R.C.M. & E. Test Report

G-45 MICRO-SPACE

Digital proportional system

by Rex Boyer

THE G.45 Micro space digital proportional system from Japan, now available in U.K. through Mann Models, has created more than just a slight stir of interest, partly for its distinctive appearance and, not surprisingly, due to its highly competitive pricing.

Consequently, the early arrival of a complete, four-function unit for test analysis has enabled us to introduce this test report while interest and speculation about this system are high.

The total complement consists of Tx, Rx, four servos of Micro's own manufacture, plus battery pack. The set is offered with choice of either 'dry' or Ni-Cad power pack for the airborne system. Also supplied with the full four-function system are two servo trays, a frequency flag and a neck strap.

As one of the current series of lower-priced systems at present on offer, the technical standard of circuitry obviously comes in for close scrutiny, so if the price is low, how does the manufacturer achieve it?

First, let us say that there are no circuitry short cuts. Technical specification is up to current standards and quality of components is also satisfactory.

How then do they do it? The answer, without a doubt, lies in mass production, and very cleverly engineered mechanics, which eliminate such components as little screw brackets, etc. that cost time and money to make and put together. In fact, study of the unit indicates that a lot of intelligent thought and time has been spent on its design.

The Tx is certainly the most 'different' and distinctive part of the system. Unusually styled in two colours, it is a two-part injection moulding in rigid plastic. The control sticks are integral with the front half of the case, while the rear half is but a cover for the works and carries location runners for the battery pack.

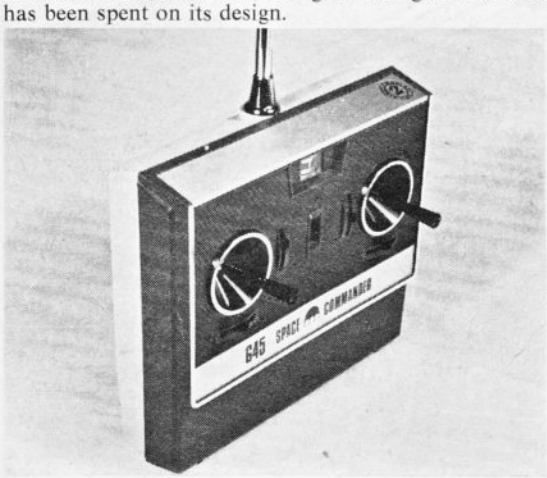
The P.C. board is set in the centre of the case, copper side out and appears to be flow soldered. It is also one of the smallest four-channel P.C. Tx boards we have seen . . . and, here is perhaps an insight into the production concept of the system . . . after all, P.C. boards cost money, so the less of it you use, the cheaper it is!

Because the case is plastic there is no need to provide an insulated aerial bush. In the G.45, the aerial passes through the rear case of the Tx and screws directly on to the P.C. board.

Power for the Tx is derived from eight pen cells providing a nominal 12v. supply. There is provision in the case to substitute rechargeable cells if desired and a charger socket and an indicator light are fitted but not wired.

The meter on the front of the Tx monitors the supply voltage, and provided the needle is in the 'green' area, the system is safe to fly.

Like the transmitter, the receiver/servo system is



Below left: the distinctive part of the G-45 system is certainly the transmitter with its moulded case which is surprisingly tough. Below: the Tx rear cover removed to reveal internal layout. Note small area of P.C. board.

designed to operate from a 'dry' battery source, and so it is not surprising to find that the Rx is zener diode stabilised to avoid the ill effects of slow and more linear voltage reduction which is characteristic of dry batteries.

In the test results at the end of this analysis you will find test figures both with the dry battery pack and the Ni-Cad pack.

The servos of this system are quite unconventional in design and two sets of output arms are supplied.

'Dry'-V-Rechargeable

Before going on to the technical description of each item, perhaps a few words on Ni-Cad-v-'Dry' batteries would not come amiss as we are aware of several other systems which will in the future be offered for 'dry' battery operation.

In the early days of digital proportional R/C systems, great efforts were made to ensure that the voltage supply to the pulse generator remained constant. To do this, zener diode/transistor voltage regulation was incorporated and since at that time the prices of zener diodes were high, this made a significant effect on the total cost of the finished product.

Now, the very flat discharge characteristics of the Ni-Cad batteries was just about as good as a zener, hence the demise of the zener diode in the Tx. The only other criticism was the low internal resistance of a Ni-Cad as compared to the then current dry batteries.

Modern, realistic prices of zeners, etc., coupled with better electronic design and the current high output dry batteries, have now overcome those early problems, so dry batteries in the Tx are most certainly perfectly acceptable.

With regard to the Rx, we have the problem of a difference in nominal voltage between Ni-Cads and 'dry' batteries, i.e. 2.4v-0-2.4v (Ni-Cad), 3v-0-3v (dry battery). In addition, we have loads varying typically between 50 mA and possibly 500 mA. Because the voltage from the dry cells varies a great deal more with load than that of Ni-Cads (due to the higher internal resistance of the Dry batteries), much more attention to circuit stability has to be built in, but, as the G.45 proves, it is possible to do this successfully.

The one real saving grace of the dry battery-v-Ni-Cad battle is that, unlike Ni-Cads, the voltage level of the dry battery drops away during use at a much more linear rate than that of a Ni-Cad and consequently, it can be argued that it is easily possible to see the servos slowing down before failure occurs, whereas the Ni-Cads, if taken to the limit, result in a drastic fall off in voltage level, possibly in mid-flight with obvious results.

Technical analysis

So much for the pros and cons of various battery packs. Now on to the technical stuff.

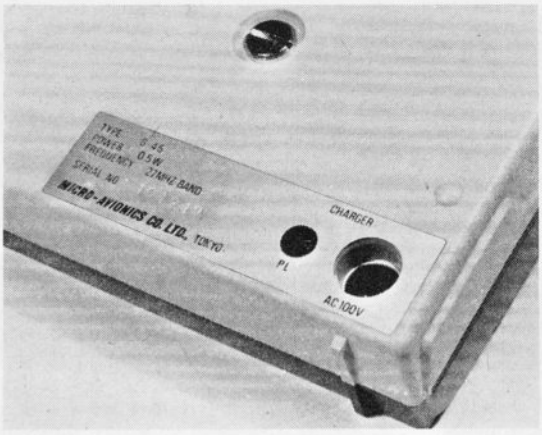
Tx.

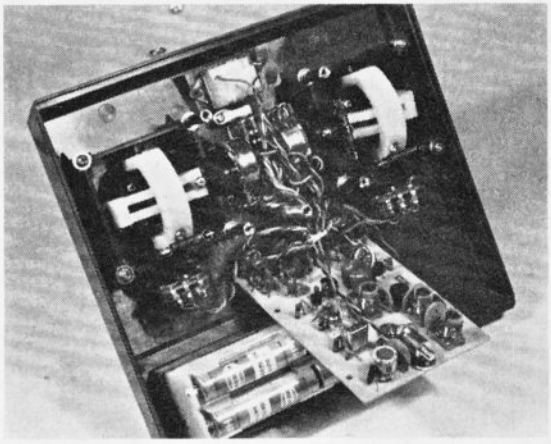
This consists of a conventional multivibrator clock generator followed by the usual chain of half shots. Plastic 'Silec' type transistors are used throughout the logic of the Tx.

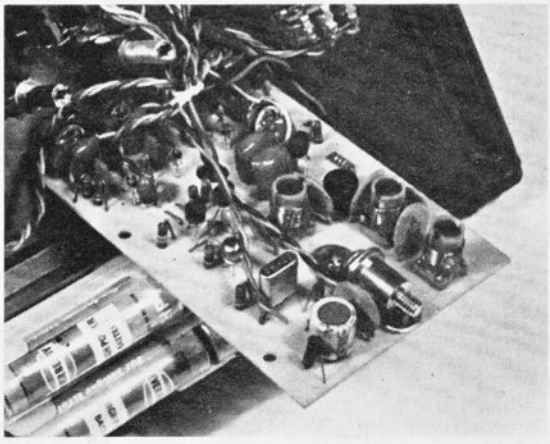
The crystal oscillator is conventional but the P.A. stage is of the 'parallel tuned' type as distinct from the now much more common π output stage. The aerial is base loaded.

Rx.

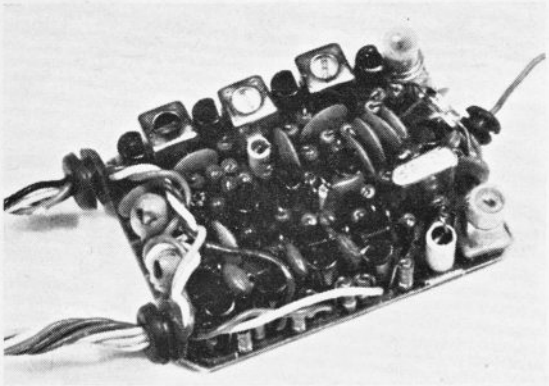
Here again we found conventional circuitry with separate crystal local oscillator and double tuned front end. The decoder is of the double transistor







Top: close-up of Tx rear cover showing single screw fastener which retains rear cover, plus unused charger socket and charge indicator. Centre: P.C. board removed from mounting reveals stitch unit layout and neatly arranged interwiring flyleads. Above: close-up of the P.C. board component size.



type and 'Silec' plastic silicone transistors are used throughout. The output has positive going pulses.

Servo

This uses Micro Space mechanics, with rotary output and in physical size is comparable to the *S.L.M.*, MacGregor MR10, etc. It uses the small 16 mm type motor and these certainly accelerate quicker than the bigger 22 mm type (due to the smaller mass of the armature) and also run faster.

One other advantage is that for a given case size they give a lot more P.C. board area, enabling 'normal' size components to be used instead of very specialised micro miniature types – another factor which has direct effect on product cost.

The amplifier board is trapped between the servo body proper and the bottom case, a more positive mounting system, we feel, than the current normal practice of 'stuffing' between a couple of layers of sponge plastic. The servo amplifier circuit employs seven silicone 'Silec' transistors and a Germanium output pair.

General

All the P.C. boards, as is the airborne complement, are generously coated in Polyurethane varnish, which holds all parts very rigidly in place. We would not expect long-term vibration to effect this set up.

Test results

Now to the test figures. As can be seen, the results for both dry batteries and Ni-Cads are given. In each case, the servo loads quoted are being pulled on the $\frac{1}{8}$in. radius point on the servo output disc.

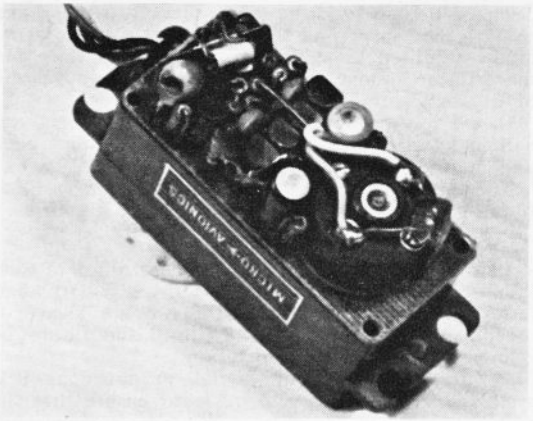
Load in oz./in.	Dead weight load at $\frac{1}{8}$" Rad.	Dry Batteries Time Against (sec)	Dry Batteries Time with (sec)	Ni-Cads (500 DK2) Against load (sec)	Ni-Cads (500 DK2) With load (sec)
1	2.65 oz	0.64	0.61	0.66	0.62
2	5.3 oz	0.65	0.56	0.68	0.58
3	8.2 oz	0.67	0.55	0.70	0.55
4	11.0 oz	0.75	0.5	0.75	0.55
8	21.0 oz	1.1	0.47	1.1	0.48

Servo travel is ± 40 degrees.

With either battery pack the servo stalled at 38oz. (10½in./oz.)

Airborne power pack Current consumption With Tx. ON

No. of servos	Dry Battery	Ni-Cads
Nil	10 mA	8 mA
1	18 mA	12 mA
2	24 mA	21 mA
3	32 mA	32 mA
4	40 mA	36 mA



Above left: the G-45 receiver and decoder circuits are arranged on a single p.c. board, allowing a neat and compact slim line receiver unit. Above: The servo amplifier layout in normal arrangement in case bottom, beside servo motor.

Average running current was 200-250 mA with 4 servos, moving.

Tx frame rate timings

Frame length: 16 ms (62 frames sec.)

Function	Low	Neutral	High
Aileron	1.3 ms	1.84 ms	2.25 ms
Throttle	1.25 ms	–	2.4 ms
Elevator	1.25 ms	1.7 ms	2.25 ms
Rudder	1.25 ms	1.75 ms	2.25 ms

All trims centre

Tests were made to see how low the Tx batteries would go before the pulses/output was affected.

The Tx output meter is divided into green, red and black segments, the green segment being at the top of the voltage scale. The meter needle dropped into the 'red' at 9v (measured) but the pulse lengths were not affected, and continuous running of the Tx indicated that the needle could just about drop on to the 'black' before the pulse train became distorted. At this point the measured voltage level of the Tx power pack was just under 8v. We *do not*, however, recommend that the system be used to operate a model under these conditions, the R.F. output had fallen considerably at this stage.

As a matter of interest, Tx current on 12v was 150 mA and at 9v it was 130 mA.

Just supposing that the Encoder and Xtal oscillator take 30 mA (which is realistic) then in the 12v case, the input into the R.F. and P.A. is 1.2 watts and at 9v 900 mw, indicating an output drop of 25 per cent.

Conclusions

As can be seen, the G.45 shows up well in the performance figures and at the very competitive price of under £100 must be a good buy.

British importer and supplier

Mann Models Ltd.,
Mann House,
Alcan 2,
Ballasala,
Isle of Man.

Prices

Transmitter : £28.84
Receiver : £23.11
Servo : £11.00 (each)
Receiver Harness and Power Pack : £4.00