity principle, the more complex a unit, the more there is to go wrong.

The operating instructions are supplied as a multi-language booklet with 24 pages of clear, logical information in English, and this covers all aspects of the use of this unit. It is really not difficult to use and the very clear back-lit screen has an attractive blue tint with all of the software read-outs in English, as are the labels on the unit itself. There are only two areas where care has to be taken during the early learning stages of using the MultiCharger. The first is in terms of the equaliser/balancer connections on the right edge of the case, and the problem here is to ensure that the balancing cables on your packs are compatible with these sockets. Multiplex, Flight Power and Thunder Power packs are connected directly but there are adaptor sets available for other types.

I found the charger to be very user friendly. I have operated a lot of chargers over the last few years and I would not make that statement about all of them. The charger is connected to a 12 volt battery by the crocodile clips provided, or to a suitable bench power supply, and the screen lights up. The unit normally reverts to the last mode used but it is easy to switch to different modes if you are trying to charge a different type of battery. The parameters for the chosen process are simply scrolled in turn and adjusted up or down as required. Once these are established the start button is held down for a few seconds which commences the process. In the case of Lithium packs there is some preliminary interrogation to confirm details of cell counts, balancing etc. but then charge/discharge continues automatically.

Details of the main parameters such as voltage, current, capacity etc. are displayed on the screen throughout. As ever with lithium packs, the recommendation is that the process should never be unattended. This charger also has a facility to balance packs without the pack being charged which can be useful if you are in the habit of fully charging a set of flight packs some time before you set off to fly. There is always a possibility that individual cells may drift out of balance between charging and flying and it is quick and easy to re- balance them at the field immediately before flying.

As you would expect from an organisation like Multiplex, this is a well-made and reliable unit with a wide range of facilities. It is clear to use and to understand, and it should give years of useful operation.

Contacts.

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Photographs.

QEFI76-1 **The new Load Unit in its stand-alone mode.**

QEFI76-2 **The two Load Units combined to give up to 100 amps.**

QEFI76-3 **The three Loong LiPo packs tested.**

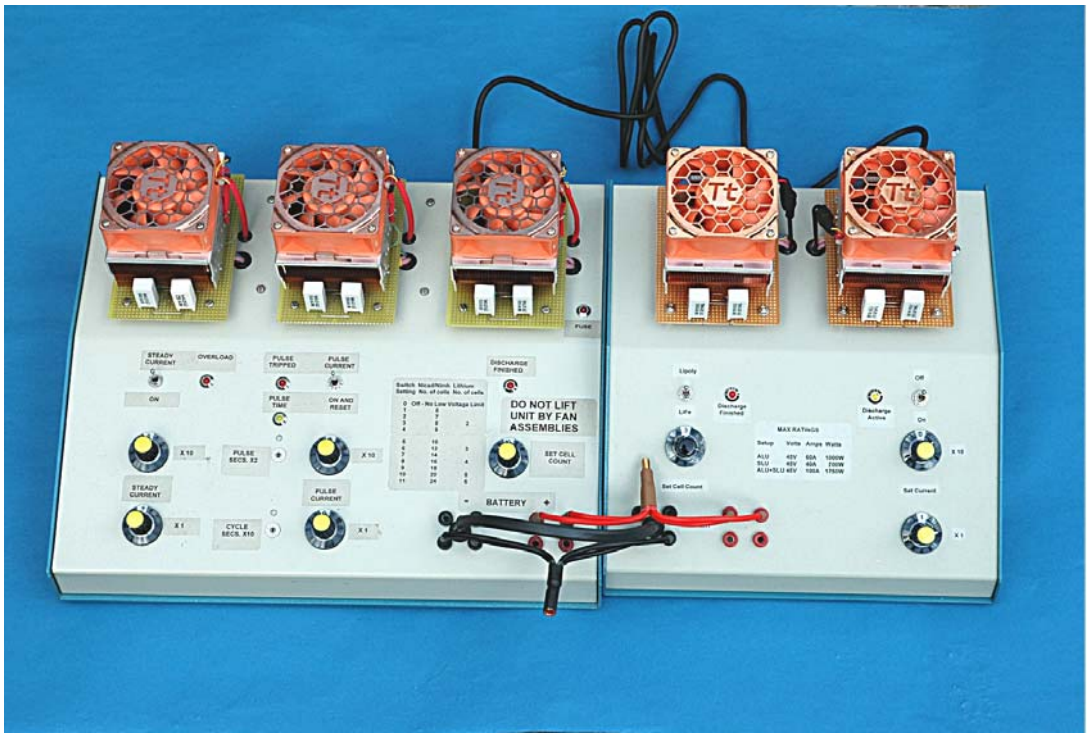
QEFI76-4 **The Multiplex LN6015EQU MultiCharger.**

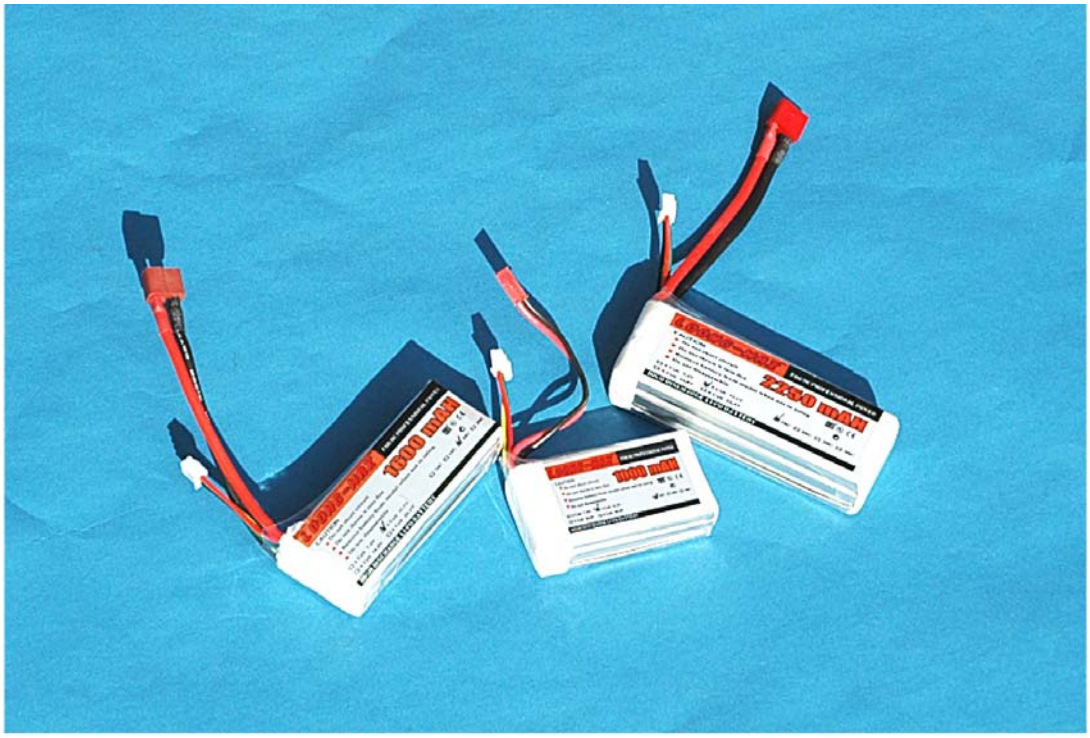
QEFI76-5 **The face of the MPX charger showing screen and control buttons.**

QEFI76-6 **The cable and connectors for either 12 volt battery or bench power supply.**

QEFI76-7 **The equalising (balancing) connectors on the end of the case.**

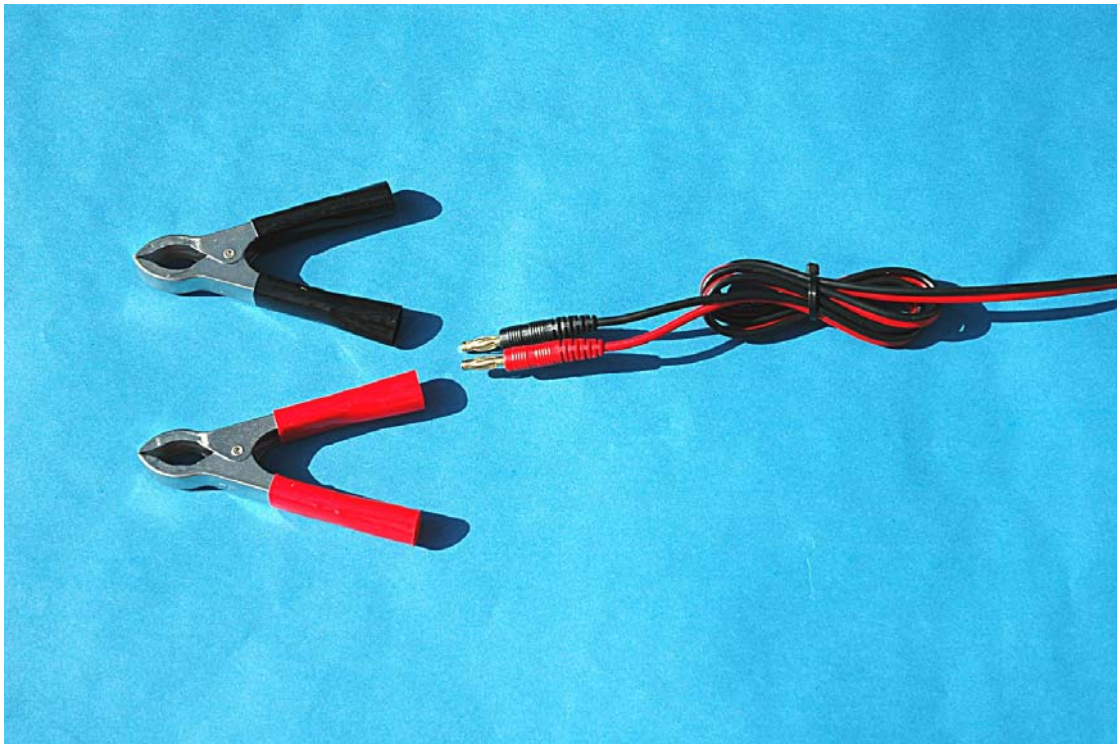
QEFI76-8 **The LCD screen backlit in attractive blue.**

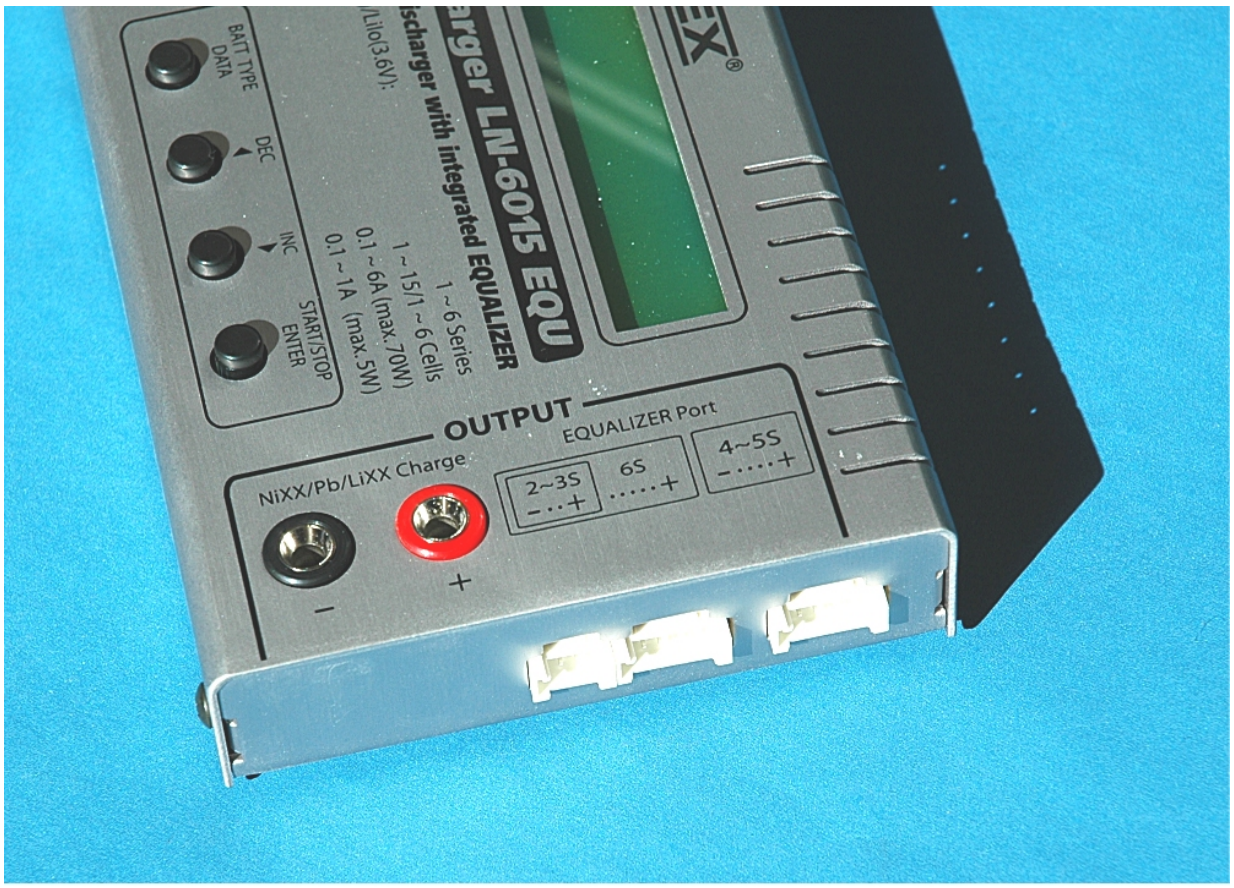



1000 mAh
1000 mAh
2250 mAh


MULTIPLEX
Backlit
Data
Display
MULTIcharger LN-6015 EQU
Digital Charger/Discharger with integrated EQUALIZER
INPUT
DC11~15V
OUTPUT
BATT TYPE
DATA
DEC
INC
START/STOP
ENTER

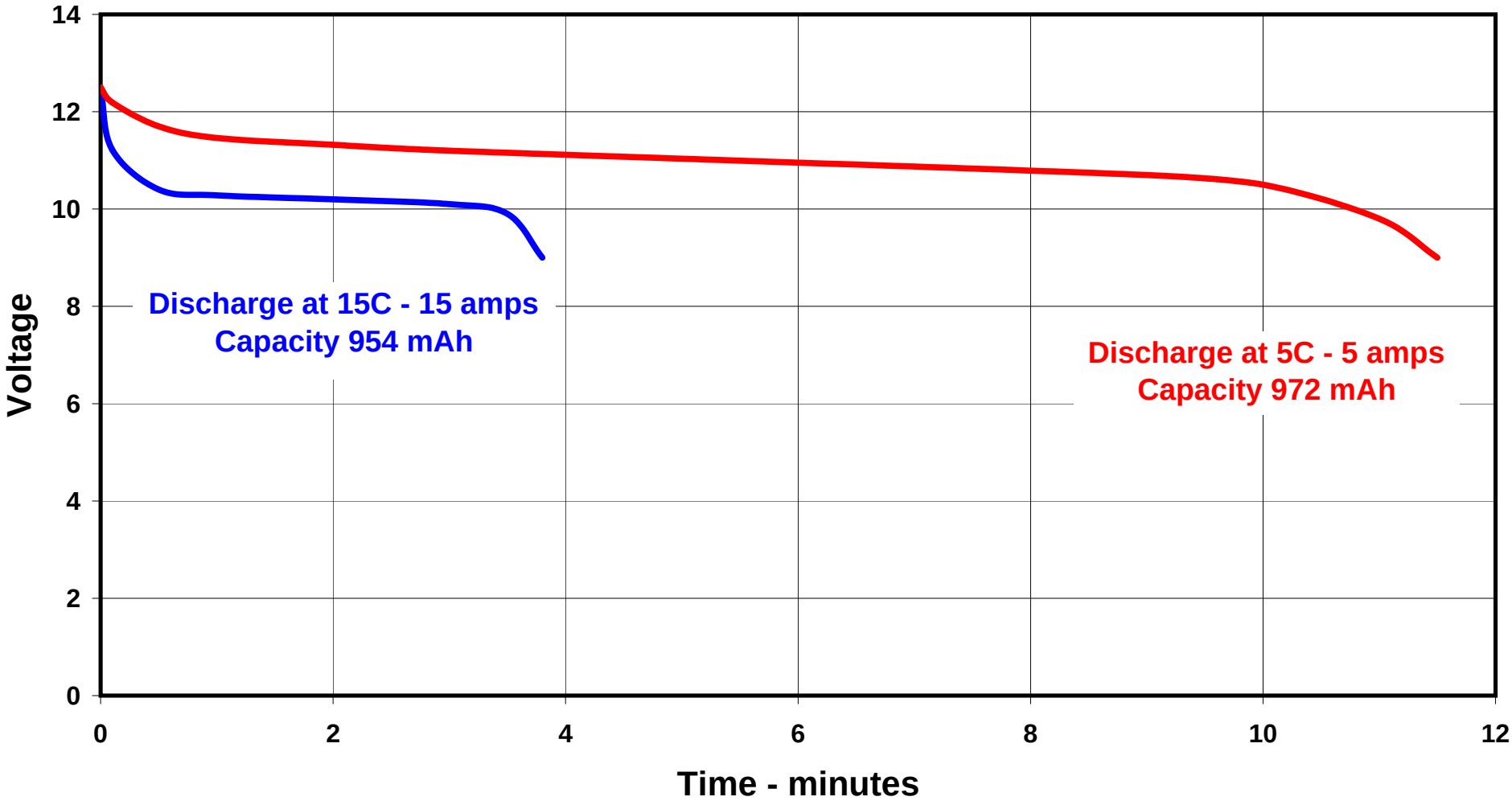

MULTIPLEX®
INPUT
DC11~15V
Backlit
Data
Display
MULTIcharger LN-6015 EQU
Digital Charger/Discharger with integrated EQUALIZER
LiPo(3.7V)/LiFe(3.3V)/Lilo(3.6V): 1 ~ 6 Series
NiXX/Pb: 1 ~ 15/1 ~ 6 Cells
Charging Rate: 0.1 ~ 6A (max.70W)
Discharging Rate: 0.1 ~ 1A (max.5W)
BATT TYPE DATA
DEC
INC
START/STOP ENTER
92532
OUTPUT
EQUALIZER Port
2~3S
6S
4~5S
NiXX/Pb/LiXX Charge
+
-



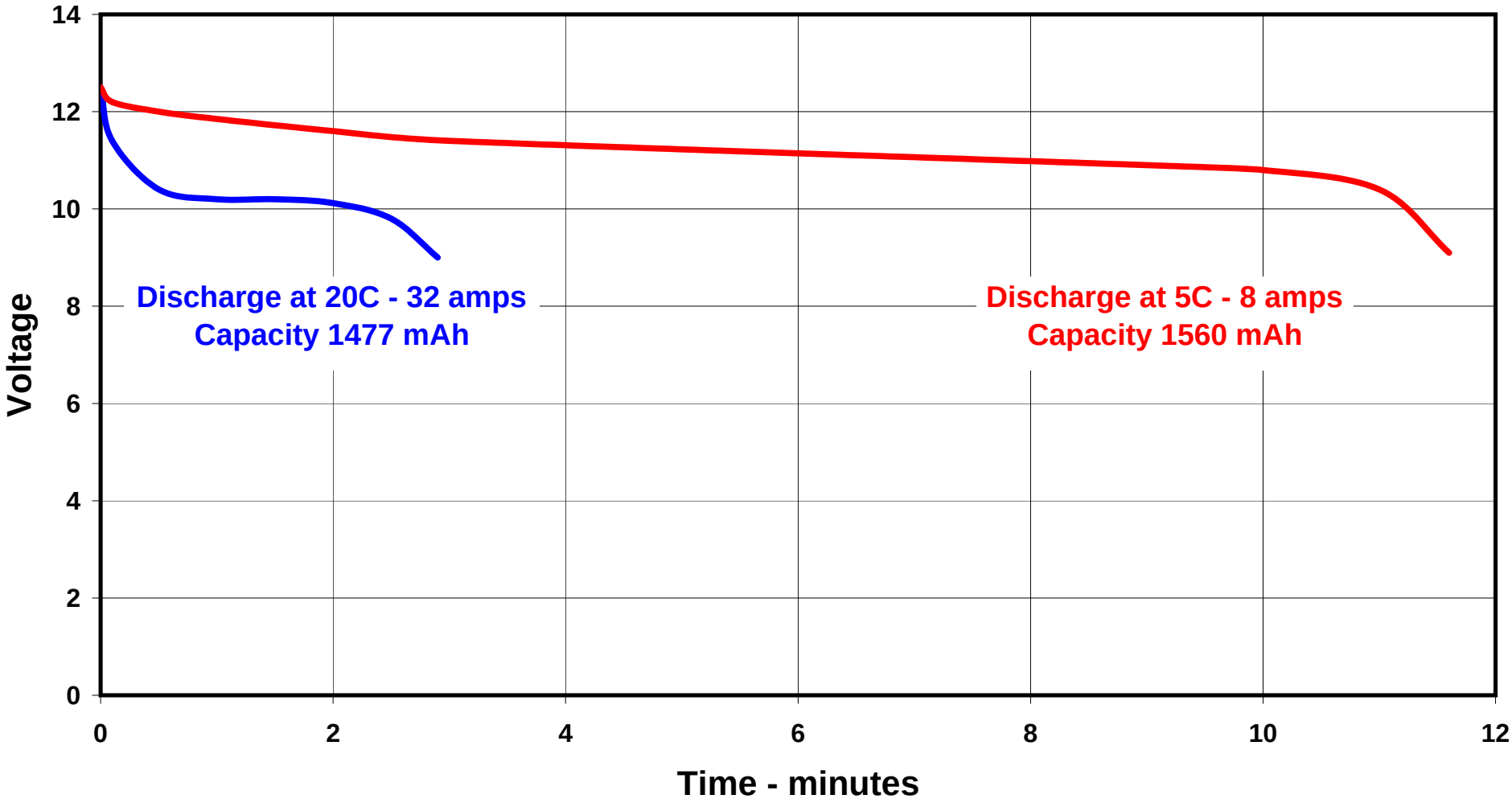

BATT TYPE DATA
DEC
INC
START/STOP ENTER
Charger LN-6015 EQU
Discharger with integrated EQUALIZER
LiPo(3.7V)/LiFe(3.3V)/Lilo(3.6V):
1 ~ 6 Series
NiXX/Pb:
1 ~ 15/1 ~ 6 Cells
Charging Rate:
0.1 ~ 6A (max.70W)
Discharging Rate:
0.1 ~ 1A (max.5W)
OUTPUT
EQUALIZER Port
NiXX/Pb/LiXX Charge
2~3S
6S
4~5S
-
+


MULTIPLEX
INPUT DC11~15V
Backlit Data Display
LiPo CHARGE
C=2250mAh 11.1Vp
MULTIcharger LN-6015 EQU
Digital Charger/Discharger with integrated EQUALIZER
LiPo(3.7V)/LiFe(3.3V)/Lilo(3.6V): 1 ~ 6 Series
NiXX/Pb: 1 ~ 15/1 ~ 6 Cells
Charging Rate: 0.1 ~ 6A (max.70W)
Discharging Rate: 0.1 ~ 1A (max.5W)
BATT TYPE DATA
DEC
INC
START/STOP ENTER
OUTPUT
EQUALIZER Port
NiXX/Pb/LiXX Charge
2~3S
6S
4~5S
#92532

Graph 1 - Discharge of Loong 3S 1000 mAh pack.



Graph 2 - Discharge of Loong 3S 1600 mAh pack.



Graph 3 - Discharge of Loong 3S 2250 mAh pack.