Design of the Lavco Pro — Dyno

The Pro Dyno is housed in an exceptionally neat brushed grey aluminium case, covered in colour coordinated decals. On the back of the unit there is a heatsink for the voltage regulator, and dyno load. Another heatsink is fitted to the top of the unit, which is used to dissipate power from the motor under test, and also the load motor. Both motors are clamped in place in such a manner as to dissipate any heat effectively. The load motor is actually a 70 turn motor specifically designed for the job, and it is connected to the test motor using a specially designed flexible coupling. Also on this coupling is the optical sensor used to measure the speed.

There are two LCD digital readouts, one for power output, and the other for the speed in RPM. Whilst the characters are quite small they are very clear and easy to read. Underneath these displays are the switches to control the dyno. These include an on-off switch; a switch to select four, six or seven cell testing; a selector switch to alter the motor current during the test to 15, 20, 25, 30 and 35 amps; and finally a push button to apply power to the motor and perform the test.

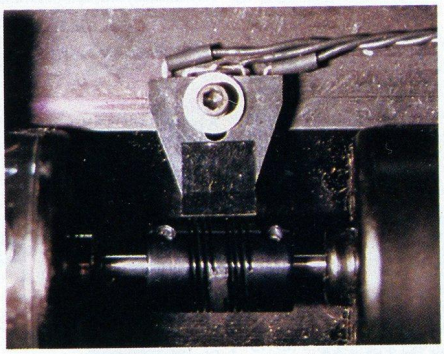
During testing there is a green LED which lights if everything is OK. This is basically to indicate that there is enough voltage from the supply battery. The unit is designed to run from one more cell than the selected number of cells, so in our case a seven cell pack is required to simulate six cells. If you want to spend even more money, there is an adaptor available which

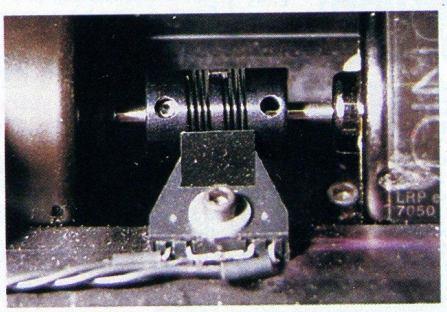
DYNAMIC DYN

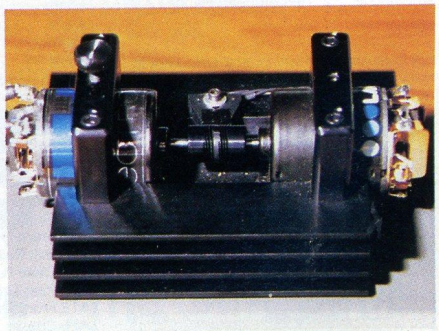
REVIEW BY DAVID GALE

One of the major problems facing the experienced racer is trying to find ways of measuring the performance of various parts of the car without actually running them on the track. For nicads there are numerous dischargers and testers available which can be used to measure performance accurately. However testing electric motors has always been a problem as there are far more variables involved, and simple testers rarely give useful results.

I believe that the Lavco Pro Dyno is the first commercially available tester that has become accepted as giving useful results, and as such has been given the "thumbs up" from Mike Reedy amongst others. The Schumacher motor tester has also been given approval from Mike, but due to it's cost and size tends to mean that it is a tool for the Elite, instead of the masses. The lavco scores heavily in terms of simplicity, and its ease of use.







Separate views of the infra-red sensor.

allows the dyno to be operated off a 12 volt car battery.

Lavco also make another Dyno, called the Sport Dyno, which has been simplified to keep the cost lower (nearly half the price). As far as I can tell, it has only one digital readout, and can only test at 10, 15, and 20 amps. From what I have seen of the Pro Dyno this would make it more than adequate for standard class racing, but would not really give enough information for Modified class motors.

The only negative point with the presentation of the Pro Dyno comes with the instructions, which are vague to say the least. These could be much more informative, and guide the user through operating principles, and how to interpret the results. Instead they assume that you bought the Pro Dyno because you know what you are doing, and leave out a lot of background information which would be very helpful to the majority of people.

Testing at 15 amps — notice power and RPM readings.

Principles of Operation

The principle of any Dyno is to load the test motor, and measure the power output at that load. From these results it should be possible to get a good idea of the motor's characteristics at high and low loads. The load in the case of the Pro dyno is another motor, which is being used as a generator. When this motor is turned it generates a voltage, which can be used to supply power to an electronic load.

By adjusting the amount of current taken from the generator, the loading on the test motor can be controlled as required, as a higher output from the generator obviously requires more power from the test motor. At any point the power supplied by the test motor must be the power given to the generator, which we can measure through the electronic load. If the current and voltage supplied to the test motor are known, then it is also possible to calculate the efficiency of the motor.

In the case of the Pro-Dyno there are five different load settings at which measurements can be taken. These are at 15, 20, 25, 30, and 35 amps, which correspond to the current taken by the motor under test. At each of these settings, the load on the test motor is adjusted through the generator, until the test motor is using that number of amps. This means that the unit will take a few seconds to stabilise as the load is a adjusted .

It is also very important that the motor under test is supplied with a constant voltage, and the Pro-Dyno has a built in voltage regulator to ensure a repeatable supply. In fact this is slightly more intelligent, as the voltage supplied reduces as the current increases. This is to try and simulate the effects of the internal resistance of nicad cells, which reduces power outputs at higher loads.

At each load setting, the power and RPM figures are displayed on the digital readouts, and from these it is possible to calculate the torque and efficiency for the motor under test. From these figures it is possible to draw a graph, and by finding the peak efficiency point estimate the optimum operating current for the motor.

The only problem with a Dyno tester such as this, is that it can only give a set of "static" test results, from which a "Dynamic" picture of performance can be estimated. It cannot take into account several factors which have quite a large bearing on performance. The particular one that springs to mind is how the inertia or rotating mass of the armature, affects acceleration. A heavier armature will obviously require more power/force to accelerate as fast as a lighter on, and with any any Dyno of this kind, this cannot be taken into account.

Operating the Pro-dyno

Testing a motor is a fairly simple procedure : Firstly the motor should be run in for a couple of minutes to allow it to warm up. Then the motor must be clamped into place, and the wires supplying power soldered on. This is an unfortunate necessity which prevents errors in the voltage regulator due to poor connections.

Then, at each of the load settings, the test button is pressed, and readings taken when the readings have stabilised. This normally takes a few seconds, after which there may be a small amount of drift as the motor heats up. If the readings are very unstable, it is possible that the motor under test is suffering from a large amount of brush bounce, which is affecting the readings.

Testing at 25 amps — notice how power has increased and rpm decreased.

Interpreting the results

One of the major problems of any dyno is interpreting the results. For each load setting the power output and RPM's are measured. If you are comparing two motors of similar types, then it is very easy to see which is the best. For example, I tested two identical eighteen doubles, and got the results below.

a) 18 double no 1

AMPS	POWER	RPM's
15	296	22.1
20	406	20.1
25	492	18.4
30	551	16.5
35	584	14.7

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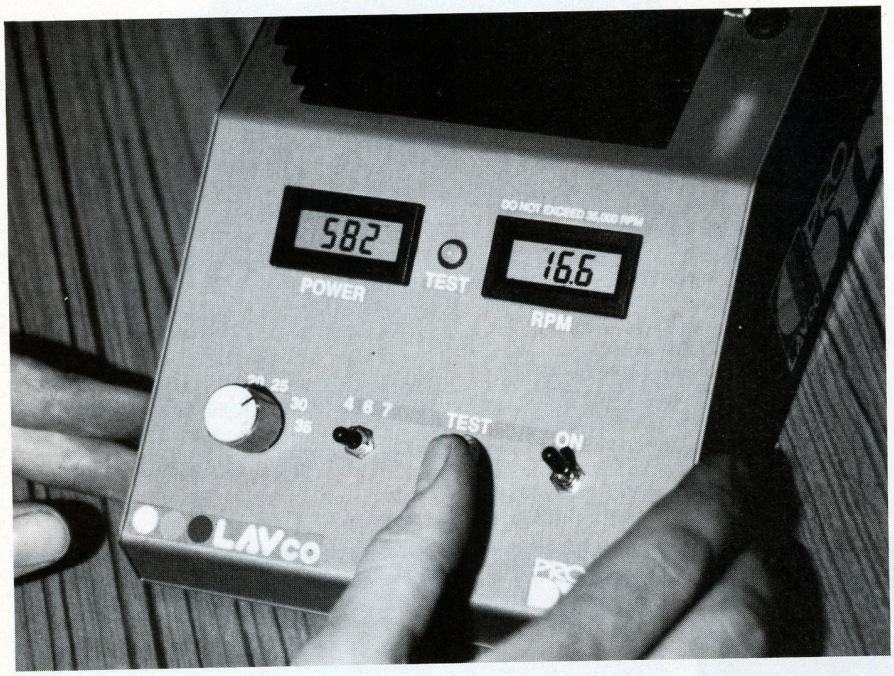

Testing at 30 amps — the power has increased even more and the rpm has lowered.

b) 18 double no 2

AMPS	POWER	RPM's
15	280	23.3
20	393	21.0
25	486	18.7
30	527	16.3
35	557	14.4

By comparing the results, it is clear that the first motor is better, as it produces more power at all loads. It is also better at maintaining it's rev's at the higher loads, whereas the other one loses performance.

The next example shows the effect of changing the brushes from standard to Corally brushes on another 18 double.

a) Standard brushes

AMPS	POWER	RPM's
15	266	20.1
20	356	18.4
25	416	16.4
30	491	15.1
35	517	13.4

b) Corally brushes

AMPS	POWER	RPM's
15	287	23.1
20	396	21.0
25	479	19.1
30	543	17.3
35	590	15.5

The effect is rather amazing, resulting in much higher power and RPM figures at each load. Brushes have a surprisingly large effect on motor performance, and the results were not unpredicted, although to see the difference so clearly was an eye-opener to say the least.

Conclusions

The Lavco Pro-dyno is an extremely useful and well made motor tester, and would help anyone to get the most out of his/hers motors. It is simple enough to be used trackside, although only three or four tests can be done before the nicad pack used to power it will need recharging.

Interpreting the results can be difficult, especially for motors of widely different characteristics. If you had two motors from the same manufacturer with the same specification, it can easily tell you which would be the better of the two.

If you wanted to compare, say a 17 double with a 14 quad, then the results would be very difficult to relate. It would however be able to detect something obviously wrong with either of the motors. For example, when I first got the Dyno, I tested several 18 turn motors, and found them all to be much the same. I then tested a 17 turn motor, and it produced more power, and higher RPM's. This was basically inconclusive, as this is what you would normally expect. A little later I tested another 17 turn motor, and it produced less power and RPM's than the 18's tested earlier, indicating that it would not be a good motor to use.

Once you have built up a good picture of typical characteristics, it becomes a simple procedure to refer back to previous results to make a comparison with other motor's of similar types.

Another important use for the Pro-Dyno is for detecting if a motor has gone 'off', as this is easily noticeable in the results. In a similar way it is very useful for optimising a particular motor, by testing before and after any changes have been made.

Overall I have found the Lavco Pro-Dyno to be indispensable, and at the recent Manchester National found that it helped enormously on two accounts. In the first instance it proved that there was nothing wrong with the motor I was running, so there must have been something else wrong with the car, which there was.Secondly it proved that one of my teammates motors had gone off, and needed a rebuild. After rebuilding, re-testing proved that it was as good as it had originally been, and this gave him the confidence to run it on the track. I am looking forward to doing much more testing with the Pro-dyno, and if there enough scope we will have another feature on the results.

Verdict: A very good product, but so it should be for the price.

DYNAMIC DYNO!

Testing at 35 amps — the green light does not come on because the dyno can't load the motor up enough. In this case we ignore the reading.