Brian Duggan

dynamic!

Robitronic Pro-Master

Those nice people at CML Distribution brought in one of the very latest high-tech motor dynos made by Robitronic of Austria, and PeterE, nice man that he is, allowed me to check it out.

What is the Pro-Master?

It's a professional quality motor testing device combined with a high quality battery charging unit. This impressive piece of kit is built to industrial standards and the quality is immediately apparent as soon as you open the sturdy plastic carrying case.

What will it do?

Dyno

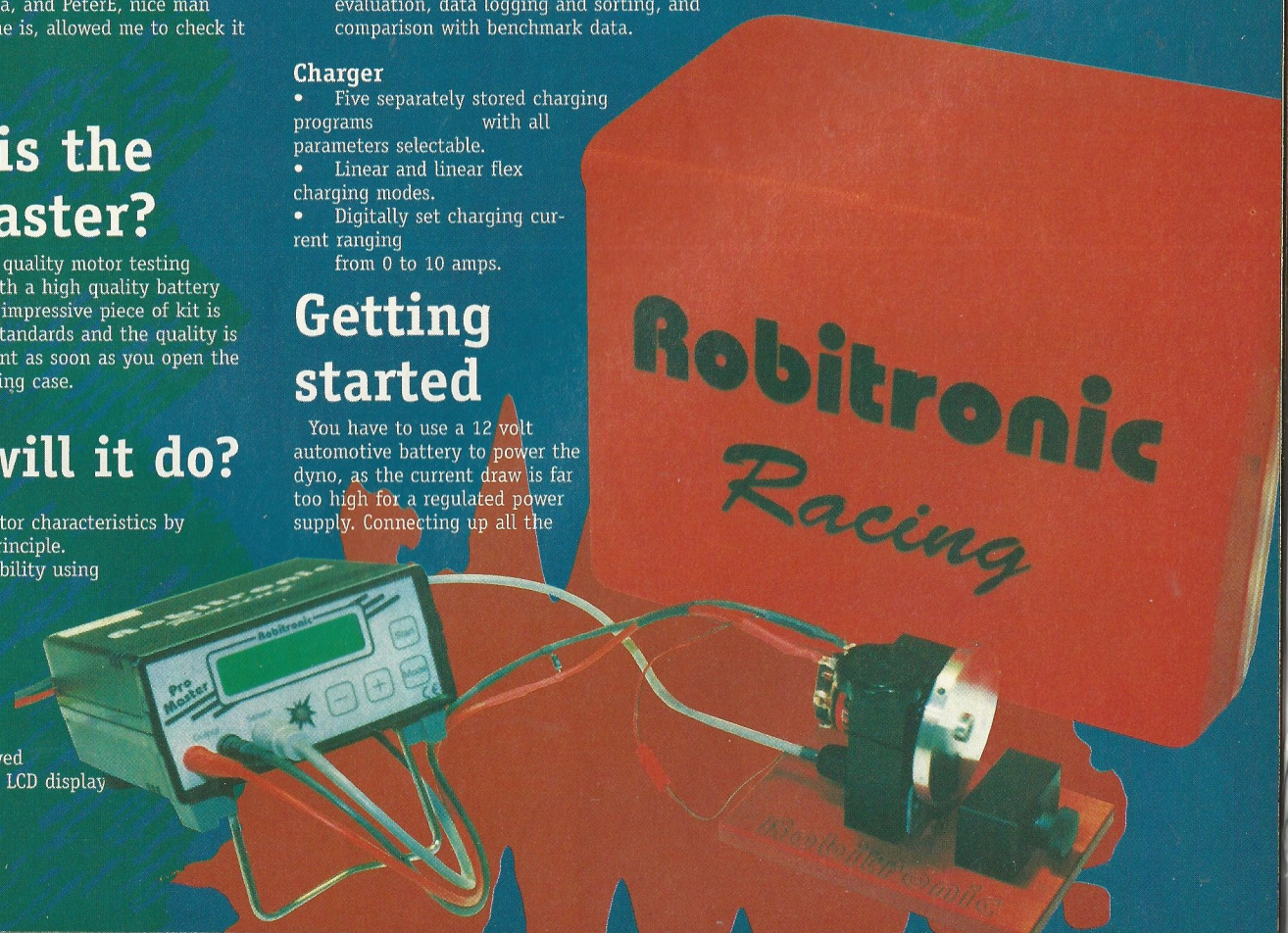
- Measure all motor characteristics by the flywheel principle.
- Precise repeatability using electronically regulated Ni-Cad battery simulation.
- Standalone operation with all data displayed on the back-lit LCD display
- Data output direct to a protocol printer without the need for a PC.
- Direct PC interface with included software, allowing full graphical and tabular evaluation, data logging and sorting, and comparison with benchmark data.

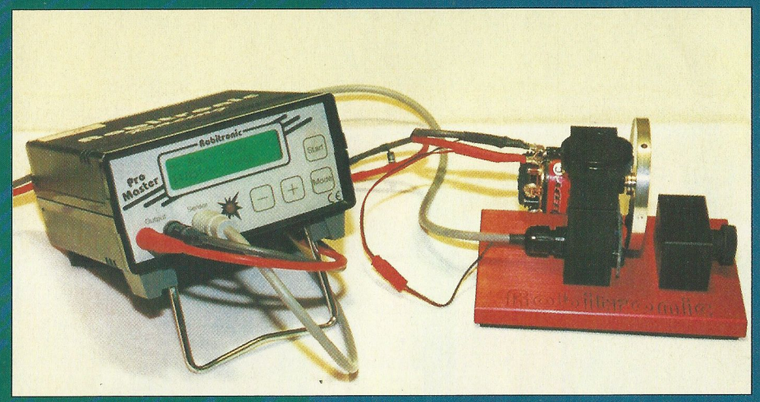
Charger

- Five separately stored charging programs with all parameters selectable.
- Linear and linear flex charging modes.
- Digitally set charging current ranging from 0 to 10 amps.

Getting started

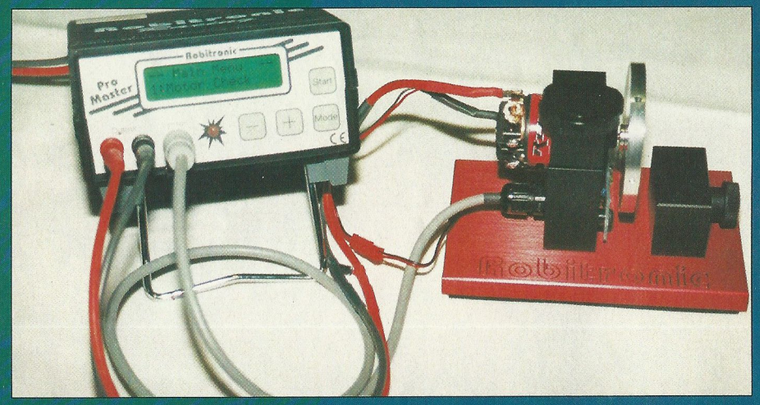
You have to use a 12 volt automotive battery to power the dyno, as the current draw is far too high for a regulated power supply. Connecting up all the leads is simplicity itself but it is worth noting that the connections to the motor have to be soldered due to the high currents being used. The motor that is to be tested slides into the clamp, the flywheel is fitted and then the distance between the flywheel and the rpm sensor is adjusted using the on-screen display. When all is well, the motor is clamped up tight and the safety guard fitted over the flywheel. Now we are ready to press the start switch.





The Pro-Master in action - testing one of the author's motors.

On lifting the lid quality hits you full on.



For such high tech and outstanding quality you do have to pay a bit extra, expect prices to be somewhere in the region of £400.

The Test

The Pro-Master simulates a fully charged 6 cell pack (it can be programmed to simulate 7 cells, 4 cells or what have you depending on your class of racing) and therefore the motor accelerates very quickly to maximum rpm. All this is done under the load of the flywheel and the electronics constantly measure all the motor characteristics while the motor is accelerating and also whilst it is braking to a standstill. All this is fully automatic and you just sit back and watch. When it stops there is a short delay while the figures are calculated and then they are displayed on the screen.

Results

Every conceivable characteristic is reported and the real Tech-Heads can have a field day with all the data. Even more impressive is the way this data can be presented and switched around. You can see what happens at incremental amp loadings or switch it around for rpm, or power, torque, time, efficiency, or voltage. For mere mortals like me the main figures that are really interesting are:

1. The maximum power.
2. Maximum rpm.
3. Efficiency.
4. Time to accelerate to maximum rpm.

The first and second of these are pretty obvious but knowing just how high your motor will rev will give you a good idea on how to gear it. Efficiency is the clever figure. Generally motor builders will want to get the best possible figure for efficiency. This means that the maximum amount of electrical energy from the battery pack is converted into power to drive the model car rather than being wasted as heat energy. I will say that most electric motors are pretty inefficient and we can all agree on that one when we feel just how hot our motors get after a five minute race. Just imagine if we could get 100% efficiency - all the power drives the car and the motor would not even get warm. Dream on! Back in the real world we just have to get the best we can and this is where there is no substitute for a good dyno.

Set the Timing

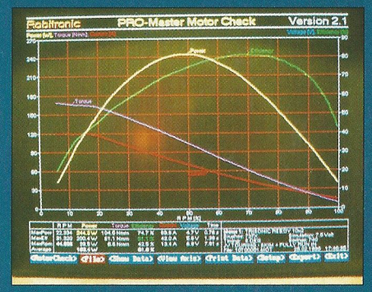
Let's face it, the motor manufacturers just don't have the time to individually dyno set every motor they make. What they do is test a few and find what advance works OK as an average. They then set all their motors to this point and for most this is pretty good. Sometimes you get lucky and it works out great and the timing is spot on. Everyone says what a super motor you've got - it must be a 'good 'un'. Another time the motor seems to be a real dog with no speed and won't make the distance. The motor timing, or advance, is critical to getting maximum performance as everything else about top quality motors is pretty consistent.

I work with Reedy motors and most of these, either Sonic 2 or Tri-Sonic, come out of the factory with 5 degrees advance. This works fine for most of them but I have checked out quite a lot now and found that, for a few, altering the timing to anything between 4 degrees and 7 degrees, I can improve the efficiency. This usually leads to more speed, more power and faster acceleration. That's what it's all about - improve the efficiency and you win all round.

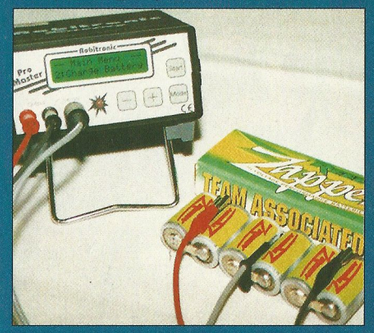
So what do you do with the dyno? After the first run with your motor, you jot down the readings, and then with the motor still hooked up in the dyno, you loosen the endbell and rotate it to either increase or decrease the advance. Lock the endbell back up and test again. Write down the new figures alongside the first set and compare. More advance will almost always give higher rpm, probably more power and most likely a higher current draw. Keep your eye on the efficiency reading. It's no good getting a screamer of a motor that draws huge amps if the efficiency has dropped off. Remember what happens - you're right, too much of the battery power goes into heating up the motor. You will not last the race and you will cook the motor anyway. Back at the dyno, it's easy to see what an increase in timing does and if the efficiency goes the wrong way, then just do the opposite with the timing until you get the best possible figure. On this particular dyno the efficiency range I have seen after adjustment goes from 78% to 83%. I wouldn't like to print what figures some motors give after they have been run for weeks without attention.

Other factors

I have rather assumed that everything about the motor is in first class condition, but re-testing a good motor after just a one day meeting immediately shows the loss of power, speed and poorer efficiency. It's important to



Power, Efficiency, Torque and current, it's all here!



Not just a dyno - it also doubles up as a battery charger.

keep everything in good condition, have your coms skimmed at least every other meeting, keep the brushes clean and replace when worn by a third or burnt, and don't forget to replace the springs if you replace the brushes - they get hot and lose their tension.

If you like to experiment, then the dyno will show the result of lighter or heavier brush springs (lighter usually means more speed less power) and the difference between brush compounds (high silver content usually gives more power but with high com wear).

With a PC

You don't have to have one, but it's great if you do. Any old PC will work as the software runs under DOS and is quickly installed on the hard disk. A colour screen makes it easier to pick out the detail. Having the motor data presented as a graph makes it easier to understand and the really, really clever bit is being able to load benchmark data and overlay one graph on top of the other. The best use of this facility is to bring up the saved data for your motor, when it was in it's best condition, as the benchmark, and then run the same motor, after it has done a couple of meetings, and compare the results on screen. I just know you will tear that motor down, clean it, re-skim and fit new brushes. You won't be able to resist it.

The PC software has several files in which you can store motor data. You can put all your Tri-Sonics in one file, Sonic 2's in another and then you're mate's motors in yet another. When you have a bit of a database it's easy peasy to sort the motors into power order, or highest rpm, even best efficiency. You will soon see which are your best motors.

All graphs and data listings can be printed out and of course, a colour printer helps a lot. When connected to the PC, the dyno is fully remote controlled from the PC keyboard. On screen displays tell you what is going on at all times and even pop up error messages if anything is not quite right.

The Charging Function

Buying a dyno may be something of a luxury but it makes a lot more sense if the dyno can double up as a battery charger. The Pro-Master is definitely a high end dyno but is also a top notch battery charger. All parameters are settable and this means the charging current, flex charging on or off, peak detect lock out time, peak fall back voltage, temperature charge, and maximum capacity lock off. Linear charging is currently thought best for RC2000 packs and the flex mode should be used from time to time to keep the cells in top condition. Peak charging is the norm and being able to set the fall back voltage lets you push the cells to the max. The peak lock-out caters for older packs that tend to false peak when they start charging. Set the lock-out for about three minutes. Really difficult packs can be temperature charged with the included probe and a nice safety touch is the maximum capacity lock off. This will stop the charge after the pre-set capacity has been reached, even if the temperature has not reached the value set. This covers the temperature probe being knocked off the pack while charging.

While the packs are charging the display shows the charging program selected, the charge current, pack voltage, time elapsed while charging and pack capacity in Mah. A bright red LED indicates charging and this is followed by a tone when the charge is complete. Then the LED flashes whilst the charger continues to trickle charge and keep the pack race ready.

Five charging programs can be stored and called up on the unit's keypad. I dialled in a Linear Flex mode at 5 Amps, 0.15 volt fall back and three minute lock-out. Program 2 was Linear at 5 Amps, 0.1 volt fall back and no lock-out. This second program works great for re-peaking. Program 3 and 4 have been set for temperature charges but I haven't had cause to use them yet. Program 5 is set for Linear at 0.5 Amps, 0.1 volt fall back and three minute lock-out. This takes care of recharging the transmitter batteries.

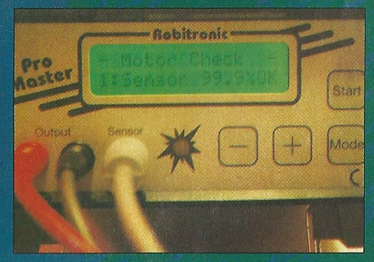
The Robitronic Pro-Master using its PC software to the full. Runs under DOS and is quickly installed onto any hard disk.

The cost

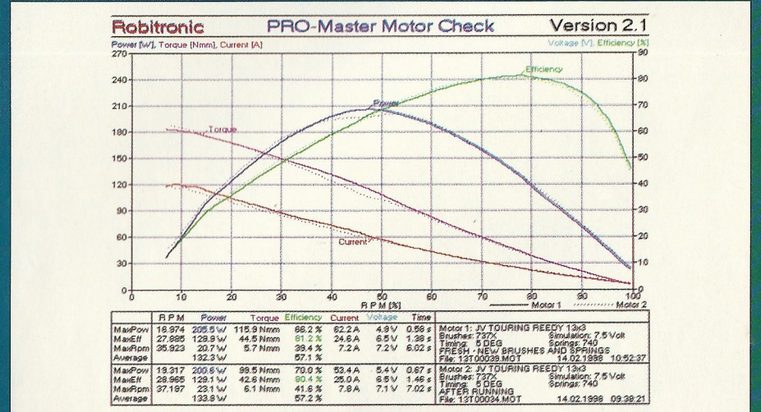
Take a deep breath! You didn't expect all this high tech and super quality would come cheap and that's a fact. The Robitronic comes from Austria and thankfully the exchange rate is in our favour. Even so, this piece of kit is going to set you back something like £400. The exact price hasn't been determined but serious enquiries can be directed to CML Distribution. See their advert in this issue.

Conclusion

Fabulous piece of electronics that is very easy to use. Gives your motors the winning edge. Extremely portable and therefore very useful for checking motors at the track. Doesn't need a PC or Lap-top. Great battery charger included. Please CML - don't ask for it back! RRC!



Displays all you need to know.



	R.P.M	Power	Torque	Efficiency	Current	Voltage	Time	
MaxPow	16.974	205.5 W	115.9 Nmm	66.2 %	62.2 A	4.9 V	0.58 s	Motor 1: JV TOURING REEDY 13x3
MaxEff	27.885	129.9 W	44.5 Nmm	81.2 %	24.6 A	6.5 V	1.38 s	Brushes: 7372 Simulation: 7.5 Volt
MaxRpm	35.923	20.7 W	5.7 Nmm	39.4 %	7.2 A	7.2 V	6.02 s	Timing: 5 DEG Springs: 740
Average		132.3 W		57.1 %				FRESH - NEW BRUSHES AND SPRINGS
								File: 13T00035.MOT 14.02.1998 10:52:37
MaxPow	19.317	200.6 W	99.5 Nmm	70.0 %	52.4 A	5.4 V	0.87 s	Motor 2: JV TOURING REEDY 13x3
MaxEff	28.965	129.1 W	42.6 Nmm	80.4 %	25.0 A	6.5 V	1.46 s	Brushes: 7372 Simulation: 7.5 Volt
MaxRpm	37.187	23.1 W	6.1 Nmm	41.6 %	7.8 A	7.1 V	7.02 s	Timing: 5 DEG Springs: 740
Average		133.9 W		57.2 %				AFTER RUNNING
								File: 13T00034.MOT 14.02.1998 09:38:21

Graph shows a before and after reading for one of Jason Varley's touring car motors. The dotted line (Motor 2) is as it came from Jason, and then the solid line (Motor 1) is after a fully service. Note the big improvement in efficiency, greater torque and power, and the quicker time to accelerate to max. rpm. The only 'loss' in this case is a drop in max. rpm.