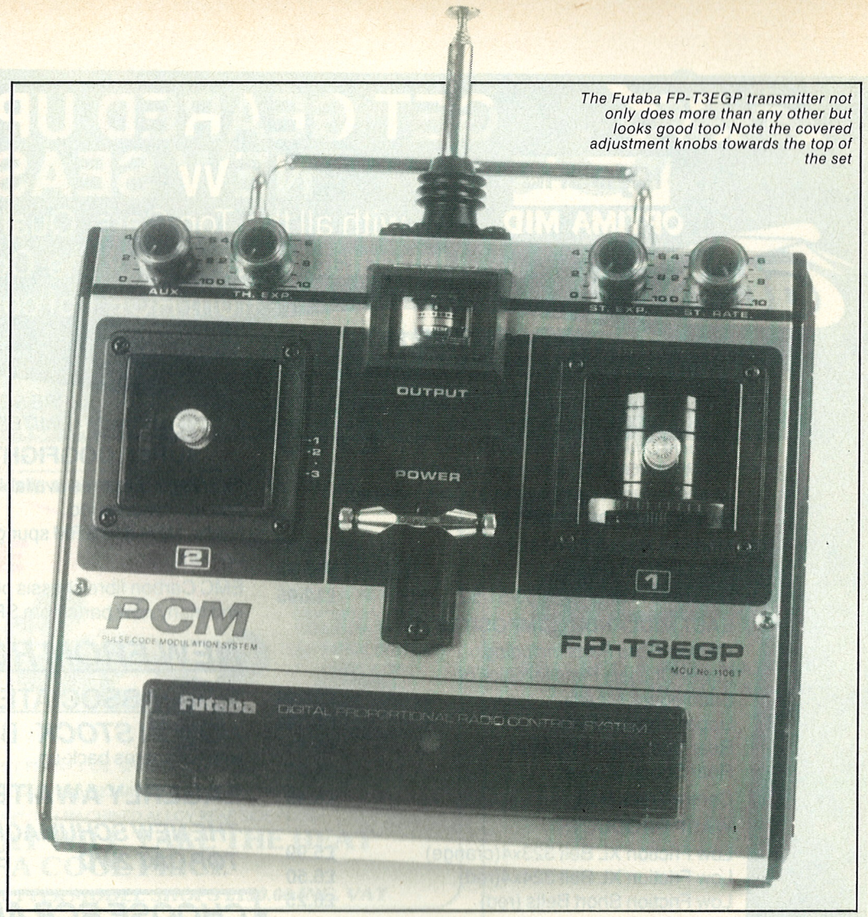
John Chamberlain reviews a top range radio system for cars



The Futaba FP-T3EGP transmitter not only does more than any other but looks good too! Note the covered adjustment knobs towards the top of the set

P·C·M
PULSE CODE MODULATION

For the last six months, I have been very privileged to have had the use of this new generation of purpose designed, fully specified radio control system featuring an industry first Pulse Code Modulator microprocessor in both the transmitter and receiver to ensure the minimum possible effect from signal noise and dead points. Whilst this system has been available for some time in the multi channel *Futaba* systems, this is a totally new concept in a three channel radio designed specifically for model car and boat operation.

The review set has been installed from day one in a *Kyosho* 'Burns' 1/8 Rallycross car and also seen service in the *Kyosho* 'Fantom' 1/8 circuit car and during the season has travelled to Italy and Denmark for the World and European Rallycross Championships in addition to having been used in all the BRCA Rallycross rounds, two team races and some club racing. A daunting and testing programme indeed and one can assume if it can handle a programme like that without problems, then it is a worthy set indeed!

By now you are probably wondering what the *Futaba* 'PCM FP-3EGP' outfit is all about and with a technical specification that runs to 17 pages in the *Futaba* manual. I think it's time we set about unravelling its marvels.

The FP-T3EGP transmitter

Beautifully presented in a gold anodised finish it looks superficially similar to the older *Futaba* '3EGX', featuring twin, adjustable length metal sticks with provision to alter the neutral position of the throttle stick, electronic throttle and steering trimmers, four function adjustment knobs with protective flip open covers along the top of the case front, and a long panel cover along the lower front of the case. On the reverse of the transmitter case is the detachable RF module available in 27 and 40MHz among others, which as normal also holds the transmitter crystal.

Returning to the front of the transmitter, at the top of the case, either side of the battery level meter are the four covered adjustment knobs. From left to right, these are the third channel auxiliary knob. Throttle exponential knob, steering exponential knob, and finally the steering rate knob. The first of these, the third channel function is probably only of benefit to the boating fraternity who might use it to control trim tabs or similar. The throttle exponential knob can perform a whole lot more useful function for us car boys. Moving the control knob from the O (off position) to the maximum position 10 changes the way in which the throttle servo reacts to a given movement of the throttle stick. In the 'O' position, the servo gives a totally linear response to the throttle stick, but as the exponential knob is rotated towards position 10, the first half of the throttle stick travel will produce less servo movement than the second half of its travel. In addition, a three position switch under the main control flap offers further fine tuning of the way in which this facility can be used. Position one is the setting most will use as it is used when the throttle stick neutral is set at the centre position on the front the transmitter. In this setting any exponential dialled in will only function on the "throttle up" side of the stick travel, leaving the 'braking' side of the stick movement in linear mode only. For those drivers who prefer to drive with the throttle stick neutral positioned in the 2/3 lowered position, but would still like the facility of exponential throttle up but linear braking travel, then just select position 2 on the switch. For anyone who runs with the throttle stick neutral set in the lowest position and wants exponential travel on the whole stick movement, then the position 3 is selected. Whew! What this means in practice is that if you are racing and you find that you have more power than grip when accelerating away from a slower corner, simply dialling in some exponential on the control knob will reduce the power available on the initial movement of the throttle stick, but allowing it all to come back in on the end of the stick travel. I have found this ability to tame the throttle response to be of great benefit in rallycross, making the car that much more docile in those poor traction conditions.

Moving along to the right, the next knob controls the exponential movement of the steering servo and is again numbered from '0' to a maximum 10. In position 'O' the steering servo will move in linear progression with the steering stick and as the knob is rotated the steering servo throw will be less around the centre position of the steering stick but greater as the stick is moved towards it maximum position. As with the throttle, dialling in exponential will make the car less "twitchy" around the straight ahead position without any loss of steering movement when the steering stick is moved fully. Strangely, I have never liked the "feel" of any car with exponential steering and yet I know several drivers who find it much more beneficial than exponential throttle! However, the facility is there so try it because you may well like it as they say.

On the far right is the throttle rate knob which is loved and understood by thousands of racers already and on the set, allows the servo deflection to be set for between 40% and 100% of its total movement in either direction for the full travel of the steering stick. Very useful for setting the required steering lock on the car without recourse to changing the length of the servo arms or such like!

Under cover

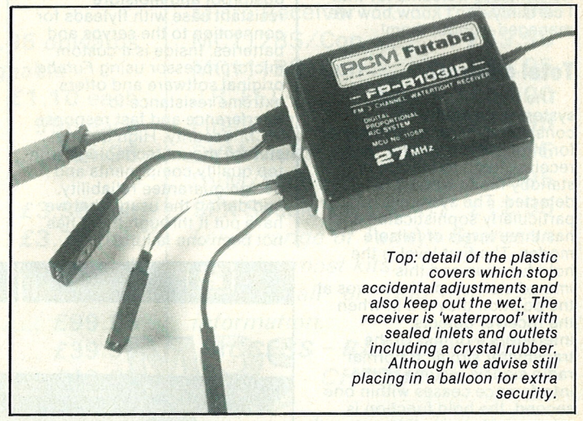
Before moving onto the next feature, it is worth pointing out that the four knobs each have a neat translucent, hinged cover that snaps into position over them preventing any accidental alteration to their settings. An excellent idea and demonstrates real appreciation of a racer's equipment.

Moving back to the bottom of the transmitter again and opening the hinged panel flap, one is greeted with what at first appears a daunting array of miniature switches and trimmer pots, controlling myriad functions. Closer study soon reveals enough really useful functions to delight the most cynical user.

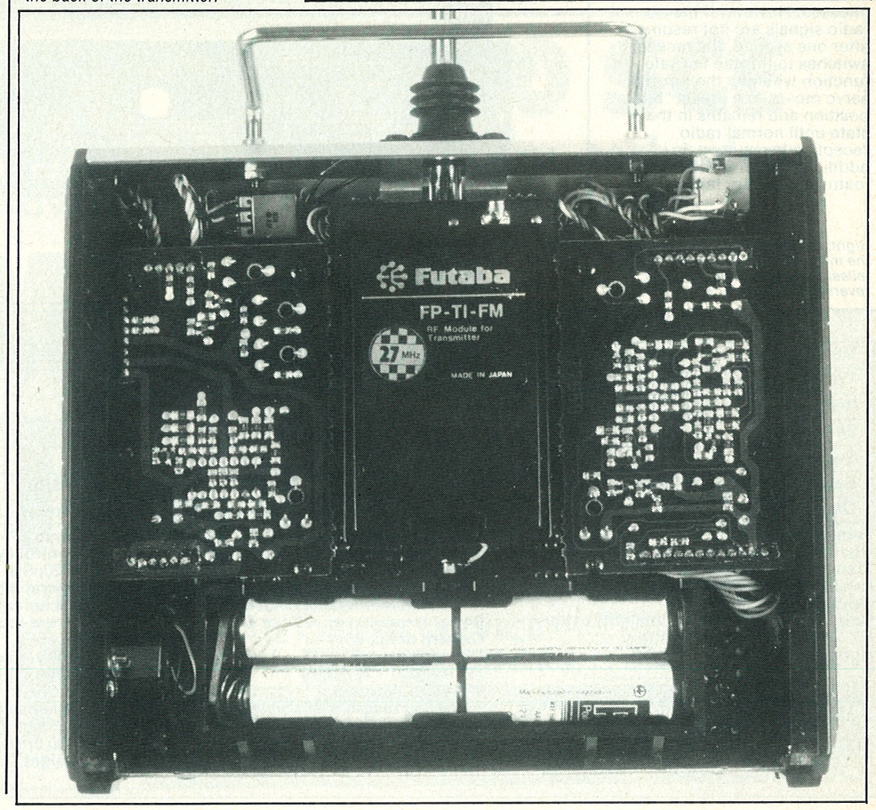
On the far left is the throttle mixing switch which has three positions. For the vast (99.9%) of car racers, the switch will remain in the off position providing no mixing function to the throttle. However for the record, position one enables a third servo to be plugged into channel 3 of the receiver and in conjunction with the mixing rate pot and the auxillary channel 3 knob on the front of the transmitter, enables independent control over the brake function to be carried out, e.g. moving the brake servo in the same direction of rotation as the throttle servo or mixing some brake servo movement with the throttle servo travel. Position 3, throttle/steering in conjunction with the mixing limit point trimmer and rate trimmer enables some input to the steering servo to be made from the throttle stick. Any such input can be changed to move the steering servo either to the left or right, also to set how much the deflection is up to a maximum of 40% of the servo movement in either direction and at which point of the throttle stick movement the mixing is actually applied! What this means in practice is that if a car or boat pulls to one side on acceleration, correction can be dialled in at the transmitter.

The next switch on the right is the throttle exponential switch and we have already covered the functions of this one in some depth in conjunction with the throttle exponential knob. Moving on from here, the next pair of trimmer pots the throttle ATV (adjustable throttle volume) are labelled low and high respectively and these are used to set the end point of the throw of the throttle servo at either end of its travel. This enables easy adjustment of the

Below: inside the back of the set the rechargeable battery pack can be seen. The module is easily removed for crystal access without removing the back of the transmitter.



Top: detail of the plastic covers which stop accidental adjustments and also keep out the wet. The receiver is 'waterproof' with sealed inlets and outlets including a crystal rubber. Although we advise still placing in a balloon for extra security.



throttle and brake/reverse total throws for both engine and electrically driven cars and boats and these functions are totally independent of any setting of the throttle stick trim lever on the front of the transmitter.

Following on, the steering ATV low and high trimmer pots enable exactly the same adjustments to be carried out on the steering servo and again the high and low adjustments are independent of each other and the setting of the steering stick trim lever on the front of the transmitter.

The final three switches are quite straightforward servo reversing switches but are nonetheless welcome for that – I certainly don't know how we managed without them!

Total control?

The heart of the 'PCM' system is its ability to consistantly monitor the signal for interference and for the receiver to go to failsafe or standby mode when it is detected. The system is particularly sophisticated and has three levels of failsafe modes. The first level is the hold function and this immediately stops the servos at the position they are in when the receiver detects interference or loss of the transmitter signal. If normal radio signals resume or the interference ceases within one second, the hold function is released. However if the normal radio signals are not resumed after one second, the receiver switches to throttle fail safe function whereby the throttle servo moves to a preset "brake" position and remains in that state until normal radio reception is resumed. In addition the transmitter features a battery failsafe function test facility and throttle servo trimmer function. Located centrally under the panel flap, pressing the check button simulates loss of signal due to flat batteries, and the adjacent trimmer pot enables the throttle servo to be set to a predetermining "battery" fail position. Then if signal is lost through low receiver voltage, the throttle servo will adopt the preset failsafe position. Brilliant stuff, eh!

Futaba FP-R1031P

This receiver packs as much of a technological punch as the transmitter, and features a dustproof and moisture resistant case with flyleads for connection to the servos and batteries. Inside is a custom microrprocessor using *Futaba* original software and offers extreme resistance to interference and fast response 'PCM' security. High quality surface mount technology with top quality components and design guarantee reliability, and during the usage that we have put it through there has not been one failure.

Futaba FP-S131S servos

The servo that comes with the radio and top of the range for car use is the '131S'. It is a coreless motor, high torque design in a glass reinforced, PBT case that is moisture sealed. Also featuring a *Futaba* low-power custom IC to provide high starting torque, narrow dead band and excellent tracking. The indirectly mounted potentiometer gives improved vibration and shock resistance and the PC board is a high quality glass reinforced resin type for reliability. The whole package is completed by strong, precision polyacetal resin gears that offer great strength with complete lack of backlash.

In service, the outfit has performed impeccably and the many features have proved a godsend when setting up the cars for racing. Despite having been virtually immersed in water at some meetings, the radio itself and the 131S servos have never missed a beat and have not required any attention at all and no other additional sealing has been used apart from the customary balloon on the receiver. Various competitors had voiced their doubts about the reliability of the 131S servos, but I have not had one failure in a season's rallycross racing using the same servo and that despite some real punishment by the weather. Furthermore the 'PCM FM' system proved its worth when on practice laps at the World Championships with some 30! other drivers, interference was detected and the *Kyosho* Burns came braking to a halt under command from the radio, sat there with the engine idling until the other driver on the same frequency with, by now, an out of control car, turned off his transmitter at which point I resumed driving! Without the *Futaba* 'PCM', I could have had a wrecked car and engine at the very least. Disadvantages? I can honestly say I haven't found any. The *Futaba* 'PCM FM' system is a pleasure to own and a joy to use. I can't recommend it too highly.

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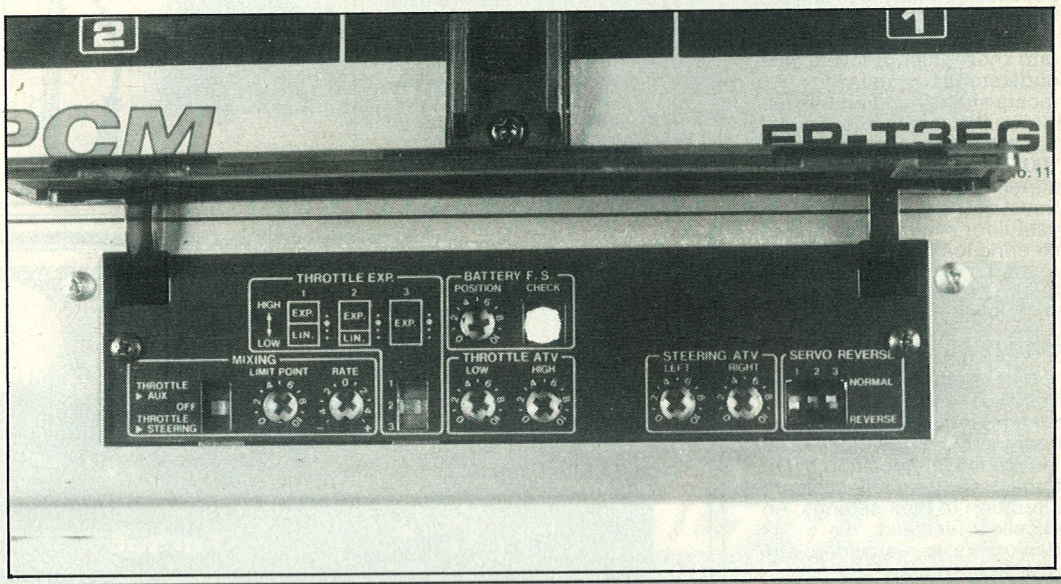

Right: the inspection hatch reveals the many adjustments from the failsafe preset to endpoints and reversing switches.

Model	FP-3EGP for engine racing car	FP-3EGP for engine buggy and boat
Transmitter	FP-T3EGP × 1	FP-T3EGP × 1
Receiver	FP-R103iP × 1	
Servos	FP-S131SH × 2	FP-S131S × 2
Switch	SSW-GS	
Battery holder/Nicad battery	R4/BHGS or NR-5PB	
Others	Frequency flag, horn, small parts (charger)	

Transmitter FP-T3EGP
Operating system: 2 sticks, 3 channels
Transmitting frequency: 27MHz band, bands 1-6 72/75MHz band
Modulation: PCM-FM
Power requirement: AA (penlight) battery × 7 10.5V or 9.6V Nicad battery
Current drain: 200mA

Receiver FP-R1031P
Miniature 3-channel PCM receiver
Receiving frequency: 27MHz band, bands 1-6 72/75MHz band
Intermediate frequency: 455kHz
Power requirement: 4.8V or 6V
Current drain: 23mA
Dimensions: 1.3 – 1.77 – 0.80in. (34.0 × 45.0 × 20.2mm)
Weight: 1.38oz (39g)
Receiving range: 300m on the ground using the FP-T3EGP (At the best radio wave condition of environment)

Servo FP-S131S
Control system: + pulse width control 1520μSN
Operating angle: One side 45° or greater (including trim)
Power requirement: 4.8V or 6V shared with receiver
Current drain: 8mA at 6V (idle)
Output torque: 44.5oz-in (3.2kg-cm): 69.5oz-in (5.0kg-cm)
Dimensions: 1.59 × 0.79 × 1.40in (40.5 × 20 × 35.5mm): 1.59 × 0.79 × 1.40in (40.5 × 20 × 35.5mm)
Weight: 1.7oz (49g): 1.7oz (50g)