



R.C.M.&E. Test Report

WALTRON 4-5

digital system

Analysed by REX BOYER

WHEN Waltron Electronics first entered the R/C field some two years ago they introduced a 4-5 function R/C system at what was then the lowest ever price for a 'Full house' R/C system. We were immediately interested in this system in case some revolutionary technical features of the circuits had been composed so as to make drastic cost saving possible.

Only relatively recently have we had a chance to evaluate and test a sample of this system. So popular has the system been that demand has always beaten the supply. However, the recent postal strike enabled us to go and collect a set from the works. In fact, we also managed to prise a two-channel away from Ron Donahue while we were there which has since disappeared in the direction of one of our R/C cars. More of this later, though.

During our tour of the Waltron Workshop we discovered that virtually everything, apart from the injection mouldings, are made on the premises... rather strange to see sheet metal guillotines, folding machines and drills, etc., on the same premises as young ladies vigorously soldering up P.C. boards!

Availability of a complete set of circuit and P.C. layout drawings made technical analysis of this much easier than normal.

Transmitter

It was pleasing to find that the Tx case was nicely styled using wrap-round grey vinyl-clad aluminium main frame and injection moulded end cheeks. Sticks are *H.B. Precision* type and there is an R.F. indicator situated between the two sticks metering output to the aerial.

The Tx aerial screws into an angled socket in the top of the case forming one of the strongest aerial sockets we have seen. The arrangement of this angled aerial is generally accepted as the best for receiver reception.

Waltron do not supply a charger as part of their set - this is an optional extra. Consequently, any charger will be external to the Tx and it could be possible to connect up the leads incorrectly. To protect the system against such an error Waltron fit a diode in the charger socket so that reverse charging becomes impossible. It's a small point, but one which could save the owner a lot of expense.

Circuitry

There was nothing startling in the logic side of the circuit.

Transistors are used for the encoding side with small trim pots fitted for adjusting both the frame rate and the pulse length of the individual channels. The components for the fifth channel on our set were absent, but this does indicate the facility for 'changing-up' to the fifth function if and when desired.

The R.F. side of the Tx warrants some comment in that it is the most significant departure from current practice.

To start with, modulation is applied to the crystal oscillator instead of the more normal method of modulating the P.A. stage. Having had previous not-too-happy experiences with this type of modulation technique, we made a close study of the circuit which revealed that considerable trouble had been taken with this area of the circuit so that generation of large sidebands does not take place.

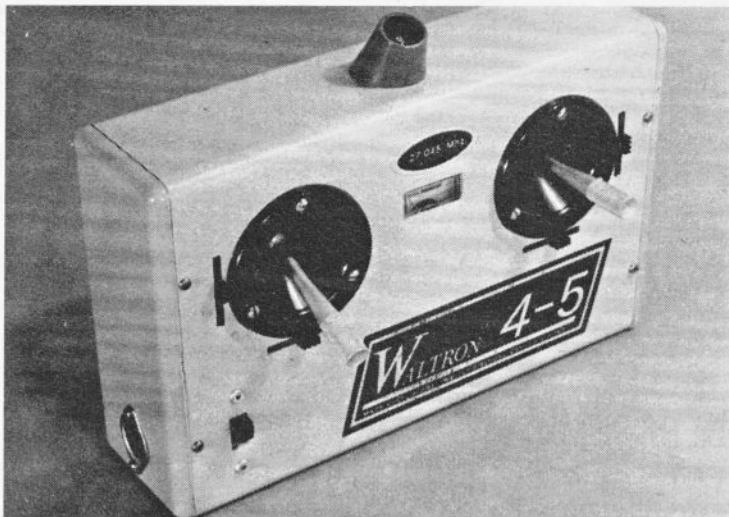
The P.A. circuit again does not follow 'normal' R/C field practice in that it is a *parallel tuned output* instead of the usual π network. However, there is more than ample R.F. power available from this 'different' circuiting. Tx Battery is by a 9.6v Eveready re-chargable pack.

Receiver

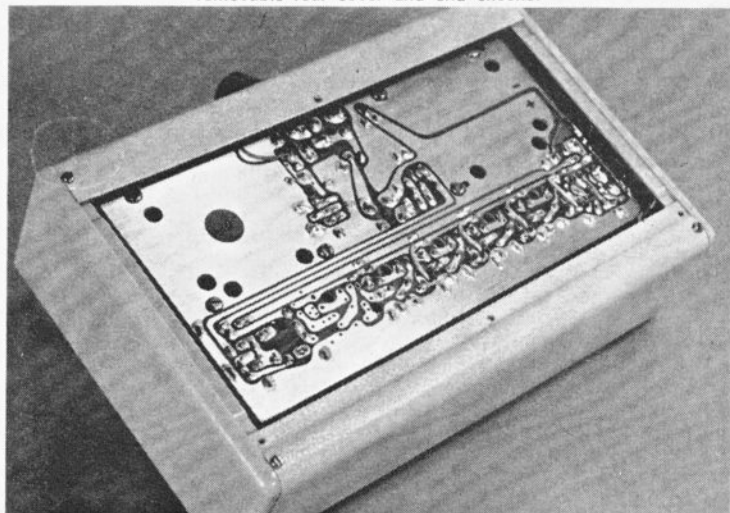
The R.F. section of the Rx is to well-established principles with amplified A.G.C. being applied to both I.F. stages. The front end is *double tuned*, inductively coupled into the mixer stage. The local oscillator, which uses a taped choke as the tuning element, is capacitively coupled into the emitter of the mixer stage. I.F. frequency is 455 KHz below the Tx frequency on all channels.

From the I.F. strip, the signal is fed via a *noise chipping* biased diode network into a rather clever *threshold amplifier*. Further transistors then do the pulse shaping and sync. detecting, the actual decoder being a conventional complementary dual transistor ring counter.

Various types of transistors are used in the Rx but the vast majority are of the *Ferranti E line* type. The servo output and the battery input are via *SLM* gold-plated plugs and sockets.



Above: current series Waltron transmitter offers choice of HB stick units or MacGregor and continues to feature trim levers on the outside edges of the Tx. case. Below: Tx. case is made up of wrap-around metal centre-body, with removable rear cover and end cheeks.



Servos

First introduced with Horizon servo mechanics, our current model has *E.K. Logitrol* push-pull servos. The amplifier circuit is again conventional, utilising the *Ferranti E line* transistors for the logic-to-analyse conversion and germanium *Mullard AC176* and *AC128* output transistors. The motors fitted to the servos are *Feruchi* type. It is possible on the *E.K. Logitrol* servos to set up the centres by the simple expedient of inserting a key in the top of the servo and turning. With the system turned on and all sticks and trims in the centre, the procedure is to adjust the key until the servo output is in the position required.

So much for the technical description. Now to a few test figures.

Transmitter
 Measured Volts 10.6 volts
 Measured Current 90 mA Aerial retracted
 100 mA Aerial extended

Frame Rate (4 functions all sticks neutral): 27 mS 37 frames/sec.

Servo timings (mS)

| Channel | Min. | Neut. | Max. | |
|---------|------|-------|------|----------|
| 1 | 1.6 | 2 | 2.4 | Elevator |
| 2 | 1.6 | 2 | 2.4 | Rudder |
| 3 | 1.6 | - | 2.4 | Thrott. |
| 4 | 1.6 | 2 | 2.4 | Aileron |

From the above, it can be seen that by comparison to most other

Tx. P.C. board bolts to the two stick assemblies to form one unit for installation into case. Charger is separate. current digital systems, the Waltron 4-5 is certainly unusual. With a frame rate of about $\frac{1}{2}$ mS of correct practice and pulse widths of about twice as long.

There does not appear to be any reason to choose these non-standard timings - it just appears to have been an arbitrary decision.

Rx

The following measurements were made on the Rx:

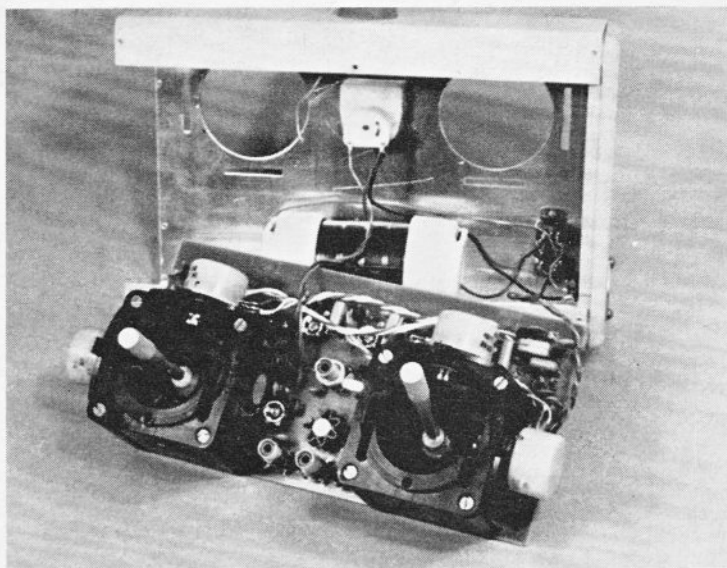
Battery Measured

| | Voltage | |
|-----------|---------|--------|
| | Tx off | Tx on |
| No Servos | 8 mA | 12 mA |
| 1 Servo | 11 mA | 14 mA |
| 2 Servos | 13 mA | 19 mA |
| 3 Servos | 15 mA | 23 mA* |
| 4 Servos | 18 mA | 30 mA* |

* These were the average setting currents. It was possible to achieve much higher currents, especially under slight load, emphasising the importance of free linkages and smooth running when the system is installed in a model.

Average running current was 150-180 mA. It might be expected that servo resolution might be impaired due to the relatively low frame rate. However, as can be seen from the response results, this does not appear to be so.

| Load | With ld. | Against ld. |
|---------|-----------|-------------|
| 0 | .425 sec. | .45 sec. |
| 4 oz. | .425 sec. | .48 sec. |
| 1 lb. | .425 sec. | .585 sec. |
| 1.5 lb. | .43 sec. | .635 sec. |
| 2 lb. | .43 sec. | .7 sec. |



Servos were just stalled at 3.25 lb. Servo travel is 0.4in. either side of neutral.

It was noticeable that there was about 5 per cent overshoot when the servo was pulling with the load.

Physical Data

Transmitter
 Size: 8 x 5 x 2½ in.
 Aerial extended: 54½ in.
 Aerial retracted: 5½ in.
 Weight: 2lb. 3oz.
 Power supply: 9.6v 500 mA.
 rechargeable pack (Ever Ready).

Receiver

Size 2½ x 1½ x 1½ in.
 Power supply: 4.8v 500 mA.
 rechargeable pack (Ever Ready),
 common with servos.

Servos

Size: 1½ in. x 1½ in. x ¾ in. (add ¼ in. each end extension for mounting lugs and ¼ in. to depth for output drives).
 Total airborne system weight: 13½ oz. with Logitrol servo mechanics.

Prices

Transmitter: four function with power pack £39.50 (add £7.00 for fifth function).
 Receiver: four function with power pack £23.00 (add £3.00 for fifth function).
 Servos: Logitrol £10.50 each
 MacGregor MR10 £10.00 each
 FB3 Fastback £10.00 each

Left: Waltron offer choice of three types of servo. E.K. Logitrol mechanics with dual push-pull output drives, shown here. Waltron's own amplifier circuit used. Below: the Waltron receiver carries R.F. circuit and decoder on one p.c. board.

