Built-in controllers.

This is a follow-up to last month's reference to brushless motors with built-in controllers. You may remember that I mentioned two of these from different manufacturers which had reached the UK market at the same time, and I have now had the chance to run some tests on both of them.

Dualsky XM 2812 RTR-33.

This motor is the smallest in the Dualsky XM range of brushless outrunner motors intended for shock/park/indoor flyers and this 33-turn unit has the following specification.

Max Power (15 secs)	Current at Max Eff.	Kv Rpm/volt	Weight	Length	Diam.	Shaft
70 watts	5 amps	1470	28 gm	28 mm	28 mm	3 mm

The motor in the photos was obtained from Al's Hobbies who are the main UK agent for the Dualsky range of products and it is a combination of the standard XM 2812-33 motor and the XC0610 ESC built on to a circular circuit board. Although a tiny unit, this controller is to a high specification and is fully programmable for brake, battery type, timing, low voltage protection/threshold, start-up, etc. It is also a BEC controller with a maximum supply to servos of 1 amp. The whole unit is a very neat package and is obviously designed as a simple fixture which can be bolted with 2/3S LiPo battery to the front of any suitable lightweight model to give a ready-to-fly set-up.

It is intended for suitable props in the 6 to 8 inch range (such as the GWS props I used) and has the now fairly typical O-ring flexible prop-mount. The one clear indicator of the built-in controller is the supply lead, which is a twin lead with suitable plug to allow the battery to be fitted directly, but note that there is no facility for reversing the motor's direction of rotation with this arrangement (you cannot access the three controller-to-motor cables to reverse a pair of connections). The converse of this is, however, that the motor cannot be accidentally set up to run in reverse.

Running the motor involved a simple bench test using GWS 8" x 4" and 7" x 6" propellers with a 2S LiPo and plotting static thrust against power input in watts. I used a servo driver to avoid any RF problems (as I normally do) and the motor performed perfectly throughout. The results in the curves are fairly typical but I also produced the propeller calibration charts so that anyone with an optical rev counter can check the figures against their own units if they wish.

Cyclon Plug and Fly 40.

This is the second of the two motors I referred to last month, and as you will see from the photos, it is a very different size of animal. Cyclon motors (and Twister from the same stable) have been around for a few years now and originate from France. They have always been very innovative with a range of motors covering specific design requirements somewhat out of the mainstream. The three motors in the range are the 30, 40, and 50 (nominally 300, 400, and 500 watts) and I borrowed a Plug and Fly 40 from BRC Hobbies to run my tests on. This motor has the specification in the following table.

Nominal Power	Max Power (30 secs)	Max Current	Kv rpm/volt	Weight	Length	Diam.	Shaft
500 watts	550 watts	40 amp	1000	220 gm	55 mm	44 mm	5 mm

There are several quite interesting aspects of the way these motors have been designed and it is clear that they are intended to be as close to a simple bolt-on replacement for an IC motor as the designer could achieve. In the case of the motor I have tested, the intention is that one could take the IC motor and tank out of a model flying with a 40 sized IC motor and replace them with the Cyclon 40 P&F and a suitable LiPo battery, resulting in comparable (but clean and quiet) flying. There are several features of the system which help this intention, but the side effect is that the motor/controller is somewhat more restricted that you might expect compared to an alternative electrical package with separate ESC. As an example, there is the limitation to 4S LiPos, 3S and 5S will not operate the motor.

Although the English Language translation of the instructions is somewhat confusing in places, it does contain the information you need to set up the motor correctly. The controller is not programmable, but it has been designed (or maybe pre-programmed) to make the operation of the unit as safe from mis-application as possible. As I have mentioned, you cannot operate the motor with the wrong size of pack (the controller will not switch on if anything other that a 4S LiPo is connected), there is a temperature sensor built into the unit which protects both motor and controller from overheating, and the unit also has a throttle ramp to indicate and protect against both power battery and Rx battery (the controller is not BEC) voltage drop/capacity limit. There is finally a throttle failsafe for loss of RF signal.

There are also firm suggestions as to the size (and make!) of propeller to be fitted, and to the somewhat unusual (but fairly logical) start-up process. The controller is designed to reproduce the transmitter throttle stick movements that you might set-up with an IC motor. The transmitter is switched on first with the throttle stick and the throttle trim in their lowest positions. Switching on the receiver and connecting the drive battery produces a series of audio tones which indicate that the power and signal are OK. The throttle trim is then advanced which produces a second set of tones, the propeller rotates 90 degrees back and forward, and the motor begins to run normally but at low revs. Advancing the throttle stick then gives normal increasing revs up to full throttle and, in the air, the throttle can be operated anywhere between full and idle as with an IC motor. The motor can be stopped completely by reducing the throttle trim to minimum. This is a fairly complex arrangement but you can see the intention behind it. Again the motor will only run in the correct direction and cannot be reversed (intentionally or accidentally).

Testing the motor followed an identical pattern to the Dualsky tests (though at significantly higher outputs) and the graphs are self-explanatory. Again the motor performed faultlessly.

Power in/out and LiPo capacity.

The tests involving these two motors led me incidentally to a feature of LiPo batteries which is, perhaps, not immediately obvious. The restrictions on the size of the packs recommended for the motors (2S for the Dualsky, and 4S for the Cyclon) led me to check on what I had available. Most of my packs are now 3S and I was forced to use a 3600 mAh 2S pack on the Dualsky (greatly oversized compared to what you would use in a model) and a 2100 mAh 4S pack on the Cyclon (compared to the recommended minimum of 3000 mAh for this motor.

My initial thoughts were that the voltage of these packs would be OK and that the capacity (C value) was only relevant to flight times and to maximum currents at the pack rating (e.g. 15C). Inspection of the test results, however, revealed a slightly more subtle relationship. The problem arises from voltage drop under load. We know that the voltage of the LiPo cell decreases as the load increases, a typical figure might be 15% at 20C, but if C changes then the voltage drop changes. If a particular power train pulls 30 amps from a 2000 mAh 3S LiPo (15C) the voltage might drop from the initial 12.6 to 11 volts. If you switch to a 4000 mAh pack, the voltage will drop less, say to 11.6 volts, which will give a slight increase in current, say 32 amps, but a significant overall increase in power, 330 to 370 watts. You will also get up to twice the flight time and the battery will last longer as it is at a lower loading (15C down to 8C), but at the cost of doubling the battery weight.

In terms of the test results above, the following factors should be considered when looking at the numerical values in the graphs. For the Dualsky motor, the much larger that typical battery allowed the voltage and power input values to be higher than would typically be the case, and the motor performance may be slightly optimistic. With the Cyclon the reverse is true, the battery is quite a bit smaller than the recommended size so that voltage and power values are lower than they might typically be, and the performance data is probably slightly pessimistic.

Contacts.

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Tel: 0208 500 8884 website **www.alshobbies.com**

BRC Hobbies, P O Box 226, Whickham, Newcastle upon Tyne, NE16 4WU Tel: 0191 4887879,
website - **www.brchobbies.com**

Photographs.

QEFI71-1 The Little and Large Show.

QEFI71-2 Only two wires, I thought this was brushless?

QEFI71-3 The Dualsky XM2812RTR-33.

QEFI71-4 Rear view of Dualsky showing controller circuit board.

QEFI71-5 Dualsky fitted with GWS prop.

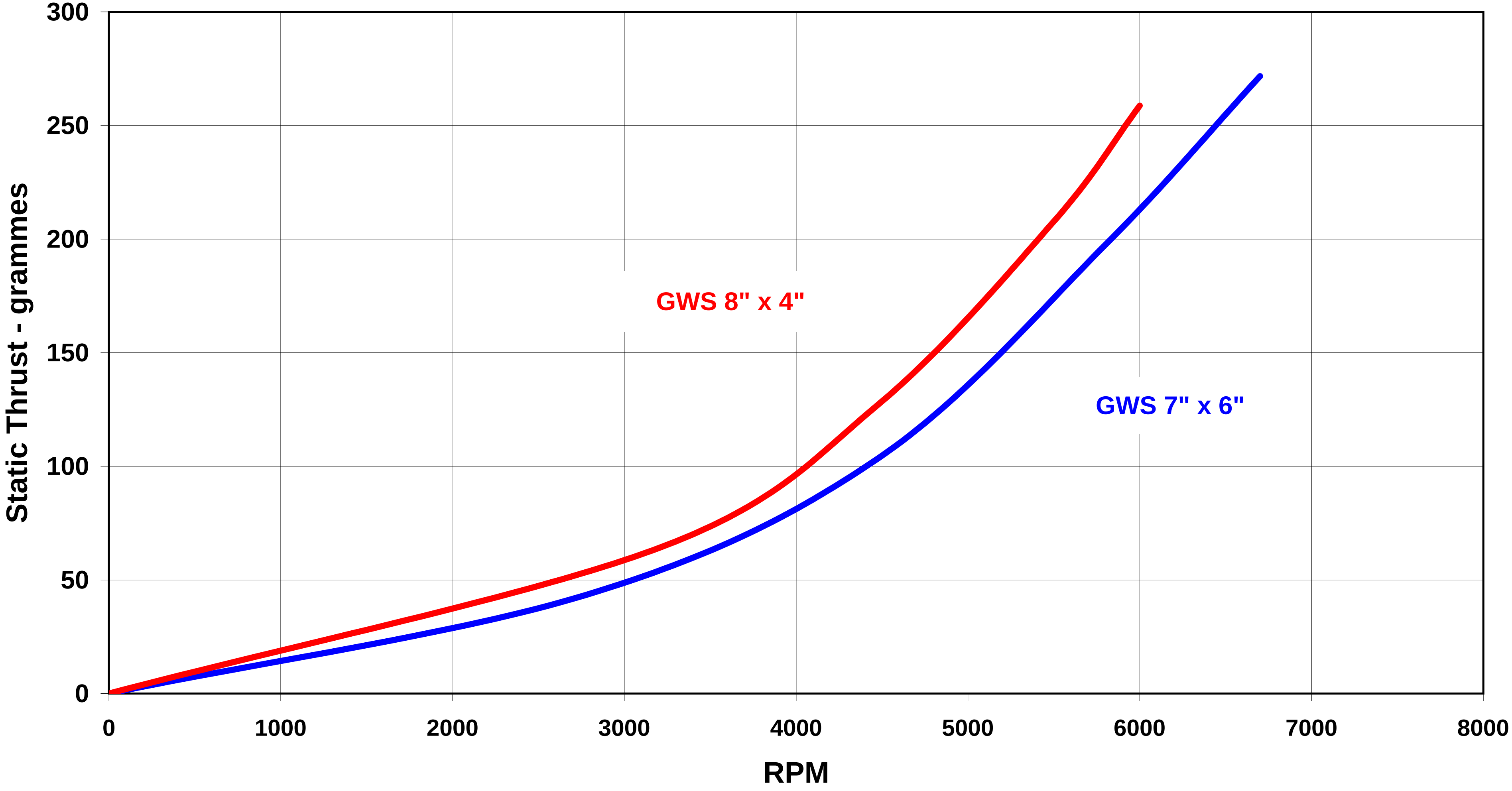
QEFI71-6 The Cyclon Plug and Fly 40.

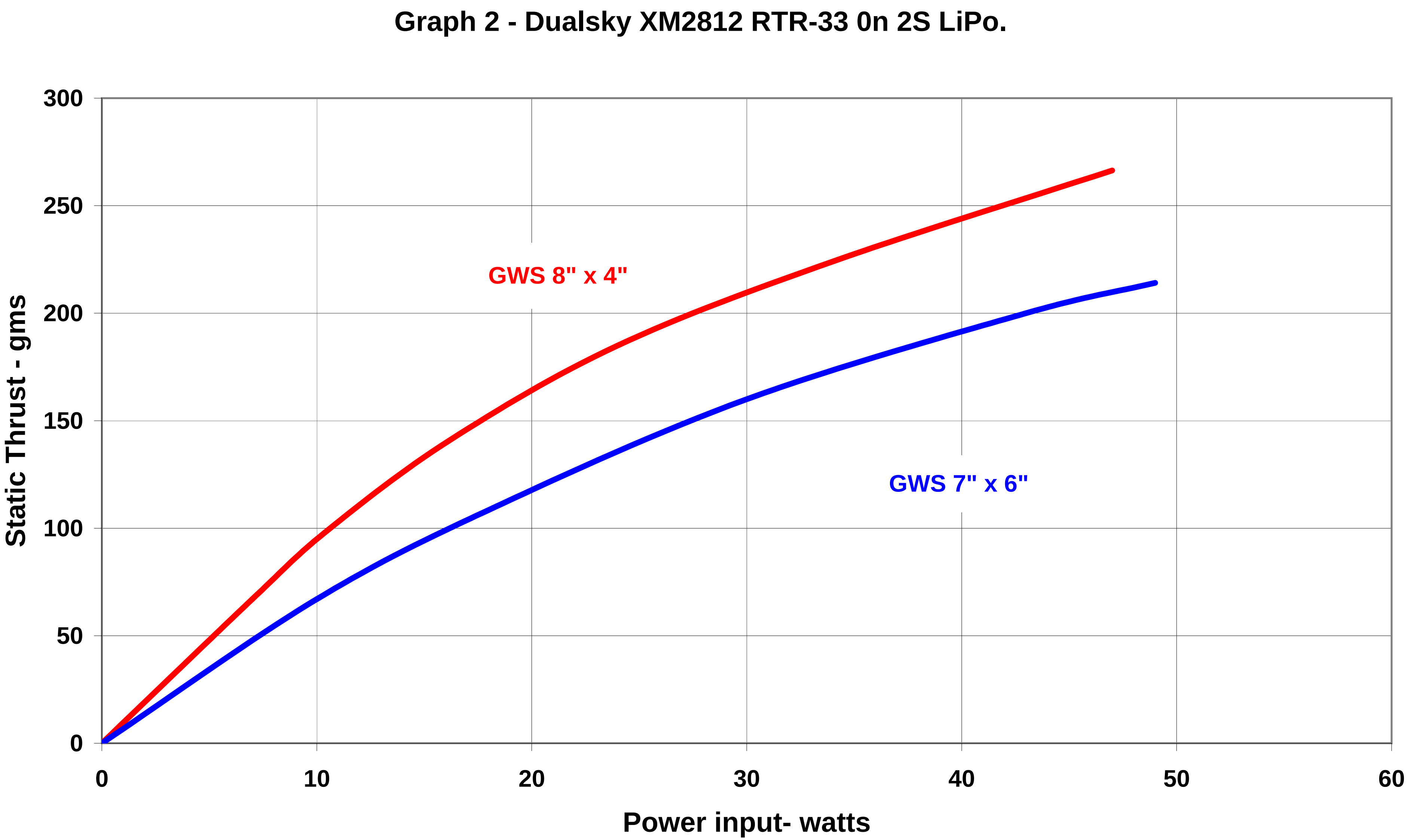
QEFI71-7 Side view of the Cyclon motor.

QEFI71-8 Cyclon fitted with 10” x 6” Master wooden electric Prop.

QEFI71-9 Rear cover of Cyclon removed to show controller circuitry.

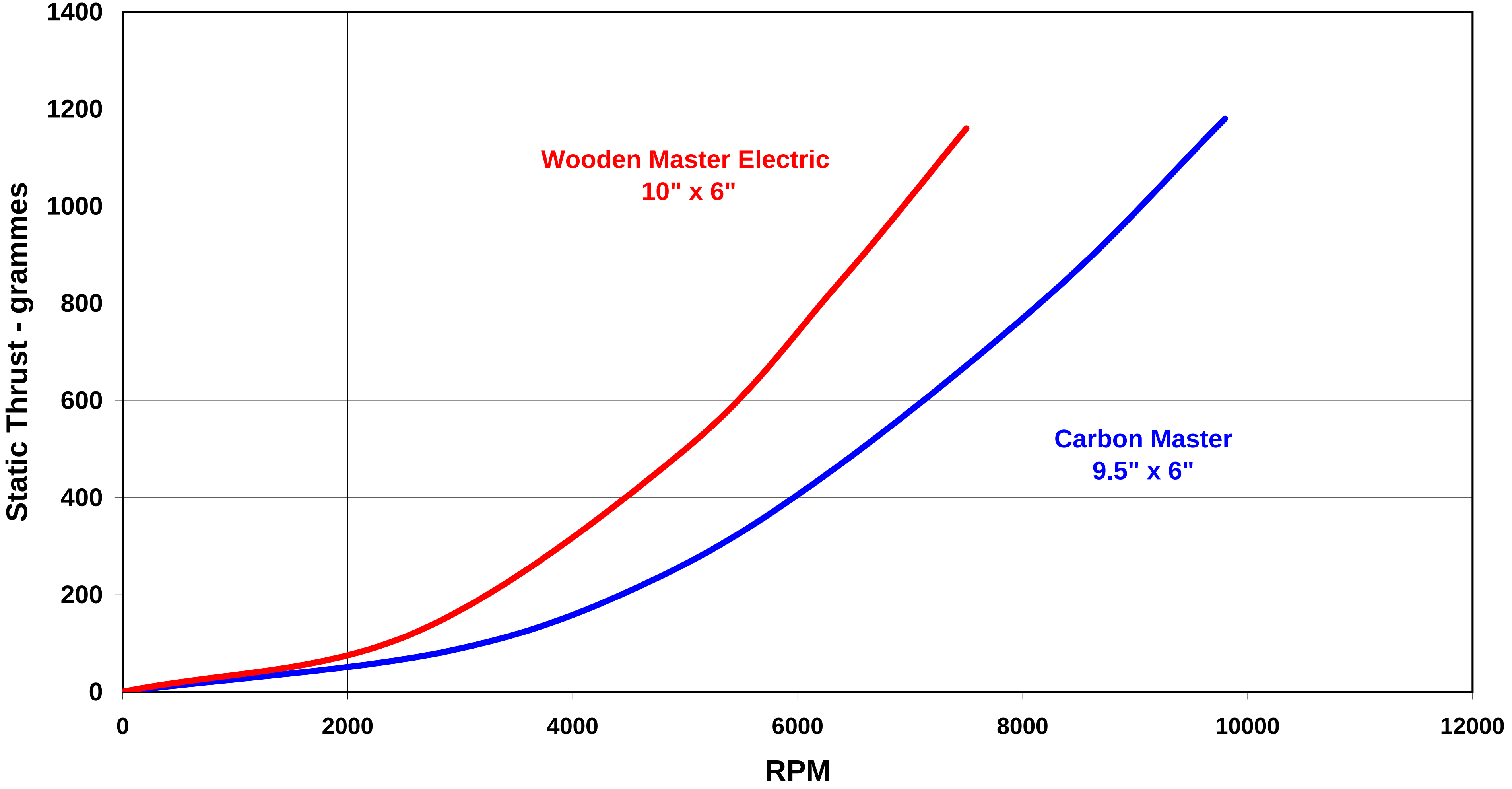
Graph 1 - Propeller Calibration - GWS props.

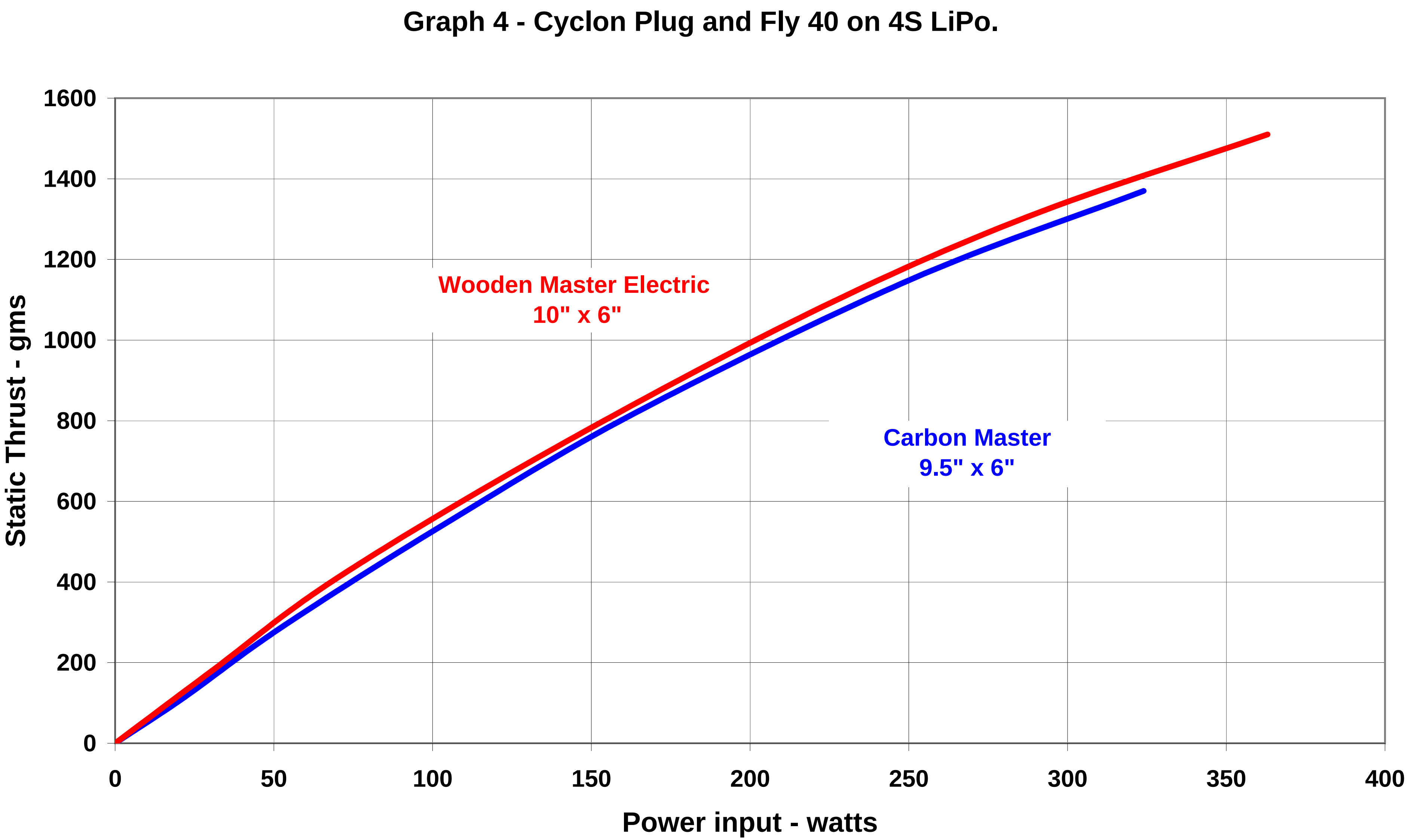


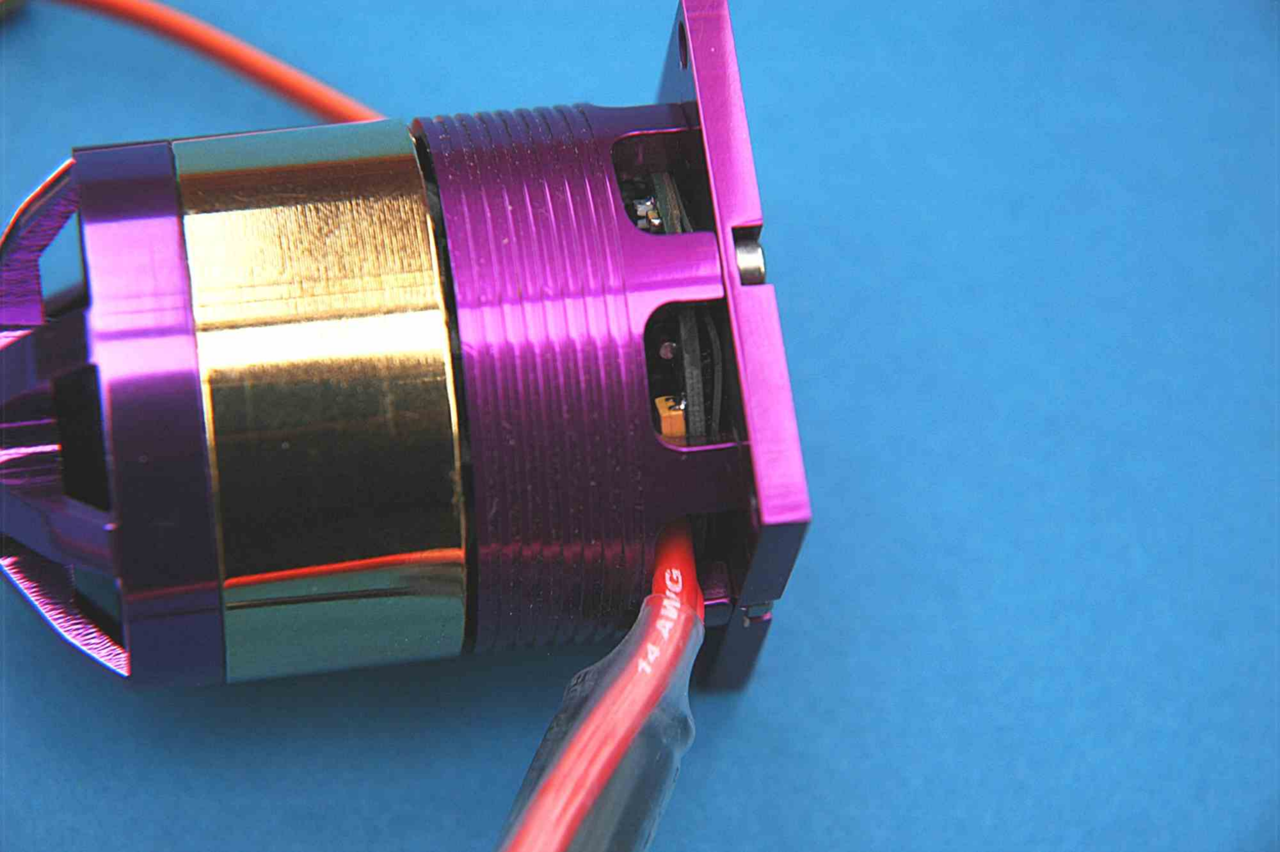


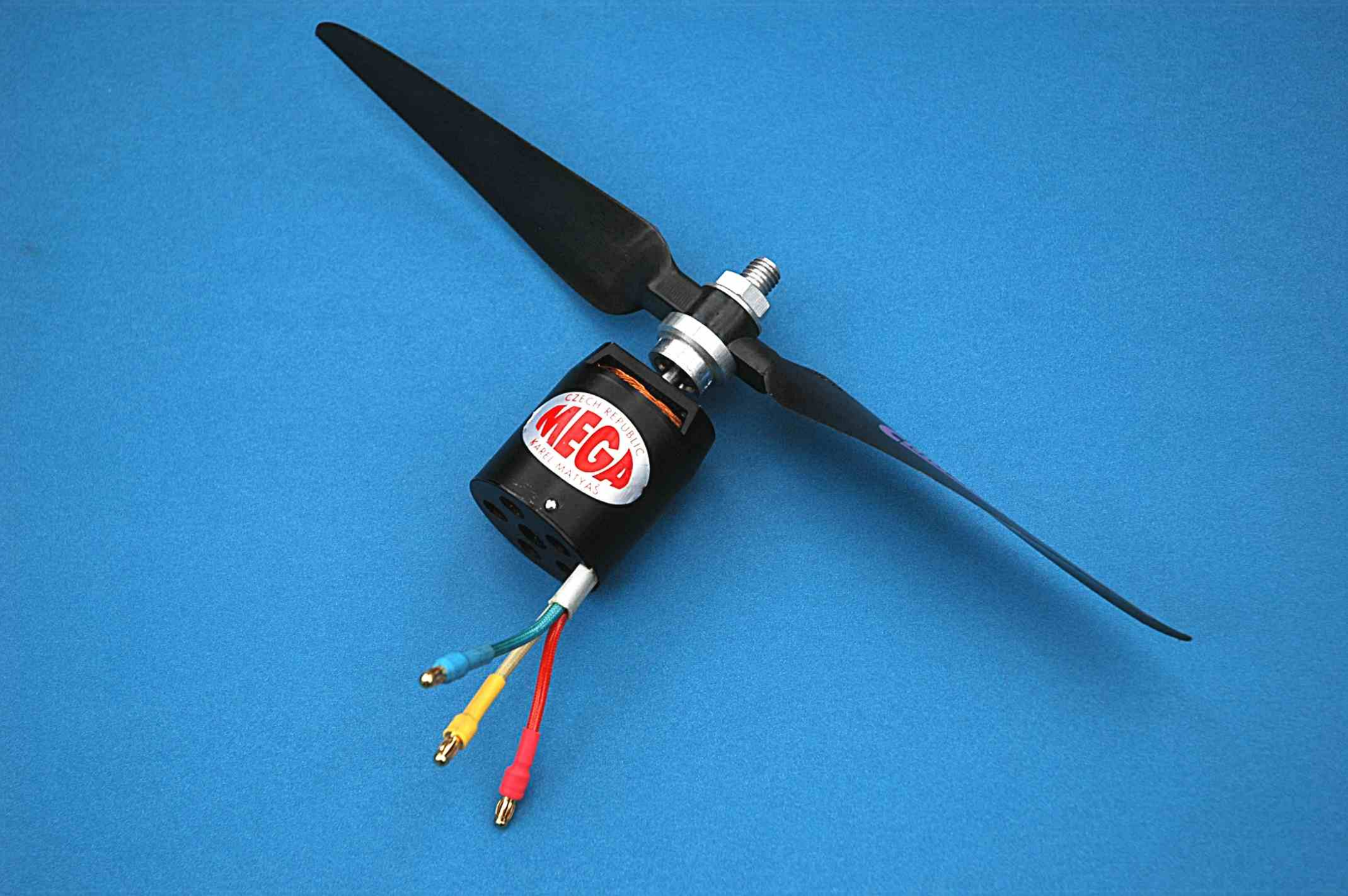
Graph 2 - Dualsky XM2812 RTR-33 0n 2S LiPo.
GWS 8" x 4"
GWS 7" x 6"
Static Thrust - gms
Power input- watts
0
50
100
150
200
250
300
0
10
20
30
40
50
60

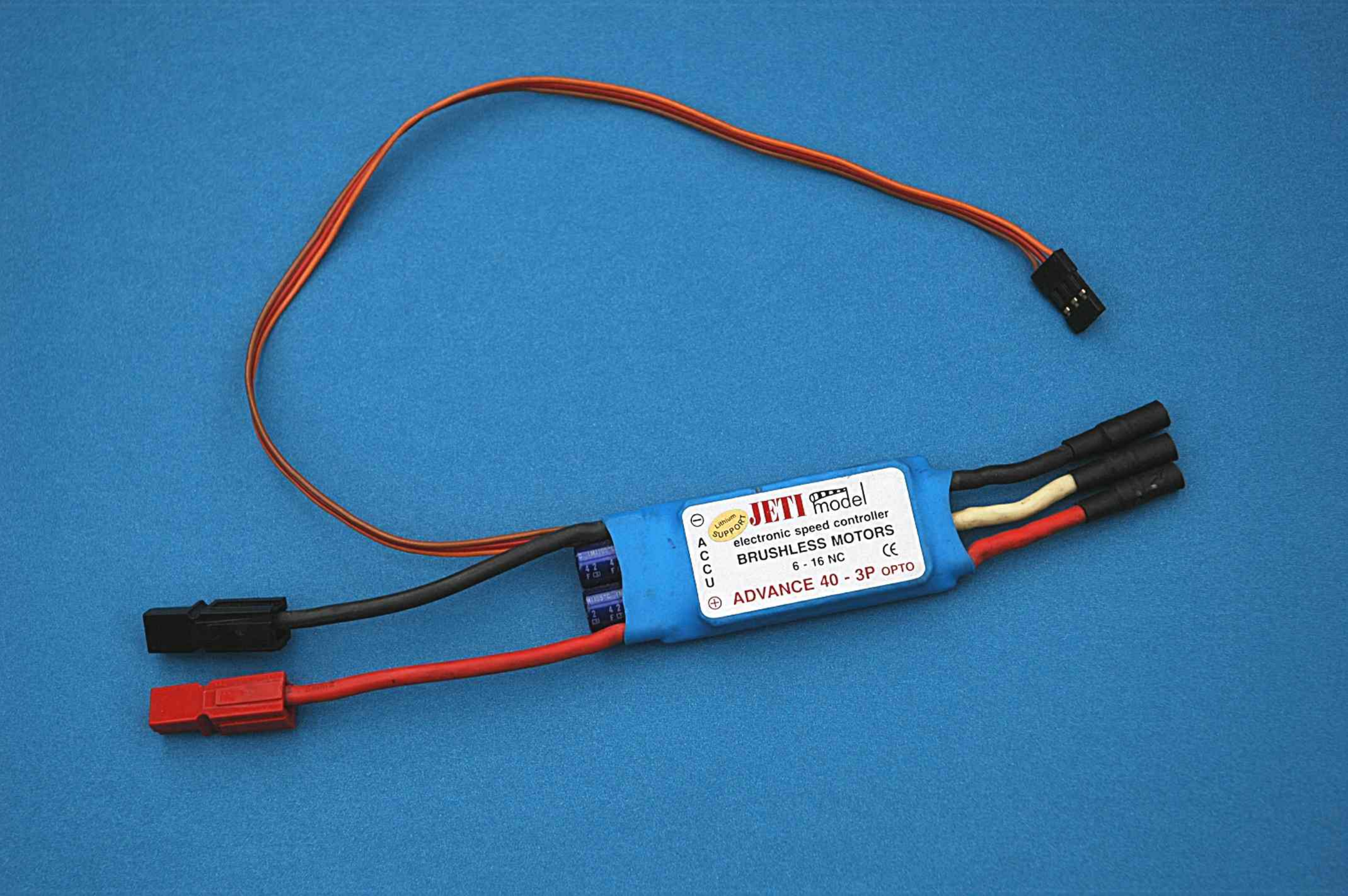
Graph 3 - Propeller Calibration - Master props.

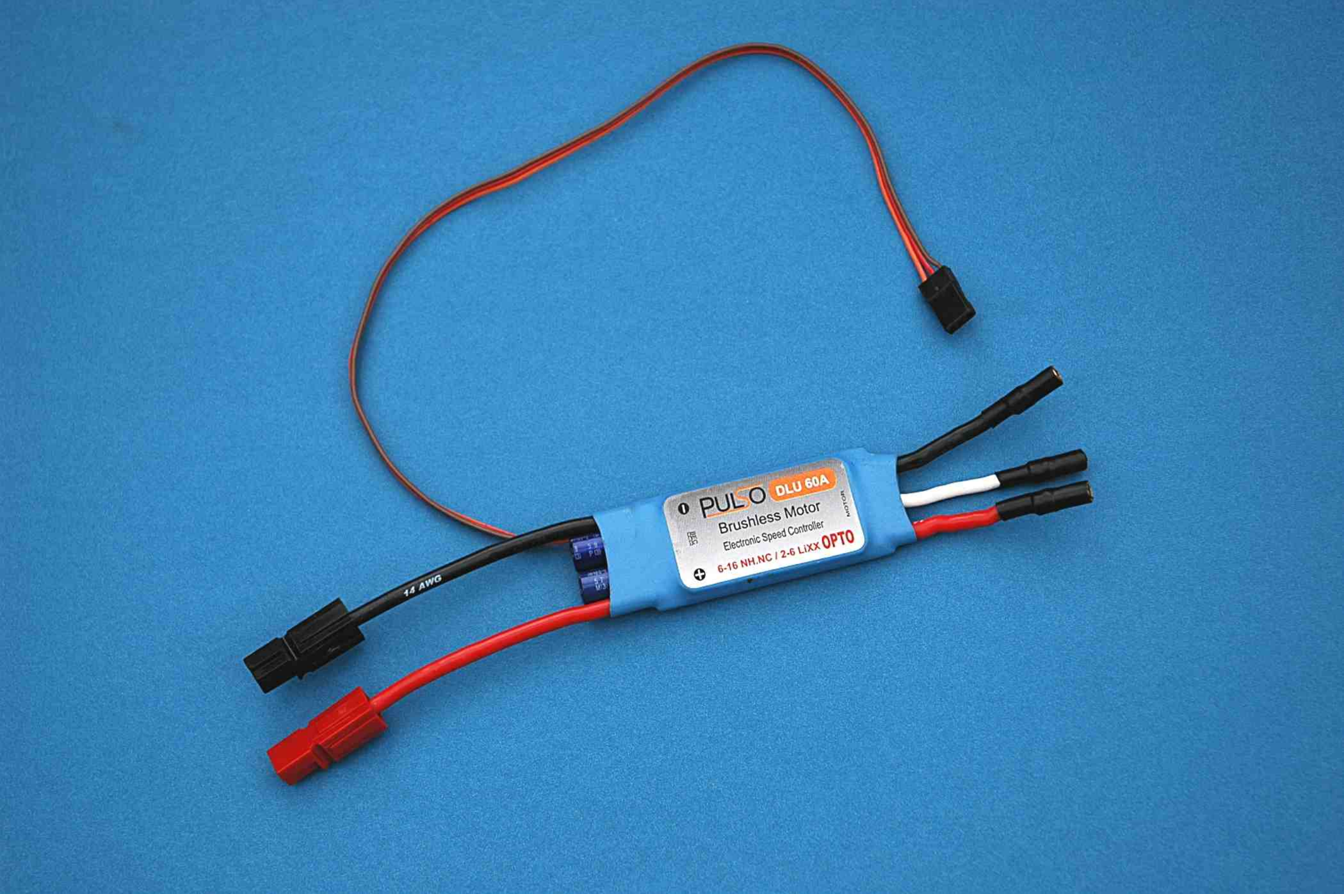


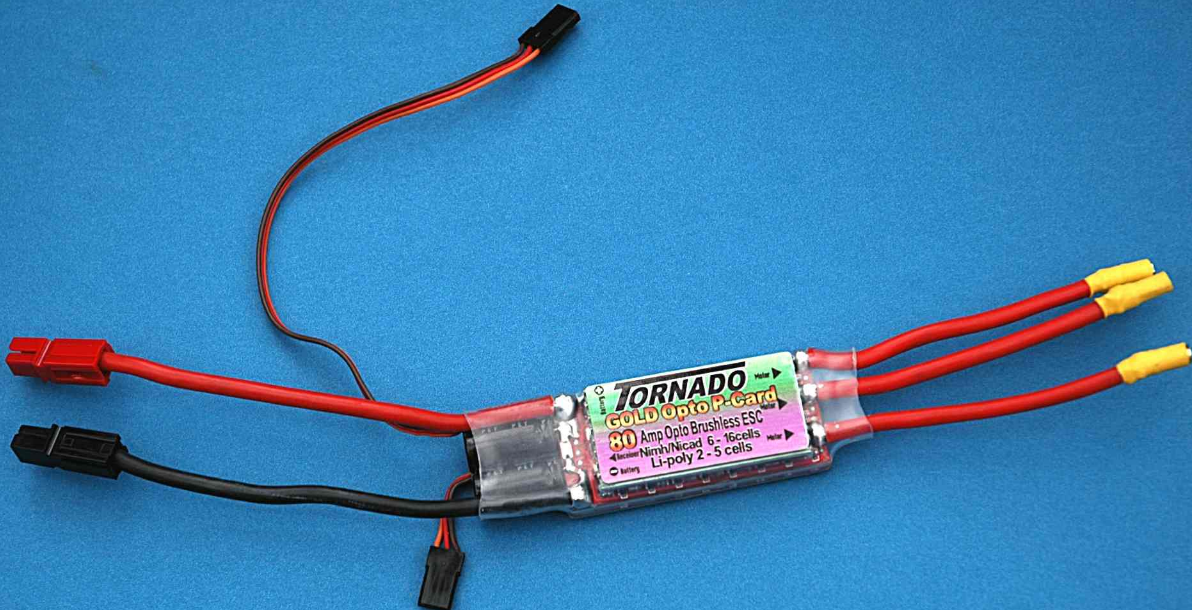

Graph 4 - Cyclon Plug and Fly 40 on 4S LiPo.
Static Thrust - gms
1600
1400
1200
1000
800
600
400
200
0
0
50
100
150
200
250
300
350
400
Power input - watts
Wooden Master Electric
10" x 6"
Carbon Master
9.5" x 6"

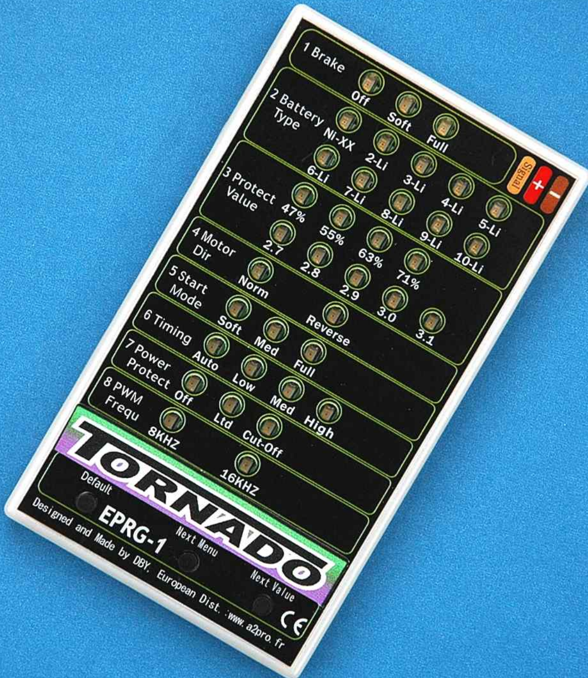

14 AWG

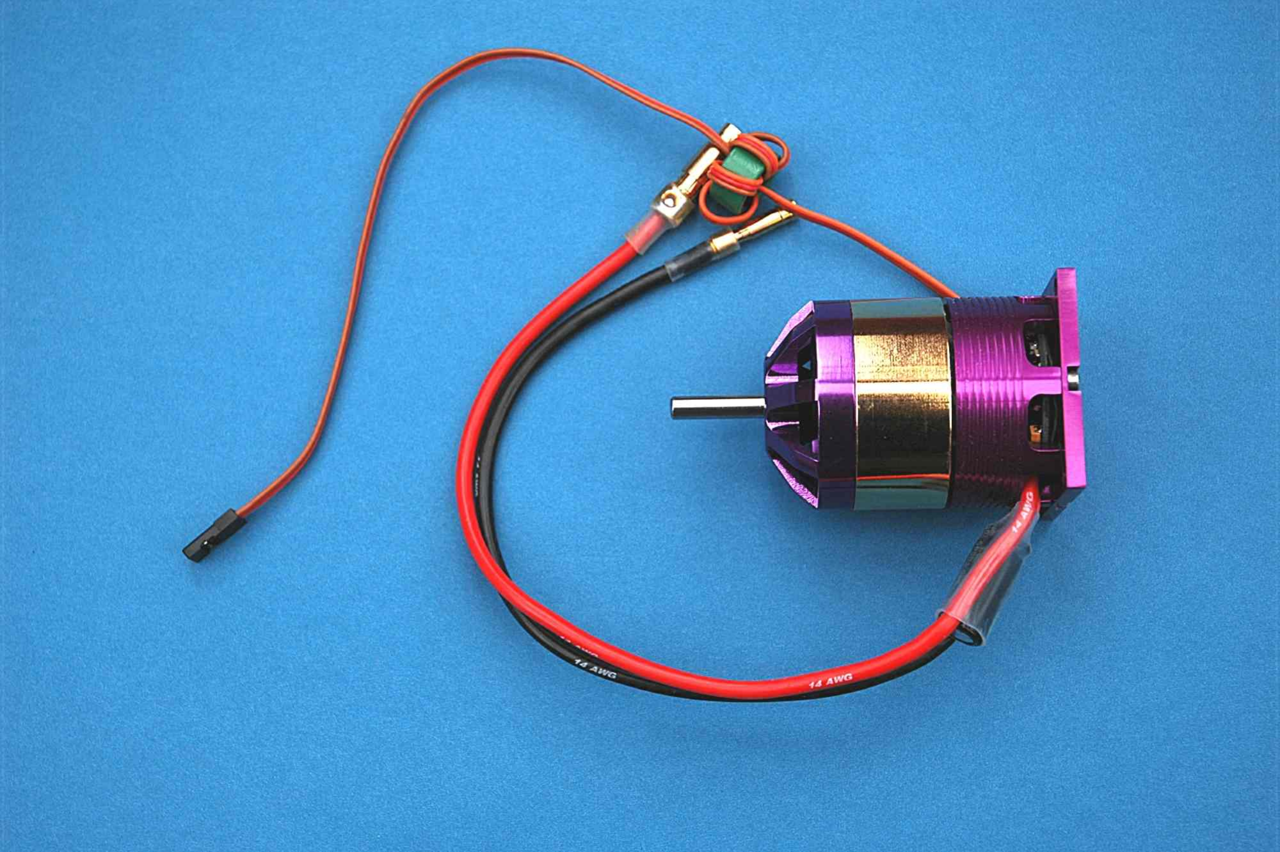

CZECH REPUBLIC
MEGA
KAREL MATYÁŠ


JETI model
Lithium SUPPORT
electronic speed controller
BRUSHLESS MOTORS
6 - 16 NC
CE
ACCU
ADVANCE 40 - 3P OPTO


PULSO DLU 60A
Brushless Motor
Electronic Speed Controller
6-16 NH.NC / 2-6 LiXX OPTO
MOTOR
14 AWG


TORNADO
GOLD Opto P-Card
80 Amp Opto Brushless ESC
Nimh/Nicad 6 - 16cells
Li-poly 2 - 5 cells
Battery
Receiver
Battery


1 Brake
Off
Soft
Full
2 Battery Type
Ni-XX
2-Li
3-Li
4-Li
5-Li
6-Li
7-Li
8-Li
9-Li
10-Li
3 Protect Value
47%
55%
63%
71%
2.7
2.8
2.9
3.0
3.1
4 Motor Dir
Norm
Reverse
5 Start Mode
Soft
Med
Full
6 Timing
Auto
Low
Med
High
7 Power Protect
Off
Ltd
Cut-Off
8 PWM Frequ
8KHZ
16KHZ
Signal
+
−
TORNADO
Default
EPRG-1
Next Menu
Next Value
Designed and Made by DBY, European Dist.:www.a2pro.fr
CE


14 AWG
14 AWG
14 AWG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