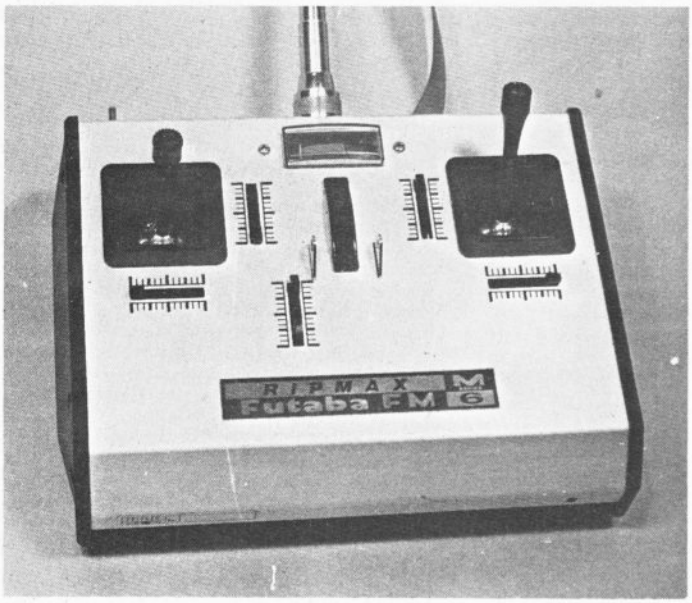
RIPMAX Futaba

TEST REPORT FM6

by REX BOYER .....



JUDGING by outward appearance the *Futaba FM* (Frequency Modulation) system is just another example of badge engineering. The size of the Tx is virtually identical to the M series AM (Amplitude Modulation) system but features an anodised finish instead of the vinyl clad aluminium.

All the rest of the Tx hardware remains the same, even the meter still reads battery voltage instead of RF! There is no buddy box socket.

Receiver physical construction is virtually the same as for the AM system. We did note that the plugs now have a small indent on their edge in addition to the staggered pins, this does improve the self polarising aspect of the plug and socket system as it was just possible to plug in the earlier plugs the wrong way; agreed it took force.

The system supplied for test featured the new FD26 servos, (see the technical description for a full report). Sufficient to say at this stage that they are a worthwhile development over the earlier series excellent as they were.

We must congratulate *Futaba* on the continual improvements to the servos they produce, although not cheap by comparative standards this servo offers a high degree of mechanical excellence.

Technical description
Servo Type FD26

This latest model of servo from *Futaba* offers yet further technical refinements, the gear train has been altered yet again from previous types. The early stages of the train are very similar to *Kraft* in layout and construction and also reminiscent of *Logictrol*. The major differences being what we feel is one of the biggest technical advances in output gear design in that the teeth are not of the usual straight cut spur type but are helical with a helix angle of approximately 25°.

The use of helical gears offers two advantages, firstly an increase in strength as more than one tooth is in contact at any one time, secondly one which does not really benefit the performance is silent running (most motor car gear boxes employ helical gears for this reason).

Looking more closely at the output gear we find that instead of being mounted directly onto the feedback pot shaft it is mounted on, what at first sight appears to be a 'dead' spindle but on further examination is in fact positively located to the output gear by a hexagon section. The bottom bearing is located in the centre section of the servo mouldings. The output gear has a further very fine toothed gear integral with it, which in turn drives the feedback pot via its own metal gear. There is a step up in ratio between the output gear and the feedback pot; this of course offers advantages in that the rate of change of resistance and total change of resistance is greater than if coupled directly to the output gear. In a nutshell the servo loop response can in theory be much improved. We were disappointed to find the feedback pot to be of the sprayed track paper based paxoline type. Surely the technical excellence of the rest of the servo merits the use of a good quality feedback pot.

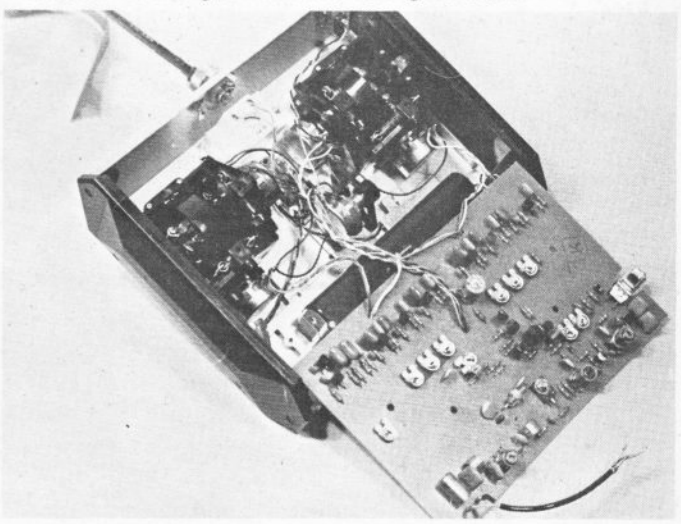
The servo amplifier is of the standard *Futaba* pattern with two in-line i.c. chips as described in 'Servo tests' (*R.C.M.&E.* May 1978), the motor is of *Orion* manufacture, 16mm in diameter.

Construction of the servo case has changed in that it is held together by four screws fed up through the bottom case.

The FM repeats the construction of the earlier AM 'M' series, the circuitry however being FM is entirely different.

Front end tuning of the mixer would appear to be fairly conventional with a small RF choke in the aerial which we assume offers some form of base loading. The usual diode to prevent front end saturation is present as are the double tuning coils which are mounted in screening cans. The local

Left: Futaba's FM series Tx features similar stick mechanisms to the AM, smooth easy action with no slop. Below: P.C. board removed from the case to show all discrete component design. We had to unsolder the aerial connection to obtain this picture, stick modes can be changed without removing the board



oscillator is also equipped with a tunable coil instead of the usual choke arrangement.

Instead of the conventional I.F. strip the Rx is equipped with two i.c.s. of *Siemens* manufacture, types SO41P which are used in conjunction with a ceramic filter unit, the I.F. frequency is the usual 455 K Hz. The necessary I.F. amplification is done in the i.c.s. Remember in an FM system there is no AGC (Automatic Gain Control) but a limiter and a discriminator. AF amplification is achieved in what appears to be a dual transistor. The AF side of the Rx and the usual Sync detector uses transistors and discrete components before the signal is fed to the usual shift register for decoding to the servo outputs.

The circuit employs the now familiar *Futaba* Series regulator circuit for the front end of Rx.

The P.C. board and circuitry is very neat and of high quality construction, the best we have seen for a good many days.

Transmitter

With all the modern technology assembled into the Rx and Tx circuit we were a little surprised to see the Tx circuitry using all discrete components, which incidentally necessitates a fairly large P.C. board just to get all the components on, not that this in any way degrades the circuitry, it just seems an expensive way of doing it.

The encoder circuitry is the very familiar chain of half shots with a multi-vibrator clock. All channels are adjustable for length as is the frame time. variations from standard *Futaba* AM come in the RF section.

In order to achieve the 2KHz frequency shift the oscillator circuit is run at 13.5 MHz, i.e. ½ 27MHz and the crystal is 'pulled' by the addition of a variable capacity diode (Varicap) effectively across it. These diodes change capacity with voltage applied across them so if we make the modulator apply and remove a voltage we can frequency modulate the basic carrier signal. The reason the oscillator is run at half the transmitted frequency is that there is a limit to the amount you can 'pull' a crystal from its basic frequency before it stops working. If we tune it at half frequency, when doubled to transmit, the amount we have pulled it also doubles, i.e. 3 K Hz deviation at 27M Hz is 1.5 K Hz at 13.5MHz..

This feature is not exclusive to Futaba, most FM systems at present on the market include this feature.

Moving up the RF chain we find the necessary frequency doubler stage, followed by the P.A. transistor and a double output stage with base loading. Only one of the π stages is tunable by a slug, the rest are fixed tuned by air spaced coils — a nice feature.

One unusual point we noted was the Tx aerial is fed via a short piece of coaxial cable, perhaps this is to prevent RF getting into the encoder logic?

Performance

As expected the *FD26* servo gave a good account of itself. Even at extreme loads the amplifier only just began to come out of saturation. It also proved to be comparable with the best with regard to stalled torque.

The linearity of response to load is better than its predecessors the *FD16M* etc., which would seem to make the geared-up feedback pot a worthwhile choice.

Travel of the servo proved to be extremely linear, in fact the best we have seen.

FD26 servo response with FM Rx/Tx

Load ozs. ⅜ Radius	Torque oz./ins.	With load	Against load
0	0	.36	.4
5.34	2	.3	.35
10.68	4	.3	.38
16.02	6	.28	.4
21.36	8	.29	.44
32.00	12	.27	.5 (+.1)
42.72	16	.28	.47 (+.15)
53.4	20	.33	.72 (+.21)

All times in seconds, times corrected for 75° *total travel.* Actual travel ‡44° – 44° TRIM + 12° – 9°. Figures in brackets are the additional times the servo required to finally reach the correct position from the extrapolated position given in full figures. Just stalled Load — 26oz/ins. or 69.42ozs. at ⅜ RAD.

Transmitter timings

Channel	Function	Minimum	Centre	Maximum
1	Aileron	.84	1.3	1.7
2	Elevator	.84	1.3	1.74
3	Throttle	.80	—	1.72
4	Rudder	.8	1.3	1.76
5	Auxiliary 1 (Proportional)	.65		1.9
6	Auxiliary 2 (Retract)	.68		1.84

Frame rate 18.2 m/s (54 Hz)
Trim ±.1 m/s.

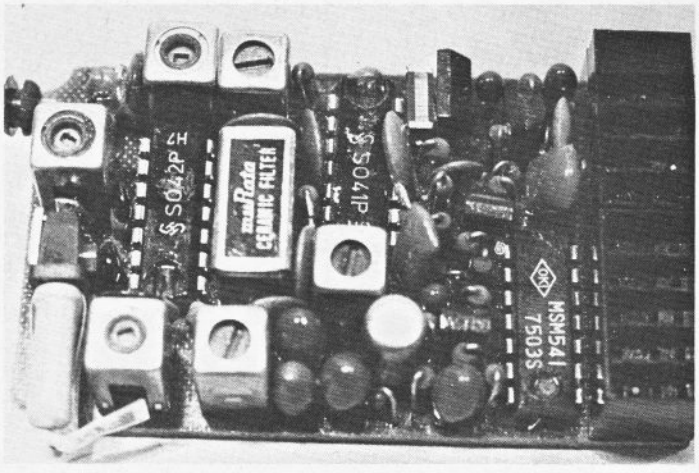
It can be seen that the control timings are very equal throughout the range. The total movements are not quite linear about the central timing.

Conclusion

In a sentence, surely one of the best presented, engineered and performing pieces of equipment presently on the market.

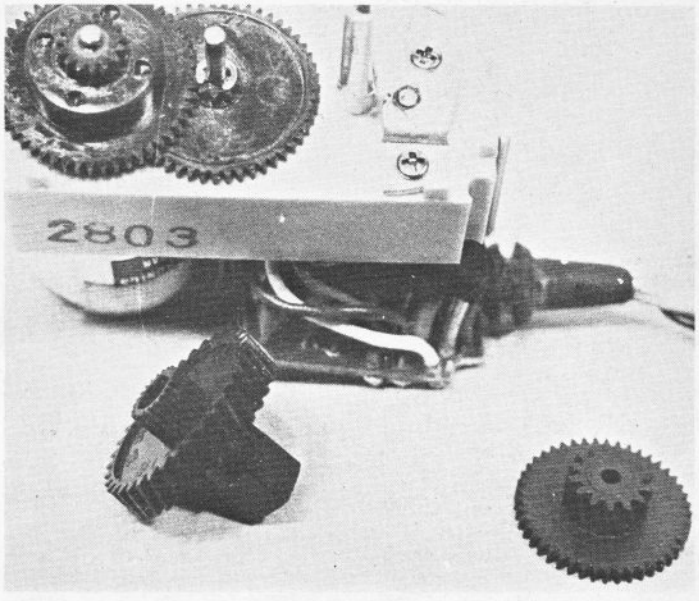
Footnote

Prior to publishing this review we forwarded copies of Rex Boyer's comments regarding the FD26 servo feedback potentiometer to Futaba who claim that despite appearances the type of potentiometer fitted has proved to be entirely satisfactory both in life and performance. (Editor).



Above: single deck receiver employs ceramic filter plus two i.cs for the front end. Output block connector is soldered directly onto the P.C. board.

Above: FM receiver is similar in size and layout to the AM but crystal is differently positioned. The socket labelled SxC is for remote operation of a throttle servo via an accessory not yet available. Below: hefty helical output gears mounted on a robust shaft are features of the 26m servo.



Make it Legal . . . get your R/C licence!

Just in case some newcomers to the hobby are not aware, operation of radio control equipment requires a licence. This costs £2.80, but it covers a five-year period, so at 56p per year, the licensing fee can't be described as expensive. Licence application forms are obtainable from: *The Home Office, Radio Regulatory Dept., Waterloo Bridge House, Waterloo Road, London, S.E.1.*