

RCM&E Test Report MACGREGOR DIGIMAC IV

THE MacGregor Digimac IV, and Digimac VI are the logical outcome of a series of all types of R/C systems from a manufacturer whose activity in this field stretches back to 1960. Few current equipment manufacturers can claim anything like such long association with the radio control hobby.

'British Made' says the inscription on the transmitter case, and there is no doubt that MacGregor can be justifiably proud of their system which is the subject of this test.

MacGregor is probably the largest British manufacturer of R/C systems and has adopted an attractive house style which applies to all their current range of equipment.

Thus, the Digimac IV transmitter has a case, made up of a basic wrap-around metal centre piece with rear cover which is retained by two Dzus fasteners. Two black moulded side caps, black stick unit bezels, trim levers and switch guard, set off the blue anodised metal to produce an attractive and distinctive effect.

The anodised metal is additionally vinyl-coated to protect the anodised finish against the accumulation of unsightly scratches which lengthy use might invite - thereby helping to retain that 'fresh-out-of-the-box' appearance that many of us try to retain, but rarely achieve. Stick units used are MacGregor's own. The Gimballs of the dual axis units are sunk deep into the slim case, helping to achieve a fairly long control column for precise control without making the transmitter uncomfortable to handle. Handling in fact is very good indeed. With the aerial extended, the unit is nicely balanced, while the stick assemblies are smooth and free, without a hint of neutral slop. Trim levers are also free, perhaps a little too much so on the test sample. The on/off slide switch is provided with a switch guard, which also incorporates a toggle for a neck strap if the operator wishes to use one.

On removal of the case rear cover (the Dzus fasteners unlock with a quarter turn of a screwdriver), we find a compact

internal layout. The case measures $5\frac{1}{4}$ in. high x $7\frac{1}{4}$ in. wide x $1\frac{1}{2}$ in. deep, so that the internal layout has to be fairly space conscious.

Mechanical arrangement is fairly complicated, though logical. The glass-epoxy p.c. board is set against the rear of the front face, retained in position by the on/off switch which is soldered to the p.c. board and bolted to the case front.

Components are neatly arranged on the p.c. board, and soldering work is good.

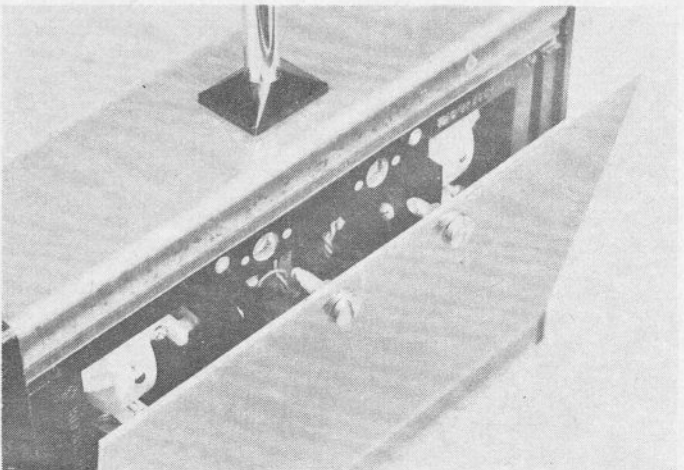
Both Mode 1 (elevator left stick - aileron right) and Mode 2 (elevator and aileron right) control layouts are available. The system incorporates the simplest system yet seen for changing the mode. A small moulded stop which holds the scissors spring apart to produce non-centring action is simply unclipped and moved to the other stick unit.

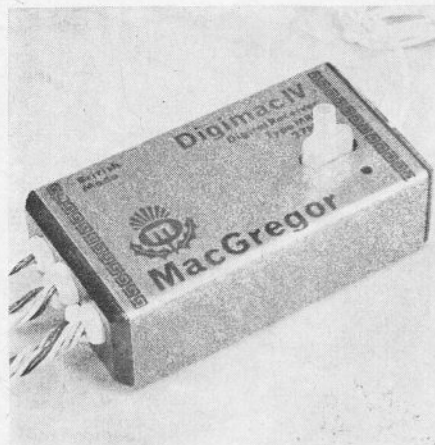
The 225 mAH power pack is strapped to the p.c. board. We also found the plug-in crystal conveniently accessible.

The Digimac IV receiver has a case which is very much a miniaturised version of the transmitter using an anodised, folded sheet metal centre with moulded black end caps, which once again produce an attractive effect. The receiver is small, size only $2\frac{1}{4}$ x $1\frac{1}{8}$ x $1\frac{1}{16}$ in. and carries all components on a single glass-epoxy p.c. board. As with the transmitter, soldering work is to a high standard. Component placement on the board is tightly spaced, though by no means the tightest we have seen. Output leads to the servos, and the input leads from the power pack terminate at one end of the p.c. board. The leads are grouped for function and exit the case through one of the case moulded ends, to terminate again at four pin line connectors.

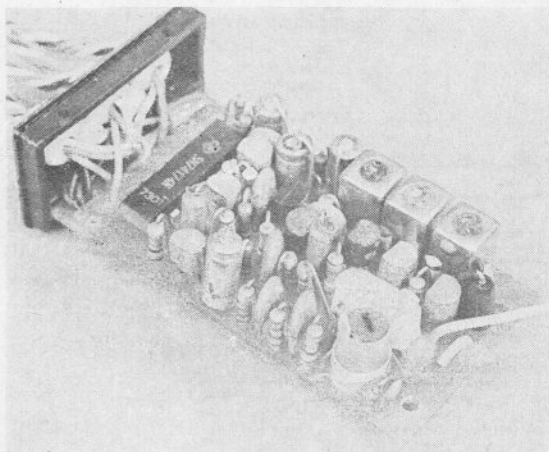
The plug-in crystal is easily accessible, protruding through

Bottom left: the distinctive and elegant Digimac IV transmitter follows very much an individual style. Case is slim and easy to handle. Note the neck-strap tag on the switch guard. Below: two Dzus fasteners hold the rear cover in place.





Left: the compact Digimac IV receiver. Note the protruding crystal, which should be adequately protected. Right: the receiver component layout on single glass epoxy p.c. board. Below: receiver case assembly.



the case top. This in fact might make the delicate crystal a little vulnerable in 'extreme circumstances' making careful protection advisable.

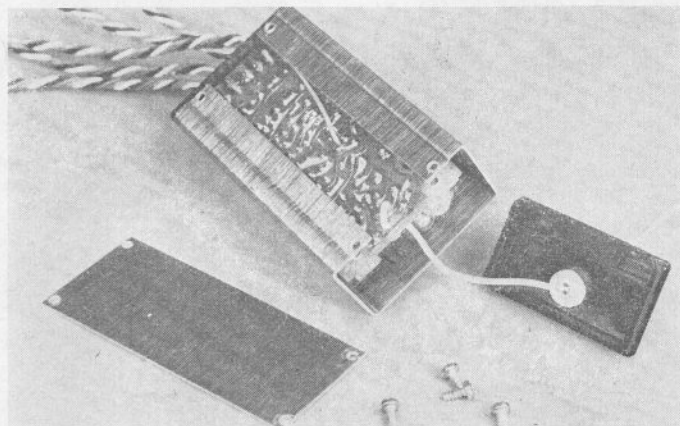
The servos supplied with the system on test are of the latest MacGregor MR 12 type. These rotary output units are very compact, measuring only 2 in. (incl. lugs) x 1 3/8 x 3/8 in. overall. They are not quite the smallest servos available but are nevertheless as small as one could reasonably require for all practical purposes. Servo action is quite fast.

Power pack is a 500 mA/4.8 v flat pack style in a moulded case, wired in series with on/off switch and line connector. The on/off slide switch now appears even more incongruous with the MR 12 servo than it did with the MR 10 (tested with the Digimac 3 in our August '72 issue), being quite large in comparison.

A separated transformer-isolated charger is supplied with the system. This unit is quite the smallest we've seen, the case measuring only 1 1/4 x 1 1/2 x 1 1/2 in. The charging harness supplied, plugs into a socket in one side of the transmitter and into the airborne power pack line connector for a charge cycle. An indicator light in the charger case shows that charging is in progress.

Since no separate charging socket is provided for the airborne power pack, this has to be taken out of circuit for charging. It is also necessary to throw the airborne pack switch to the 'on' position for charging, otherwise no charging takes place at all.

Summarising we would rate the MacGregor Digimac IV well made and engineered with excellent attention to detail apart from a few niggling points carried over from the Digimac 3 previously tested. Then as now, we found on/off switches not really suitable for the job on both transmitter and airborne pack, together with non-heat shrink tubing for the line connectors. Apart from these points, however, one



can only be impressed with the quality of the unit and excellent presentation from a manufacturer we know to be geared to mass production in the best sense of the term. Total airborne installation weight is a very satisfactory 12 1/2 oz.

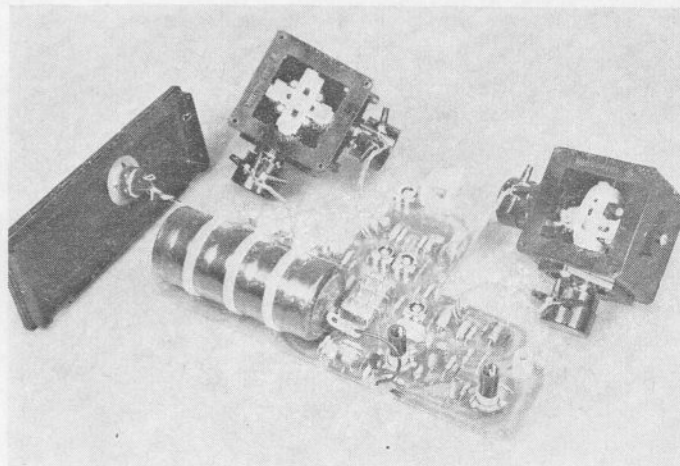
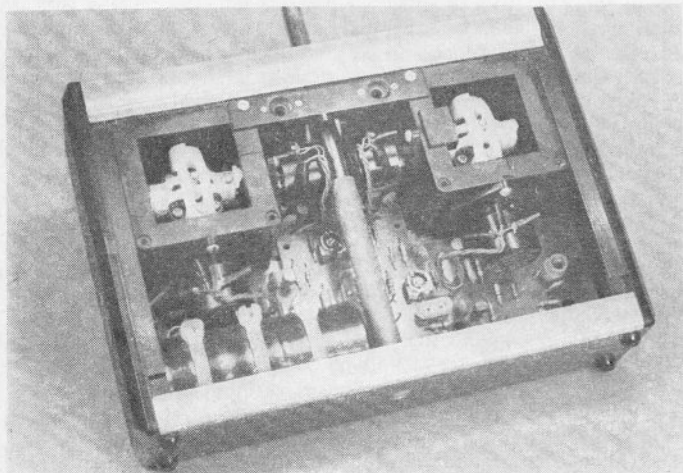
Having visited the MacGregor factory, we were more than impressed with their production system.

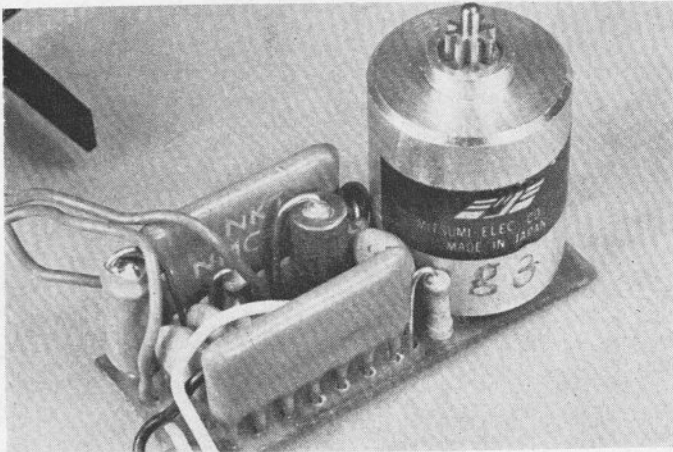
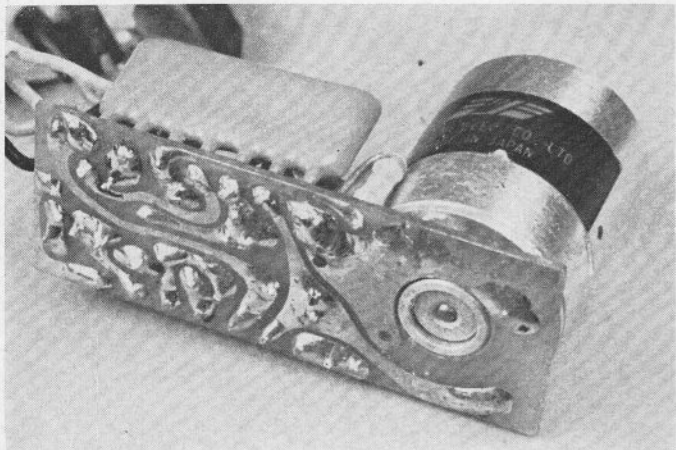
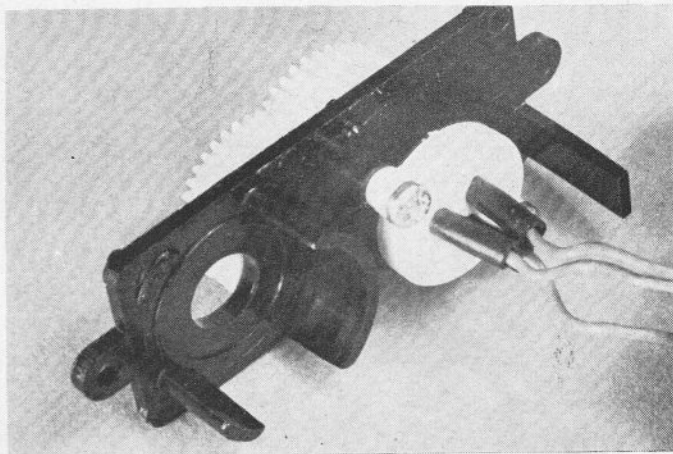
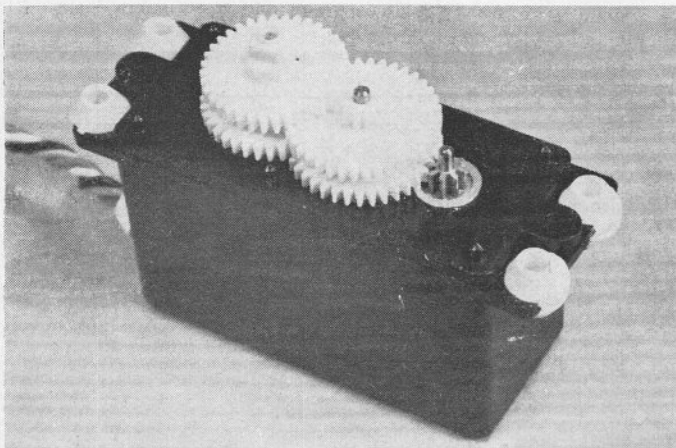
The Digimac IV with four servos costs £114 while the Digimac VI is priced at £131 with the same MR 12 servo compliment. The six-function unit with a full six servos costs £153. At these prices, the Digimac IV and VI can only be regarded as an extremely competitive offering, backed by excellent quality. All prices are inclusive of V.A.T.

Technical Analysis - By Rex Boyer

The last MacGregor system we tested was the Digimac 3 in our August '72 edition. It may be recalled that several features of the design differed from the contemporary systems and in the Digimac IV we also see quite a few divergences from normal practice.

Below: rear cover removed, reveals neat and compact internal layout. Note the nylon straps holding down the power pack to the p.c. board, bottom left of case. Construction is fairly complicated as the disassembled mechanics, bottom right, show.



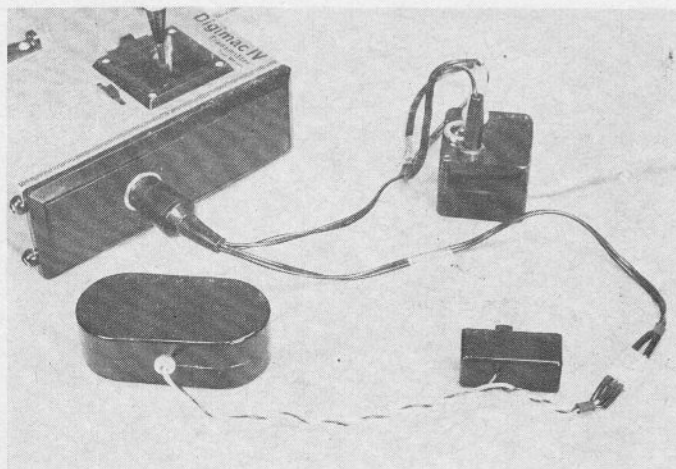


The Digimac IV transmitter strongly resembles the Digimac III unit in circuitry design. Naturally it has one more channel but the general design follows that of the 'III' closely.

Commencing with the encoder, we find the conventional multivibrator clock generator followed by the usual string of half slots. Preset pot adjustment of both the multivibrator and the individual half slots is provided to ease initial setting-up. These are not intended for owner adjustment and each pot is sealed to discourage tampering.

R.F. circuitry in the Tx is as per 3-function unit, namely a crystal oscillator driving a push-pull output stage, with modulation applied to the output stage, quite a change from the usual π (Pi) network. The output transistors are from the Ferranti E line range while the rest of the transistors are Silec plastic colour-coded types. The Xtal oscillator transistor is coded gold! As before, the stick pots are wire wound Colvern CLR series.

Power pack for the Tx is a 9.6 volt Ever Ready nickel cadmium 280 mAH while a larger 550 pack is optional. We still do not like the Tx on/off switch any more than we did when we tested the Digimac III.



The MacGregor MR12 servo showing, top left the neat gear train, while at top right is the servo gear train carrier with feedback pot in place. At left is the p.c. board which is soldered direct to the servos to minimise number of internal flyleads, while above we see the servo amplifier. Vertical standing, multi-lead components are 'thick films'.

The makers claim 2-2½ hr. running time was a 280 mAH power pack but as the test figures indicate a current drain of 150-195 mA, it would be only just over 1½ hr. for safety.

As is normal with MacGregor systems, maximum use has been made of British components but we did notice a sprinkling of *Russian* resistors.

Receiver

There is some resemblance between the Digimac IV Rx and previous MacGregor receivers. In the 'IV' we now have a separate crystal oscillator feeding a single tuned mixer stage.

The I.F. line-up is unusual and with no theoretical circuits available it is not really possible to work out exactly what is going on. Certainly it is not conventional but it would appear that the I.F. transformers are connected in a BAND PASS MODE so as to give a sort of double tuned I.F. stage. There is A.G.C. applied to this stage. The output is applied to a single A.F. amplifier with interposed circuitry (apparently a discriminator circuit) before being processed to feed the decoder, a TTL SN 74174 *six stage D type* flip flop. The chip is of the standard range and consumes some 30 odd milliamps. Output pulses are +Ve going.

Once again we see the majority use of British components, with a few Russian resistors.

Outputs to the servos go via MacGregor square pin line connectors. It is almost a year since we commented to the manufacturer, about the insulating sleeves on these plugs which do not support the wires and it was understood that, in fact, shrink-fit sleeving would be used in future. However, the Digimac IV still uses the non-supporting sleeving, leaving the

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Left: the charging circuit showing the miniature MacGregor charger in circuit with transmitter and airborne power packs.

Test Report – Digimac IV

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wires virtually unsupported. Not, we feel, a very good feature. The same comments we made about the Tx switch also apply to the Rx on/off switch.

Servos

The servos presented for test are the new MR12 which are entirely MacGregor designed and manufactured. Featuring a Mitsumi 16mm motor, the servo response in the fastest direction was very good. The servo amplifier is unique, using two thick film integrated circuits, type numbers NMC478 and NMC479. These are purpose-made by Newmarket (part of the Mullard group).

The circuitry used is quite conventional and is indeed almost a direct copy of the original MR10 discrete type. Circuitry is split between the two packs with the Monostable and preliminary circuits in the NMC478, while the pulse stretcher and output drives are in the NMC479.

Output transistors are specially selected for low saturation volts at high current, both the drives being gain matched to the output pair.

By using this technique, MacGregor have effectively achieved the best of both worlds. The form the packs take allow easy installation in the servo case and gives about the most room we have ever seen in a servo. Also, the number of additional components used, ten in all, is very low.

As is now becoming fairly common practice, the servo p.c. board is soldered directly to the motor terminals, thereby reducing the internal fly leads to a minimum. As is now common practice, the feedback pot is of the Cermet type, but one difference is the use of a carbon wiper which we would assume is an 'in-house' wiper assembly.

One technical mechanical feature we did like is that the output arms are designed to shear on impact before the servo gears become damaged. We tried some tests and were impressed with the results. Static loads up to twice the output of the servo failed to break the arms but impact loads caused the arm to shear – a very good feature.

Test results

The servos give very linear results over the whole transit time. Servo travel is set to 90° total, a bit too much we feel. To give a direct comparison to contemporary systems, the servo times are converted for a 70° throw, which is the amount we test other systems to.

By plotting a speed/load graph we found the MR12 servo response quite good. We did, however, find the small error response not up to current standards. The stall torque of 32 oz. at $\frac{1}{8}$ radian is a little low.

Servo response times are all quotes in seconds and times corrected for 70° total travel.

Loads at $\frac{1}{8}$ rad. in oz.	With Load	Against Load	
No load	.374	.420	
2.1	.362	.430	1% overshoot
5.8	.352	.445	
8.8	.350	.464	
10.7	.350	.544	
14.9	.334	.624	
19.2	.346	.792	

(All times in seconds)

Servo just stalled at 32 oz. $\frac{1}{8}$ rad.
Servo travel: +44° – 47°
Trim range: ±10°