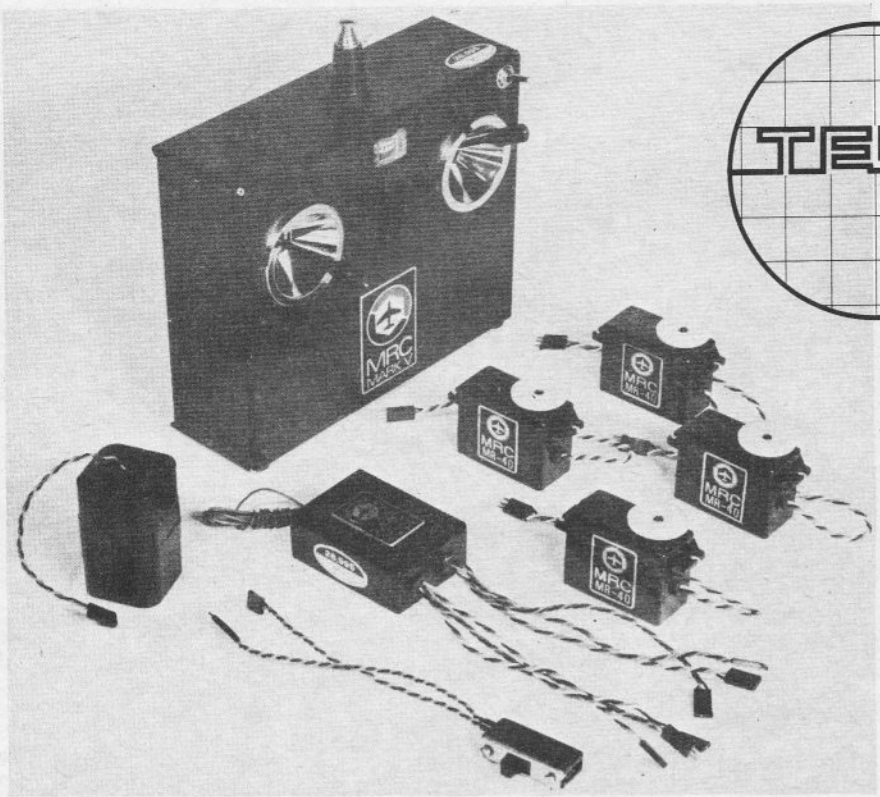


TEST REPORT

Rex Boyer looks at the

MRC MARK 5

THE MRC Mark 5 multi-proportional R/C system has been available in U.K. for slightly more than a year now, and during that time has changed distributors, now handled by Humbrol at Marfleet, Hull. Although Humbrol have no long *direct* association with the R/C Hobby, their handling of the MRC line is logical in that it completes a reciprocal trading arrangement – MRC having been U.S.A. agents for the wide range of Humbrol paints and adhesives for some considerable time.

The MRC range of radios is manufactured in Japan to the requirements of the American MRC company for international distribution throughout the Western world. The MRC Mark 5 is attractively packaged, in an elegant red, white and black carton which encloses all system components, set in a neatly moulded expanded polystyrene presentation tray. The system includes transmitter, receiver, four servos, rechargeable battery packs for both transmitter and receiver, switch harness, separate charger complete with three pin mains plug adaptor, frequency pennant, servo mounting trays and extra servo output disc and drive arms. Altogether a very comprehensive package indeed.

By any standards, the transmitter is a small, handy unit, case size only $6\frac{5}{8} \times 5\frac{1}{2} \times 2$ in. The result is a light and comfortable-to-hold package which is very well-balanced. The two dual axis stick units are MRC's own and have a particularly nice action and very nice trim lever action too – the trims being the common electromechanical type. The fifth function is controlled from a two position switch for retracting undercarriage operation and is situated top left or top right of transmitter front face according to stick mode selected. The on/off switch is clearly marked 'on' and 'off' and the meter monitors battery state but not R.F. output. Particularly neat is the aerial which collapses right into the case with only a $1\frac{1}{2}$ in. stub protruding.

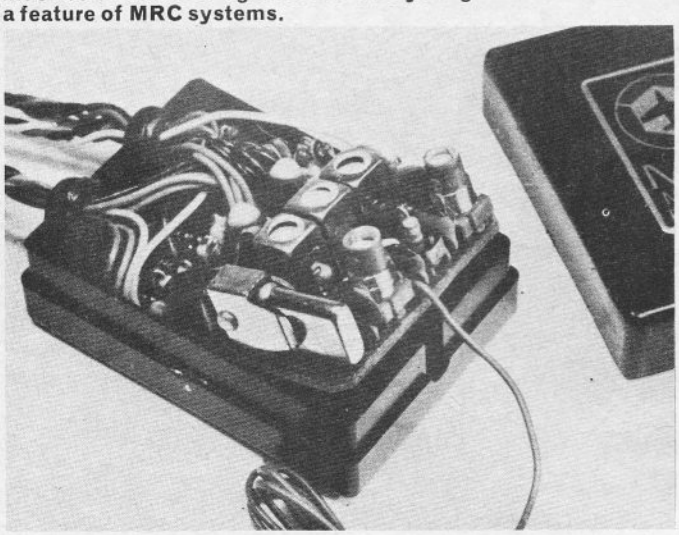
The MRC 5 receiver is a compact flat-pack unit built on to a single p.c. board. The plug-in crystal is held in place by a clip, but the receiver must be disassembled before the crystal becomes accessible as there is no slot or hatch in the receiver case. Ingenious modellers might try a 'mod' here but this must be considered against the 'one year guarantee' which is a feature of MRC systems.

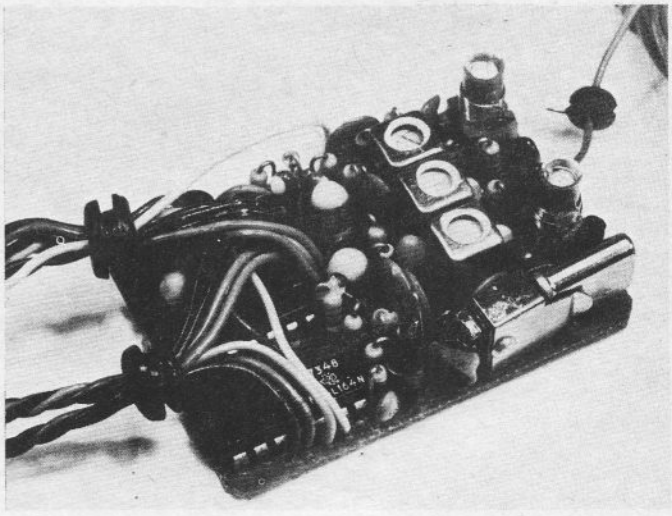
Internal transmitter layout is simple and tidy, with plug-in crystal immediately accessible. P.C. board is neatly soldered and all fly-leads are neatly tied down.

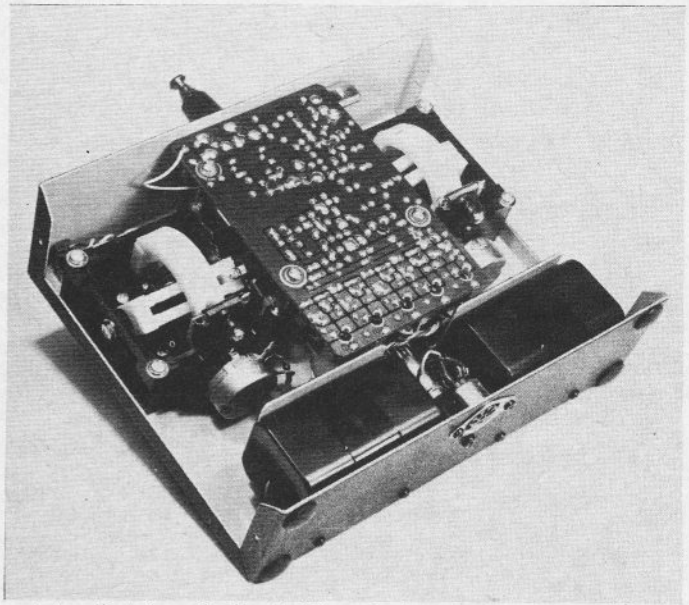
The Mark 5 receiver is housed in a crisply moulded two-piece nylon case size $2\ 5/16 \times 1\frac{5}{8} \times \frac{7}{8}$ in. to achieve a compact flat-pack installation package with R.F., I.F. and decoder circuitry on a single p.c. board. Soldering work is again particularly neat, while on the component side of the board, components have a lacquer coating for support.

Signal outputs to servos and input from the power pack go via miniature individual three-pin line connectors, the pins for which provide good friction connection and require a fair tug to disconnect. The main physical failing of the receiver is the inaccessibility of the plug-in crystal which cannot be replaced without disassembling the receiver case and removing the p.c. board.

MRC's MR-40 servos supplied, feature rotary output drive. Case size, sans servo lugs is $1\ 13/16 \times 1\ 7/16 \times 13/16$ in. and case walls are notably thick, making the case particularly robust. Individual gears on the gear train are also quite deep so that the gear train should stand up







to a fair amount of shock load without damage. Servo lugs are also particularly robust and supported at the corners with gussets.

The separate 220-240v transformer isolated charger has an American pattern two-pin connector, but is supplied complete with three-pin converter plug by the British distributor. Red warning lights monitor charges to both transmitter and receiver packs, which may be charged individually or simultaneously.

Summing up, we can only say that we were pleasantly surprised with the MRC Mark 5. The system has no outstanding original features to offer, yet in total represents a thoroughly well-built and presented system which we have grown to like over a number of flying hours. We found the transmitter stick action particularly to our liking and found the airborne system nicely compact and well-suited to our needs. Servo trays supplied retain the individual servos with small clips and require no screws. Total airborne installation weight is 13ozs.

Airborne performance was certainly positive and aided by the nicely balanced transmitter. Range has been excellent, without a hint of a glitch throughout.

Perhaps the only criticism one can level against the MRC Mark 5 concerns the receiver crystal as mentioned earlier, but at current prices, the system certainly does seem value for money.

Technical Analysis

The MRC Mark 5, now well-established on the British market offers down-to-earth 'conventional' circuitry without gimmicks or frills and, built to an again conventional standard, the quality of workmanship and finish is certainly good.

Transmitter

Here we find a compact P.C. board of glass epoxy – unusual for a Japanese manufactured radio where the less costly paper based material is often favoured. Clearly, there is a conscious effort here and throughout the entire system to meet the demands of modellers in western countries.

A conventional multivibrator clock generator feeds the usual string of half shots, each employing a rather nice completely enclosed preset pot to adjust the pulse length. There is also a pre-set pot to adjust the frame rate.

From the table of frame times, it can be seen that the MRC 5 has quite original timing. For instance, neutral position corresponds to 1.8 milliseconds which, commonly among digital proportional systems, represents full travel in one direction, and the pulse length variation at 1.2 milliseconds is also about 20 percent greater than 'normal'. About the only reason we can surmise for this deviation from convention is that the circuit may be easier to protect against interaction between control functions.

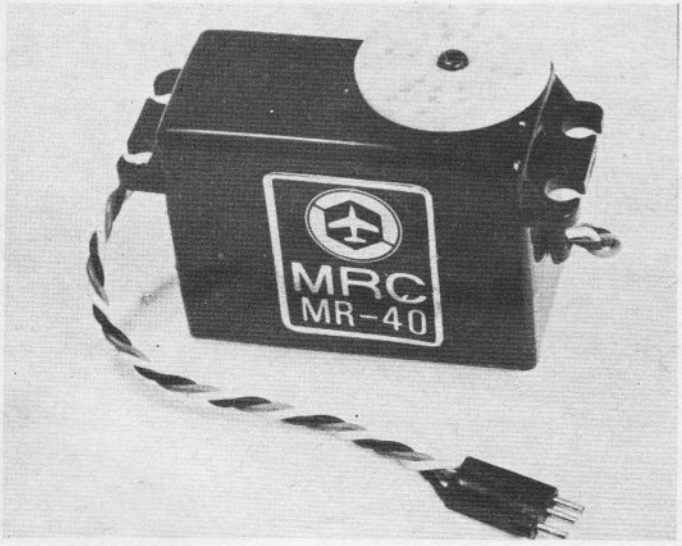
Not quite so conventional is the R.F. circuitry in that all tuned circuits employ R.F. chokes in conjunction with variable capacitors. The crystal oscillator however, has no tuning facilities, the output fed capacitively to a buffer/modulation stage (which in the American market 72 MHz version also acts as a frequency doubler). The tuned circuit in the collector is fitted with a variable capacitor and output from the buffer stage is applied to the two output transistors, which are connected in parallel. A conventional Pi (π) circuit is used, the second capacitor of which is variable for tuning. Aerial loading is an R.F. choke.

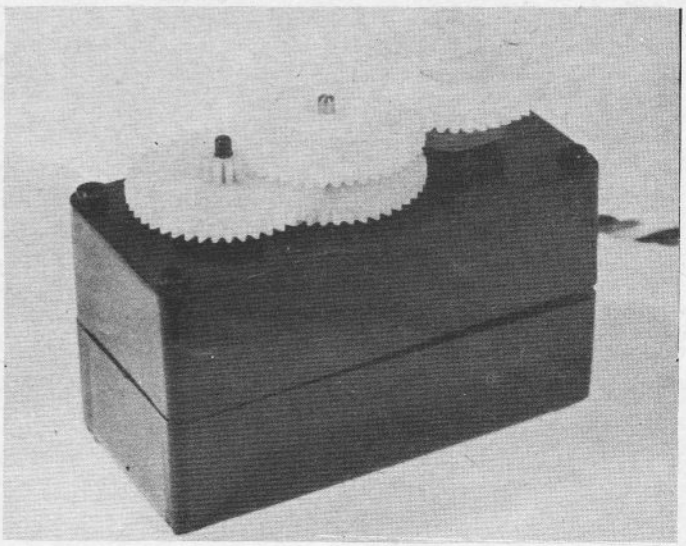
Current drain figures achieved, tend to suggest that the R.F. section of the transmitter is rather sharply tuned as the effective R.F. current almost halves between the aerial down the aerial up conditions. Lengthy transmissions with the transmitter aerial down are therefore to be avoided if the intent is to conserve battery power.

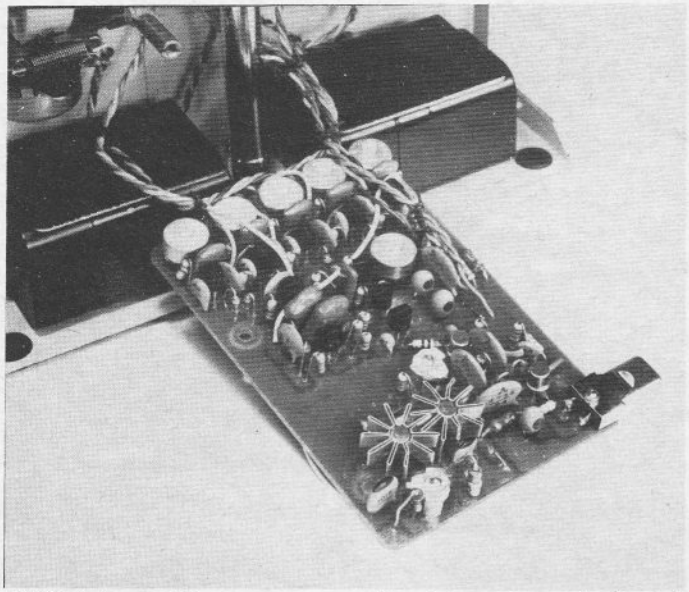
Power for the transmitter is supplied from two receiver size battery packs connected in series, so that power packs throughout the system are interchangeable.

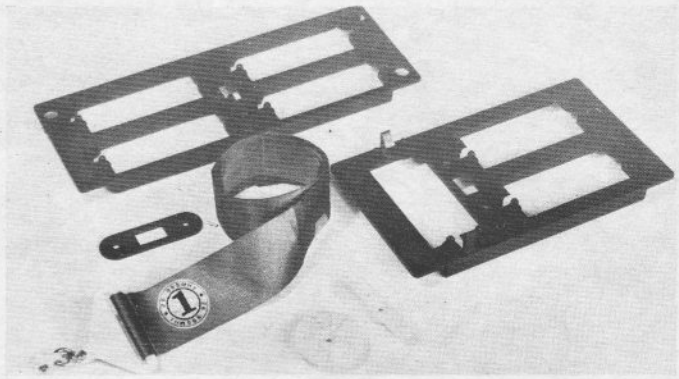
The meter of the transmitter front face monitors the battery state rather than R.F. output which we would much prefer – a point of criticism, but MRC are not alone in this practice. The plug-in transmitter crystal is marked only with the frequency and so care is required

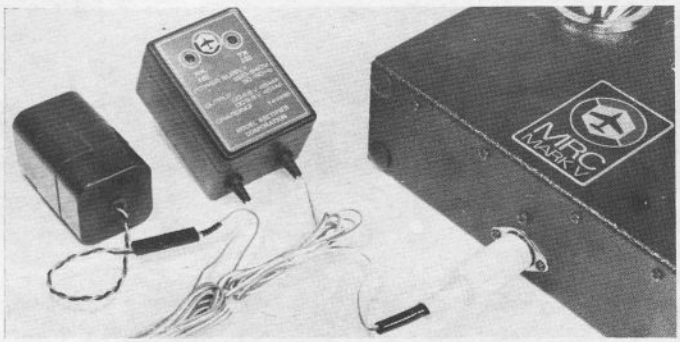
MRC-40 seams a tough, practical little servo. Case walls are quite thick as servo cases go and servo mounting lugs are reinforced with ribs. Gears also are quite deep to resist stripping of gears in the event of the dreaded 'nasties'. Servo amplifier seen below right.











MRC 5 transmitter uses conventional two piece vinyl clad folded metal case. Position of retract switch depends on mode chosen—goes next to stick with throttle function. Internal layout is simple, sparse and tidy. Crystal immediately accessible after removal of case rear cover. Top right: servo trays, frequency pennant and several servo output arms are supplied with set as is charger and harness, 2nd right.

to ensure correct identification when changing frequency, both in transmitter and receiver.

Receiver

Conventional circuitry is again in evidence. A separate crystal oscillator feeds the emitter of the mixer stage and the R.F. section uses the now familiar double tuned front end. Output from the mixer stage is to the standard two stages of I.F. amplification, both with automatic gain control applied.

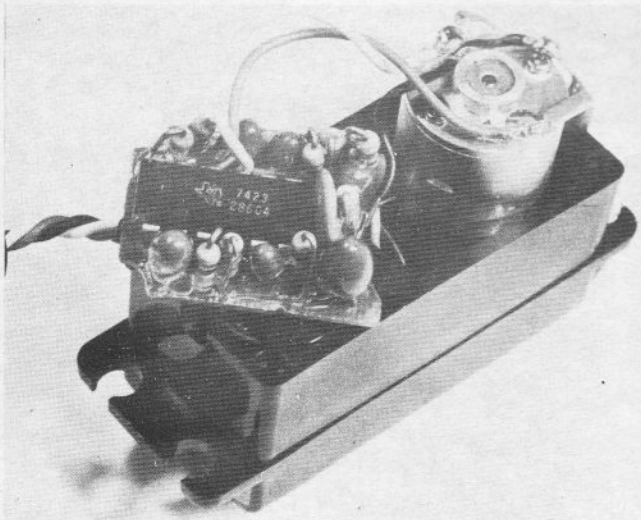
From the detector/audio amplifier stage, the signal is passed through yet another variation of the capacitor/diode/capacitor filter network before being applied to a self-biased amplifier, the output of which is further 'squared' before connection to a low power hex inverter I.C. chip in the decoder. The six inverters in the chip (74L04) are used to produce the necessary timing signals for the six stage shift register chip (74L164).

As the servos are D.C. coupled to the output of the shift register, it is necessary to have two re-set generators, the first to act as the normal sync. detector and the second to reset the shift register, should loss of R.F. signal occur (i.e., receiver on before transmitter). In such a case, it is possible that one of the outputs could come on 'high', causing the servos to rotate continually and the second reset is therefore timed to work should no pulses be present for more than 40 milliseconds (just over two full information frames).

This type of circuit has become necessary since the introduction of the I.C. type servo chip.

Servo

An interesting feature of the MR-40 servo is the use of a complete metal canned feedback pot in preference to the widely employed C.T.C.



component, and a very nice little pot it is too. The servo amplifier is neatly soldered and components are supported by a lacquer coating. A Texas SN28604 integrated circuit is the basis of the amplifier. There are no external output transistors but 18 external capacitors and resistors make up the balance of the circuit, including the two motor suppression capacitors.

Test Results

Servo Performance

Load at ⅜ Rad.	*Travel time against load*
N.L.:	.350 sec., slight undershoot.
5.3 ozs.:	.375 + .1 sec. for last 4% of direct travel.
10.6 ozs.:	.4 sec. + .24 sec. for last 8.10% direct travel.
21.2 ozs.:	.45 sec. + .475 sec. for last 10.12% (goes non-linear at 72% of direct travel.)
32 ozs.:	.46 sec. + .34 sec. for last 10.12% (goes non-linear at 72% of direct travel.)
Just stalled:	21.5 ozs./inches, or 57.3 ozs. at ⅜ RAD (3.6 lb.).
Servo travel:	CCW 40° (against load).
	CW 35° (with load).
	Trim range ± 10°.

Transmitter Control Timing

Channel	*Function*	*Short*	*Centre*	*Long*
1	Throttle (right)	1.17	—	2.39
2	Elevator	1.12	1.80	2.43
3	Ailerons	1.16	1.80	2.39
4	Rudder (left)	1.25	1.82	2.43
5	Aux. (switch)	1.19	—	2.38

Frame time: 16.8 m/s; 59.5 frames/sec., fixed.
Trim range: 0.35 m/s . . . or 28% approx.

Current drains

Tx. battery 9.6 nominal: 10.45 measured.
Tx. current aerial down: 210 mA.
Tx. current aerial up: 145 mA.

Receiver

Rx. only: 30.5 mA.
1 servo: 39 mA.
2 servos: 47 mA.
3 servos: 56 mA.
4 servos: 65 mA.

British Distributor and Service Agent

Humbrol Ltd., Marfleet, Hull.

Prices

MRC Mark 5	(with four servos) £139.50 incl. V.A.T.
MRC Mark 6	(with four servos) £149.50 incl. V.A.T.
Extra servos	£14.00 incl. V.A.T.