

TEST REPORT

COUGAR SERIES



It is some considerable time since we last had the opportunity to test an O.S. R/C system. Our test on the *O.S. Digitron 4* system appeared in our October 1967 edition, but since then, the O.S. digital line has undergone considerable change.

Latest in the line is the *Cougar* range of digitals which includes both two and four function systems, the latter being the subject of our analysis here.

O.S. R/C systems are available in U.K. through E. Keil & Co., and by any standards, the O.S. Cougar is highly competitive, both in price and in quality. At an accumulative price of £95, including power packs and charger, the full four function unit can hardly fail to attract price conscious modellers looking for a bargain. Add to this the fact that the system at this price is available through KeilKraft retail stockists everywhere, backed by a full service scheme, and you get the full picture.

Mechanical examination

The O.S. Cougar is very conventional in layout throughout but with a few touches of individuality here and there which maintain its identity.

The transmitter is housed in the usual two-piece folded metal case, vinyl clad in very pale tan colour. Case size is $6\frac{1}{8} \times 6\frac{7}{8} \times 2\frac{1}{4}$ in. – that is to say, wider than it is high! Typical of previous O.S. Tx. cases, there are no self tap retaining screws for the rear cover, which is held in place by dimples which key with small holes in the side lips of the case front – a neat touch of individuality. We also rather liked the way in which the aerial retracts right into the case, leaving only the stub end protruding.

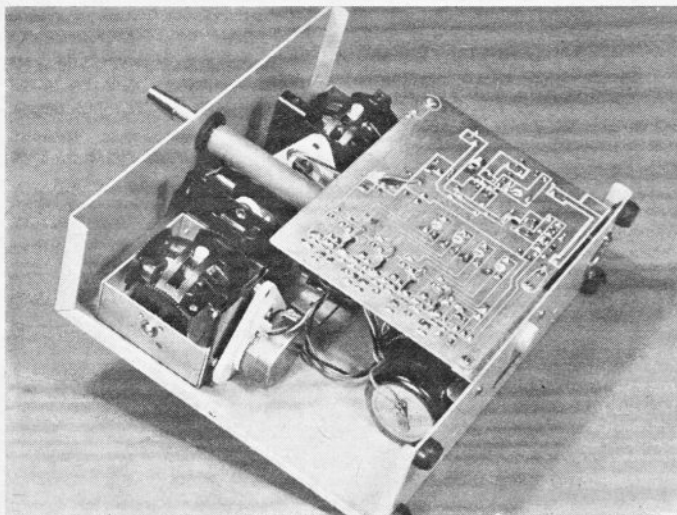
The two dual axis stick assemblies are O.S.'s own, now with somewhat longer control columns than were originally used, and with the usual electro-mechanical trim control arrangement. The trim levers on the review system had a very pleasant action, moving easily to fingertip touch, but with just enough friction to reliably hold position. The stick assemblies have an excellent 'feel' with good tight centring, and this, together with an excellent overall Tx., balance with the aerial extended makes for a very 'controllable' arrangement. The throttle function incidentally, features a ratchet action.

The Tx. front face also carries an output meter, an on/off switch with both positions identified, and tags for attachment of a neck strap. A charging socket is fitted into the case bottom.

Removal of the rear cover reveals a tidy internal arrangement with the circuit board copper side out in the bottom right-hand side. All components are individually soldered (O.S. have not yet gone over to mass wave soldering).

When the P.C. board is removed from its mounting, the sparse component layout, now so typical of modern digital proportional transmitters is revealed. Components are neatly arranged, and quite widely spread about the board. Notable were the large heat sinks of the two output transistors. The Cougar instruction book shows O.S. power packs, but these are replaced on U.K. imported Cougar systems with British *Ever Ready* nickel cadmium power packs – a substitution which helps to keep the price of the system down.

O.S. are most unusual, almost unique among current manufacturers in supplying transmitter and receiver circuits – stuck into the inside of the Tx. case rear cover. The circuits are reproduced here.



Above: rear cover of Cougar transmitter case removes to reveal neat soldering on P.C. board in bottom of case, behind which is the Ever Ready substitute power pack fitted to all KeilKraft-distributed Cougar systems. Top right: P.C. component board removed from mountings to show internal Tx layout. Stick assemblies are O.S.'s own, with excellent 'feel'. Right: detail of component layout on P.C. board. Note heat sinks on the output transistors. Unusual is the use of formers for the two large coils to maintain shape.

The receiver is enclosed in a vinyl clad metal two-piece case size $1\frac{1}{2} \times 2\frac{9}{16} \times 15/16$ in. and has its own little touch of individuality in that the case cover is removed sideways, leaving the p.c. board enclosed on three sides in a basic case frame. The circuit board slots into the frame at either end and wires to the individual servo functions and to the power pack are led out via grommets.

Again, all components are very neatly individually soldered, with components tightly, but tidily arranged on the p.c. board. Both receiver and encoder circuits are accommodated on the one p.c. We would add that, as with the transmitter, no provision is made for interchangeable frequencies, the crystals being soldered firmly into the p.c. boards on both Tx. and Rx.

One final, very practical point we very much liked on the receiver were the little identification tags on all the output leads, conveniently identifying each individual function.

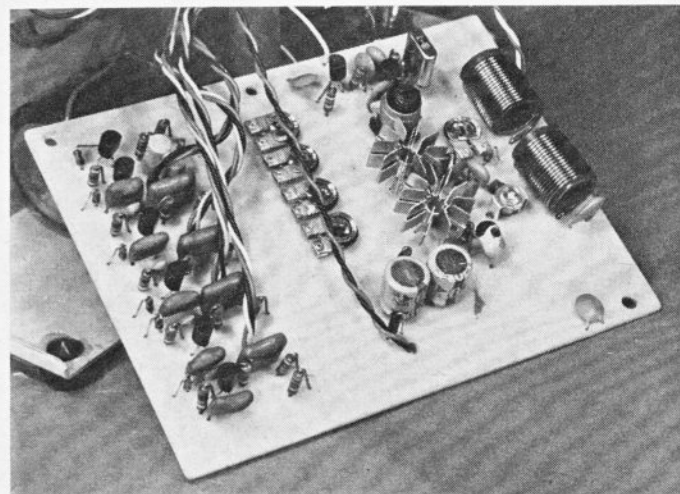
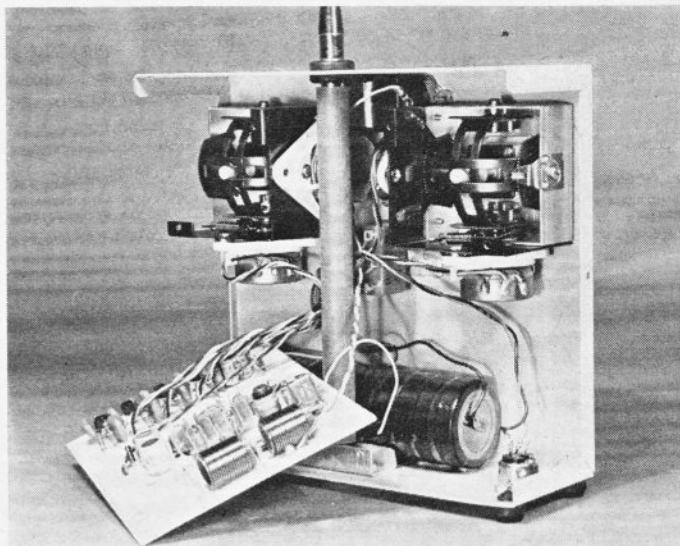
O.S. have always used servos of their own design. The Cougar uses the latest O.S. SP-260 servo mechanism which is not competitive in size with the really smallest micro-miniature units, but is, nevertheless, conveniently compact and features the common rotary output drive. Practical features we liked here were the strengthening fillets on the mounting lugs and the bridged grommet pairs. The bridge across the two adjacent mounting hole positions seems to help retain the grommets in their holes.

Another tidy design feature is the mounting of the P.C. board, neatly sandwiched between the bottom and centre servo case sections - a welcome feature we've not encountered since the days of the old Orbit PS 2 units, and so much neater than the common arrangement of amplifier p.c. board crushed into the case bottom below the feedback pot. Servos, like the receiver output lines, are individually identified as to function with small tags.

The O.S. Cougar comes complete with neck strap, frequency pennant, alternative disc output drives and servo mounting clips. Also provided is a dual output charger which charges transmitter and receiver power packs simultaneously. Unfortunately, Tx. and Rx. power packs cannot be charged individually with this charger.

Electronic analysis

An interesting departure from previous O.S. proportional systems is the use of a bottom loaded transmitter aerial. Study of the Tx. circuit will show a crystal oscillator inductively coupled to a P.A. network, where the two transistors



are paralleled, the latter feature a distinct departure from previous O.S. digitals where the P.A. transistors were connected in push-pull arrangement. Load sharing in the parallel arrangement is accomplished by two resistors in the P.A. transistor emitter lines.

The tuned output circuit is the widely used 'Pi' (π) network, into an aerial loading coil. Finite tuning of the circuit is accomplished by a trimmer capacitor connected to the output leg of the network, the loading coil being fixed tuned.

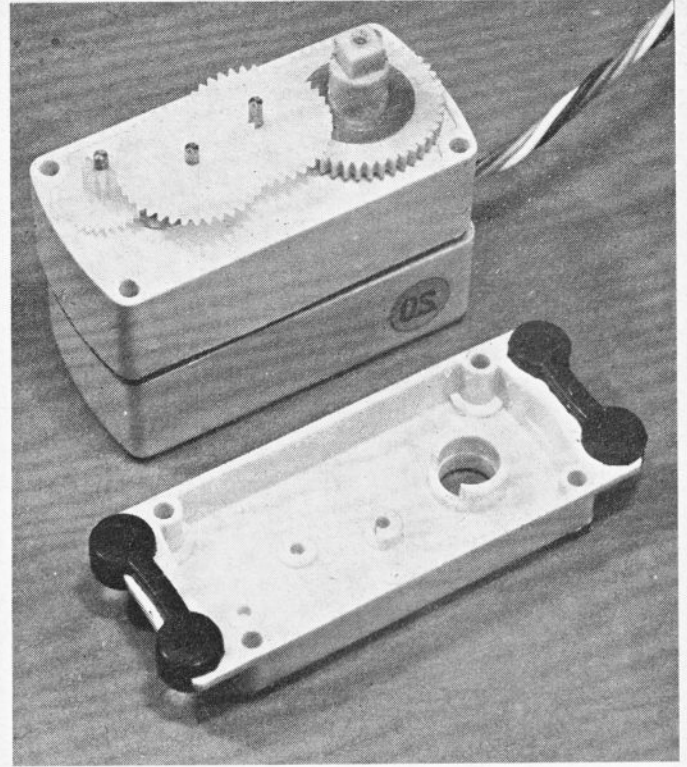
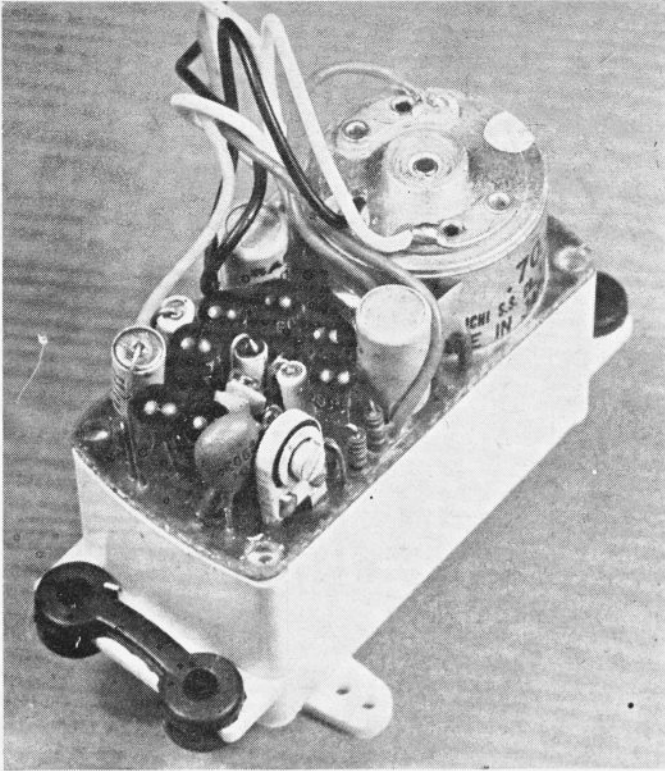
The encoding signal circuit is the usual multivibrator used to form a clock generator, fed into a line up of four half shots to produce the individual pulses.

The output of the encoder is fed to a modulation switching transistor which in turn switches the crystal oscillator. The latter is an unusual feature as it is accepted practice to modulate the P.A. stage, leaving the oscillator running.

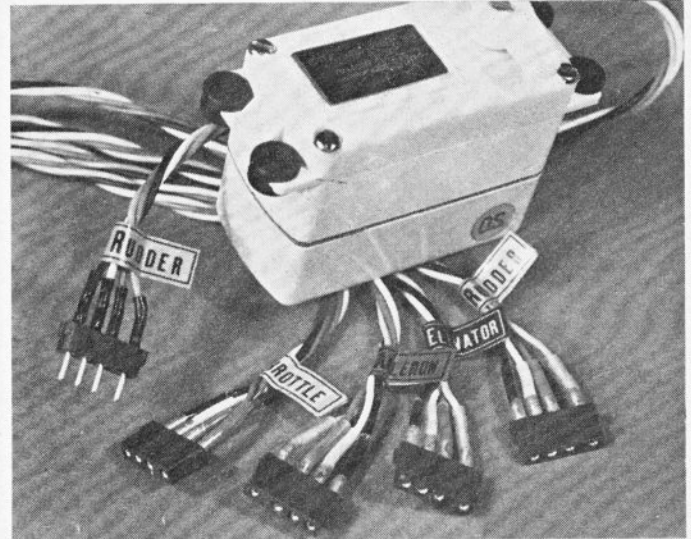
The Cougar receiver front end is double-turned in the usual way, the output from the tuned circuits being fed into the base of the mixer transistor. The local oscillator, which is fixed tuned, is injected into the emitter of the mixer transistor. There are the usual two stages of I.F. amplification, both of which have A.G.C. applied to them. Rectified I.F. signals are level-clipped by the diode network which follows the last I.F. stage. The signal is further amplified and shaped before being fed to the decoder chain. The I.F. frequency is 455 KHz.

Some O.S. originality is evident in the sync detector stage, this part of the circuit being very similar to the very first O.S. D4. The decoder uses the now common two-transistor per stage ring counter circuit and outputs, as in all O.S. Digitals are negative-going pulses.

The servo amplifier circuit is nothing unusual, electronically, but points of interest include the pre-set pot in the

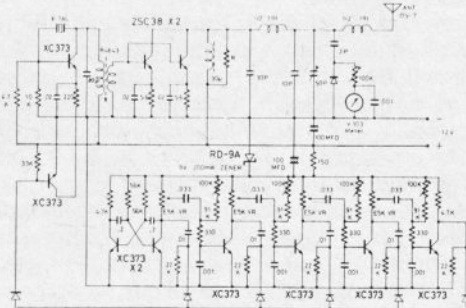


Above: the servo amplifier. Components are typically tightly-packed. Note adjuster pot and bridged grommets. See also how p.c. board sandwiches between bottom and centre body servo case members - much neater than 'crushing' into case bottom. Top right: the simple gear train of the O.S. SP-260. Test figures suggest excellent efficiency. Right: connectors on both receiver output lines and on individual servos are clearly identified as to function with small tags.

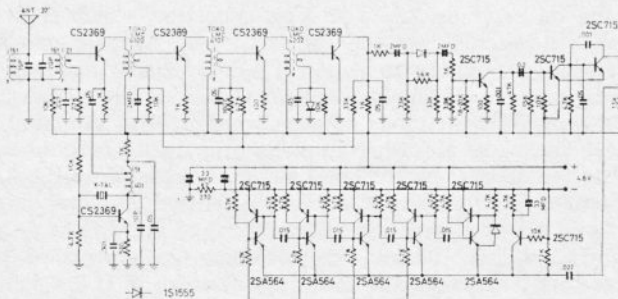


O. S.

**DIGITAL PROPORTIONAL SYSTEM
DIGITRON DP-4P
TRANSMITTER DPT-4P. T4005**



RECEIVER DPR-4P. DPR-4SG2



OGAWA MODEL MFG. CO., LTD.

monostable which permits variation in centring and servo travel at a touch. Also of note is the use of Germanium output transistors and of 1/20th watt resistor to avoid overcrowding of the component board.

SYSTEM PERFORMANCE

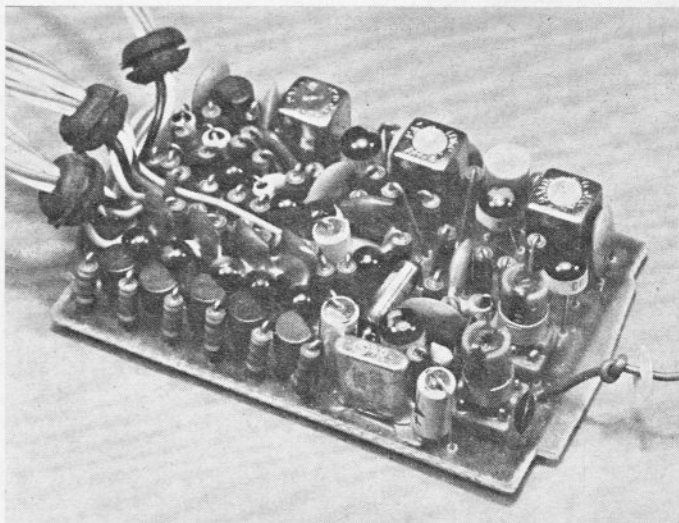
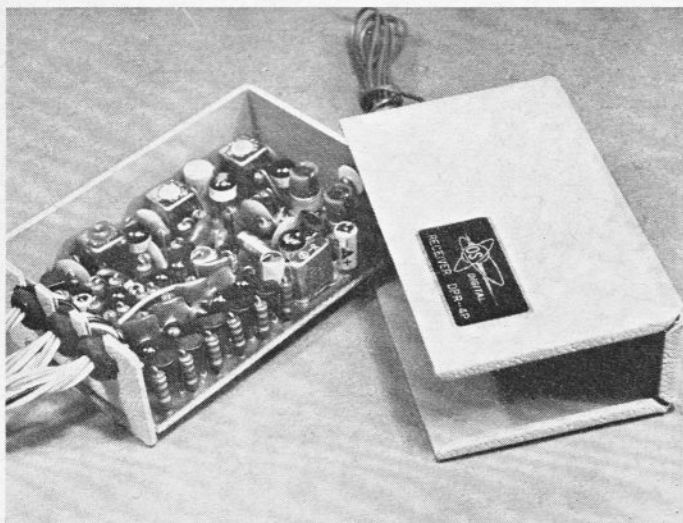
Transmitter encoding timings.

Power supply: 12v. nominal, 12.1 measured on load.
Currents: Aerial retracted 72 mA
Aerial extended 70 mA

Encoding timings.

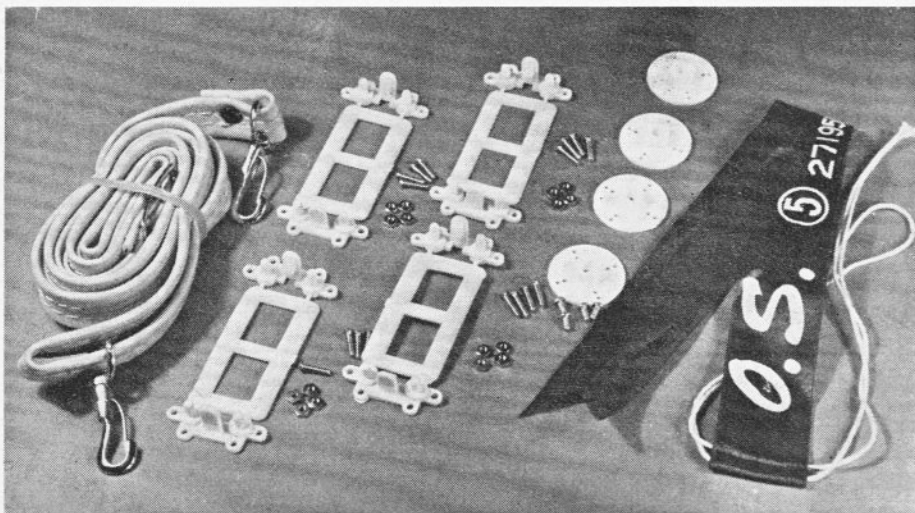
Channel	1 throttle	2 aileron	3 rudder	4 elevator
Min	1.2	1.2	1.15	1.2
Neutral	—	1.55	1.5	1.55
Max.	1.9	1.9	1.9	1.9

All times in milliseconds.
Trims movement covers 0.2 milliseconds.
Frame time: 20 m/s at 50 frames per second, constant.



Top left: The receiver showing how the case cover removes sideways to reveal P.C. board in three-sided case frame.

Top right: The receiver/dedoder P.C. board showing component arrangement. Left: The O.S. Cougar comes complete with these accessories - neck strap, servo mounting clips, disc output drives and frequency pennant.



Airborne system power consumption analysis.
Battery: 4.8v. nominal, 5.1 measured on load.

	No signal	signal
Rx. only	9 mA	10 mA
with 1 servo	—	15 mA
with 2 servos	—	20 mA
with 3 servos	—	25 mA
with 4 servos	—	28 mA

Average running current (4 servos) : 200 - 250 mA
Current with 1 servos stalled : 600 mA

Servo performance on load.

Load at $\frac{3}{8}$ Rad.	Travel against load (seconds)	Travel with load (seconds)
0	0.45	0.44
2.7 ozs.	0.465	0.43
5.5 ozs.	0.475	0.44
8.0 ozs.	0.51	0.43
10.5 ozs.	0.54	0.4
13.5 ozs.	0.565	0.375
16.0 ozs.	0.625	0.37

Servo just stalled at 40 ozs. $\frac{3}{8}$ in. RAD. From the above table it is seen that the servo is extremely linear in the speed/load tests suggesting a good gear box efficiency.

The servos oscillate with approximately 2 per cent overshoot in either direction under the higher load conditions.

Conclusions

Both mechanically and technically, the O.S. Cougar is a good example of a modern, up-to-date digital proportional R/C system. The mechanical design is sound and the electronics of the system do not display anything wildly unusual. Though not contributing anything new in electronic design for R/C, the circuitry does not attempt to cut corners electronically and can be considered sound and reliable.

Workmanship throughout can only be described as excellent and this, coupled with the very low selling price as mentioned at the start of this analysis can only make the O.S. Cougar a most attractive system to those modellers either buying for the first time or re-equipping.

British Distributor and Service Agent

E. Keil & Co. Ltd.,
KeilKraft Works,
Russell Gardens, Wick Lane,
Wickford, Essex.

Price structure

Transmitter and receiver (including power pack and receiver switch harness)	£55.00
SP-260 servos	each £9.00
Charger type C-14	£4.00
Total accumulative price for four-function system	£95.00