Review: Multiplex Royal Evo

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http://www.rc-soar.com

Introduction

When the Royal Evo arrived on the market in 2003, it was one of the most eagerly awaited R/C systems for years, not least because of the promise of an affordable synthesised transmission system. Now seems a good time to take a step back, and write a more definitive review. How flexible is it? How easy to program? Will it take the knocks? And last but not least – is it a true successor to the highly regarded Multiplex 3030?

First a few words of background. I have flown R/C since the days of single channel radio, and have been flying F3F gliders competitively in the UK league for the last six years. F3F is a demanding application because of the mixing required to drive the wing servos[1], so a good computer transmitter is a necessity. To start with I used a Multiplex 3030, and for the last three years I've flown with a 4000. Both sets have served me flawlessly.

The Evo is the successor of the 3030 – a tough act to follow. Where the Evo exceeds those standards, there is praise. However, where it falls short I've not hesitated to pull punches.

So let's have a closer look.

System Specs

System	Multiplex Royal Evo 9 (International set)
Channels	9
Memories	20
Timers	3
Flight Modes	4
Transmission	PPM 6/7/8/9 (auto selected)
Current Drain	165 mA (HFM-4), 190 mA (HFM-S)
Weight	900 g incl. Batteries
Manufacturer	MULTIPLEX MODELLSPORT GmbH+Co.KG
Availability	Distributed by Flair Products LTD and through the appointed MULTIPLEX
Mixers	14 (all programmable, 5 inputs)

[1] For example, application of crow brake (spoiler) requires both flap surfaces to move downwards, both ailerons to go up, a small correction on elevator, and suppression of aileron differential.

Review System

The system reviewed is the 9 channel/20 memory International version with synth Tx module, 9-channel dual conversion IPD receiver, four Royal BB servos, 1700 mAh receiver battery and switch. A rather feeble wall charger was also included, (100 mA fixed, no indicator light, continental plug…). Use it for the initial slow charge cycles, then consign it to the spares box…

The International set comes with good quality airborne components, however those servos and the 1700 mAh battery pack just aren't going to fit into your average sport model. You can purchase the transmitter on its own, and pick 'n mix an airborne system to suit your needs.

The set is also available in 7 and 12 channel versions – see the modelspot.com web site for differences.

Transmission Modes

Standard PPM transmission is employed as used by virtually all third-party receivers. To further aid compatibility in the USA, MPX have announced that a shift-select selectable option will be available with v1.27 of the firmware.

PCM is not supported. Many PPM receivers (e.g. Multiplex IPD, Schulze ADPR) employ a microprocessor providing pulse verification/rejection, and perhaps failsafe, thus offering many of the advantages of PCM. PPM also offers a faster response.

Both Uni (1.5 ms) and MPX (1.6 ms) servo centres are supported and can be mixed between servos within the same model.

The system automatically selects between PPM 6/7/9 depending on the highest channel in use (the number denotes the number of channel pulses transmitted in each frame).

The 12 channel version also has a PPM12 mode which requires a 12-channel MPX receiver. The reason being that to squeeze 12 pulses into a frame (~20 ms), the transmitter shortens the pulses by about 300 microseconds – a special receiver is required to restore the original commands.

General Features

14 mixers are provided, plus three programmable timers, for cumulative time, slot time, and countdown alarm. Addition background timers indicate total time switched on, and total elapsed time per model memory.

User-upgradeable Firmware

Firmware updates are installable from a PC using a special cable and software, and updates have already been issued. I had no problem upgrading the firmware. This is an excellent feature, top marks here.

Ergonomics

Case Design

The case is a two-part plastic moulding. The front section has a sprayed on silver finish. A large hi-res LCD screen can be tilted upwards by approximately 30 degrees to aid viewing with a transmitter tray. An integral carrying handle is provided.

The unit feels light at only 900 g, and is very comfortable to hold. Balance with the aerial extended is good.

Sticks

The sticks are a new design - a big improvement on previous efforts from Multiplex. They have ball bearing gimbals, and feel very smooth. Not only are they adjustable for tension, but the whole assemble can also be rotated up to 15 degrees, the idea being that this feels more natural for your thumbs. The review unit had a few degrees of offset, and it felt very natural.

Changing the throttle ratchet is accomplished by adjusting two screws (a screwdriver is provided); alternatively a friction wheel can be used.

Three pairs of stick tops of different lengths are provided, to suit both 'thumb-on-top' and 'thumb-and-forefinger' flying styles. Micro switches can be installed by the user on the long sticks (one on the top and two on the side).

Antenna

The antenna is refreshingly short, and thanks to a clever knuckle joint arrangement, it can be positioned straight out, or canted up and to the left. To change its position, pull it against a spring, swing to the new position, and release. It can be retracted inside the case after use.

Switch Gear

Moving on to the twiddly bits, there are 2 sliders, 6 switches and 2 buttons, all symmetrically arranged on the front and sides of the case. The controls on the side can be operated without taking your fingers off the sticks and are ideal for flight mode switching, and throttle cut.

The controls on the side look a bit vulnerable, and breaking a switch could be expensive since a complete subassembly would need to be replaced. However I have not yet read or heard of anyone breaking a switch so perhaps they're stronger than they look. The switches do suffer from some lateral play, and the round-section stems are not very finger-friendly. I also found the switches next to the LCD a little awkward to reach in flight, so these are best used for less used functions.

Trims

The digital trims are arranged in a quadrant under each stick. A raised dimple in the centre provides a 'home' position for the thumb. Each trim increment is accompanied by a short beep. The buttons auto-repeat when pressed continuously, and trims can be quickly centred by pressing opposing buttons together – a nice touch.

Build Quality

There were a few build quality issues[2] on early production units. I'm glad to say that all of these appear to have been addressed on the more recent unit I handled. In particular, the wires are more flexible, reducing the strain on the soldered joints. The

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- [2] Tubing had slipped off some of the solder joints on the main board leaving them unsupported.
- Cable to the pots was too short, resulting in the cable straining, and acting like a secondary spring on the stick unit.
- The antenna on my unit was hard to extend, so care was required not to damage the knuckle joint mechanism when extending it.
- The catches for the case were very stiff.
- The case creaked when squeezed

method of mounting the main board has also been improved, with proper standoffs being used. Other minor detailed changes include a small lip on the LCD frame, to aid tilting. Full marks to Multiplex for their policy of continuous improvement.

As a result of these changes, I would regard the build quality of recent units as good, and the low component count will surely aid reliability.

As regards weather resistance, with that hinged LCD and all those exposed buttons I'd keep the unit well protected from the elements.

Synthesiser Module

The Evo is supplied with a choice of synthesised (HFM-S) or crystal (HFM-4) rf modules. Now that the synth module is widely available, I won't say anything more about the Xtal module as it's very fiddly to change crystals.

The synthesiser module is indeed the perfect partner for the Evo. The desired channel is simply dialled in via a special menu. I say 'simply', but in fact you have to go through a couple of hoops to prevent activation of an unintended frequency.

A word here about channel numbers as there is the potential for confusion. The channels are entered using 3 figure codes in the format PNN, where P is the band prefix and NN is the channel number. The UK supplied synth supports both UK (P=0 or 2) and German (P=1) segments of the 35 MHz band. Germany and UK have many of the 'NN' channel numbers in common, so it is possible – quite easy in fact - to select the German channels in error. Since the forthcoming synthesised Rx's are believed to also support the German frequencies, it would be possible to select an illegal frequency and fly without being aware of it. Remember to choose channels with UK band prefixes 0 or 2.

The Tx synth module is a great leap forward in convenience and flexibility. Many pilots will buy the Evo for this reason alone.

Battery Management

Power is supplied by a 6-cell 1500 mAh NiMH battery pack incorporating a self-resetting thermal fuse. There should be no problem in replacing it with a conventional pack should the need arise.

A battery management circuit monitors battery drain, both during normal operation and whilst on charge. It even makes allowance for self-discharge when switched off! Estimate of the remaining flying time, and residual capacity, are displayed on an info menu. The system assumes a full charge to be 1500 mAh by default, but the user can change this figure once the battery capacity has stabilised after a few cycles.

For the management circuit to work, the battery must be charged through the Tx. However, Multiplex strongly advise against connecting a fast charger designed for more than eight cells, to avoid damaging the main board. In order to use such a charger, the battery should be first disconnected from the transmitter, but of course this means foregoing the battery management facility.

Maximum charging current though the Tx is 1.5A.

Expect around 6-7 hours operation with the synth. A beeper sounds when the battery voltage falls below a safe level.

Instructions

A bilingual (German/English) instruction manual is provided, in A4 format. There are 56 pages for each language. Although the manual is quite comprehensive as a reference manual, there is no proper overview for beginners, and it suffers from quirky translation and somewhat confusing layout.

Operation

Switch the Evo on, and you are greeted with a trill as it boots up. Rf transmission can be suppressed by pressing the Setup key while switching on, allowing simple checks to be made on the field without interfering with other flyers.

A 'throttle check' follows: the throttle servo is forced to the idle position, and a warning is displayed until the stick is moved back - an excellent safety feature for helis and electric models, though it can be disabled.

There is a choice of three status screens, showing various combinations of model/flight mode status, trim positions, timers, and battery condition.

Entry to the programming screens is via the upper row of 'quick access' keys. From that point, anyone who has programmed a Cockpit will feel immediately at home, as the Evo's 'digi-aduster' wheels work in the same way - twist a wheel to select an option, then push-and-click to confirm. Either wheel may be used equally.

The second row of keys is used for menu navigation, and to confirm or cancel a selection. Text entry is similar to mobile phones, and both capital and small letters may be entered.

Once I understood the function of each of the menus, I found the programming interface very easy to use, helped by the large LCD screen and graphics.

In Flight Adjustment

The digi-adjusters have another very powerful function: they can be used for in-flight adjustment of virtually any parameter e.g. travel, expo, differential etc.

You can also adjust parameters affecting more than one servo, for example on an F3x model you can adjust the elevator to flap mix in flight. This is incredibly useful! (It can be done on the 4000 but only with some effort).

Setting up is easy, you go to the appropriate menu, select the parameter you want to make adjustable, and press a special key. Back in normal mode, the parameter value is shown on the LCD, in big characters. Each digi-adjuster can be assigned a different parameter. For an F3x model, you could adjust snapflap with one adjuster, and differential with the other.

Programming Concepts

As with all Multiplex systems, the Evo's programming is much more elegant and flexible than comparable Far Eastern. There is a clear distinction between things which you move ('controls') and what they do ('functions'), and the things which do it ('servos/channels').

Control Layouts

Control mappings or 'layouts' are another powerful feature. They define which knob/switch slider does what. The Evo stores up to five different control mappings,

three of which are already set up to suit power, helicopter and glider pilots. The other two are initially empty. Any of the five mappings can be altered and renamed to suit your own purposes.

To change a mapping, choose a function (e.g. 'flap') from the menu, then move the corresponding slider or switch on the transmitter, and confirm. Beautifully simple! The same applies to secondary switches e.g. mixer switches, flight mode, dual rate, combi etc.

Switches can perform multiple functions, e.g. a flight mode switch can also trigger one of the timers. You can also specify 'software' switches, which work like real switches except they're triggered by moving the throttle control or a slider.

My only gripe here is that mappings are 'global', i.e. shared between models. For example if you change the function of a switch in the GLIDER layout, it will affect all models which use that layout. More about that later.

Free Channel Assignment

Channel assignments are also freely assignable. For example, you can emulate your old transmitter's channel numbering e.g. 1=Aileron, 2=Elevator, 7=Aileron etc. Alternatively by assigning all your servos to the lowest possible channel numbers, you can fly a full-house indoor model just using a micro 4-channel receiver – very useful.

Flight Modes

Each model can have up to four switchable flight modes. These provide a way of activating different sets of control adjustments e.g. aileron diff, expo, travel etc. Flight modes are assigned a name from a set of 13 standard choices (it would be nice if they could be named freely).

Mixing à la Multiplex

Mixing Overview

The Evo mixing system is simplified from the Profi[3], yet is still very powerful.

Before we delve into the detail, a quick recap: mixers are used in computer radios whenever a servo can be driven by more than one input. For example the servos on a V-tail can be driven by both rudder and elevator inputs, so each servo would be assigned to a mixer.

Mixers on the Evo can have up to five inputs, instead of two as on most Far Eastern sets. Each input is assigned a response curve e.g. symmetrical, asymmetrical, linear or non-linear, and flavours in between. Thereafter, only two adjustments are required to set the exact shape of the curve for a particular model. Note that there is no concept of primary and slave inputs - it's up to the user to adjust each input's relative effect.

Mixer inputs can be switched on/off during flight. Any switch can be used for this purpose. However the middle position of the 3-position switches is always 'off', which can be rather restricting for complex models.

Fourteen mixers are provided, all of which are 'free', i.e. they can all be reprogrammed and renamed. Five of them are already set up the factory: elevtr+, vtail+, delta+, aileron+, and flap+. These cover everything from elevons to crow

[3] The Evo mixers have all the curves on the input side rather than the servo side. This reduces the amount of button pressing, but also reduces flexibility.

brakes on 4-servo gliders. The remaining nine mixers are named ‘mix6’ thru ‘mix14’ and are initially empty.

Global Mixers and Layouts

Now for something which advanced flyers will not like very much: mixer definitions and control layouts are ‘global’, i.e. shared between models. For example, if you have two gliders which use the AILERON+ mixer, then adding a switch to disable the flap input, or changing the flap curve type from single-sided to dual-sided – such operations will affect both models.[4]

Similarly, control layouts are also shared. So for example you might change the function of a switch in your GLIDER layout, forgetting that it is used to control a mixer input in another memory.

At first glance, this feature might appear to be useful, if you have several identically configured models. However in practice, most of the time you only want to alter the model you’re working on at the time.

If you do make a change to a mixer or layout, the system warns you that other memories may be affected. However it’s up to you to check the effects, and this may not be straightforward since the interactions between memories can be subtle.

A workaround is to dedicate each mixer, and each layout, to a single model. Then there will never be any possibility of a change affecting more than one model. However, with this approach, you’ll run out of mixers and layouts well before you run out of memories – five in fact, which is the maximum number of transmitter layouts.

Beyond five models, and backing up/restoring groups of models using the Data Manager software may be the safest option.

Quite why Multiplex designed it this way is a mystery, although a clue may lie in the reduced memory requirements in such an approach. I really think Multiplex should address this issue to realise the full potential of the system.

In fairness, if you are content to use the standard mixers – as I suspect most sport flyers will - then this will not be such an issue.

Programming Capabilities

New Model ‘Wizard’

Let’s move on to something more positive. Multiplex have made a great job of simplifying the initial set up of a model. A ‘New Model’ menu guides you through the initial process. There are three steps: first you choose a template (Basic, Acro, Hotliner, Delta, Glider, 4-Flaps, HeliMech, HeliCcpm). Then you select control layout (Power, Glider, Heli). Finally, you select a channel numbering scheme (MPX, Futaba, JR).

Having created the basic framework, you are free to alter any of the assignments, mixers etc. to your heart’s content. Each new model can be given a name of up to 8 characters.

[4] Note it’s the mixer *definitions* which are shared between models, in other words the mixer inputs, curve types, and mixer switches. The *mix ratios* are specific to each model.

Setting up a Zagi

To see how quickly we could get up and running, I chose a Zagi – just about as simple as you can get, but it does use a mixer!

Entering the New Model menu, I selected the 'Delta' template, the Futaba servo numbering scheme, and the 'Glider+' control mappings. I also selected 'Mode Two' as my stick mode – this assigns elevator to the right stick. Then I pressed OK, and hey presto! All the main functions were operating. Not bad for half a minute's work, I have to admit.

The next stage was to adjust the servo centres and travel, and tweak the aileron and elevator settings. This did take a bit longer to do and is the trickiest bit.

The secret is to start off in the servo calibration menu, then work back to the mixer menus, and finally to the control menus.

The servo calibration screen is where the basic servo movements are set. A graph is displayed showing the servo response curve, so you can see at a glance both the maximum movement and servo centres and adjust them to suit. The idea is to adjust so that paired servos have identical response across their whole range. Up to five points can be specified on the curve – very useful when trying to match up the movement of large control surfaces like flaps.

The dynamic mixer menu is where the relative effects of the mixer inputs are defined. In the case of the Zagi, the movement of the elevons due to the elevator and aileron controls were set here.

Finally the control menus offer some finer adjustments. For example the aileron control has trim increment, dual rate and expo adjustments. These apply across all flight modes. Two further parameters – travel and trim offset – can be set differently for each flight mode.

Setting up an F3F Glider

In order to explore the upper end of the Evo's envelope, I set about programming my Acacia F3F soarer. This model has four wing servos, plus two servos for the V-tail. The aerodynamic functions include crow brake, and thermal flap. Mixing includes crow-brake, snapflap, and spoiler to elevator compensation.

The Acacia is normally flown with my Multiplex 4000. The way I've set up the 4000, all the interactions and adjustments are controlled from a single three-position flight mode switch for launch, speed, and landing.

How would the Evo fare against the 4000? This is a tough and in many ways unfair test, as the Evo is not meant to replace the 4000 – but by stretching its capabilities we can begin to see its limits.

I started with the 'Basic' template. I also created my own custom control layout, and set up a custom flap function since the built-in version provided negative flap, which I did not want.[5]

Crow brake facilities are good. Aileron differential can be suppressed, allowing good roll control with full crow deployed. I like the ability to use the full range of travel on the flap servo (not possible on the 3030).

[5] At this point I found bug in the mixer engine. It is not a showstopper so I won't mention it further here, but if you're interested there's a description in the Evo section of the web site.

I could not exactly mimic the flight switch configuration of the 4000, however the final result was still usable, at least the way I set up my model. The main stumbling block was that all the centre position of the 3-position flight mode is always considered to be OFF by the software. I got away with it because one of my flight phases (the landing phase) has all the switchable mixer inputs disabled, thus allowing it to be assigned to the middle position of the flight mode switch. However, your mileage may vary.

I was pleased to see that the servo travel adjustment acts a true electronic end-stop, as on other Multiplex radios. This is particularly useful when setting up a mixer e.g. crow brakes and V-tail, as it can prevent damage to the hinges if you set large movements on individual mixer inputs. On V-tailers it is a real boon.

It's when we move to more complex F3J and F3B applications that we first encounter some real limits. For example, I attempted to program large launch flap offsets for Launch mode, but this was only possible using some mixer trickery. For these models, the Evo is still no match for the 4000.

Flight tests

I've used the Evo on and off for about a year now. I've flown a Mini Ellipse, a Piccolo indoor heli, and a Gladiator DLG. The light weight of the transmitter makes it a great choice for DLG flying.

As regards practical use, the aerial assembly works well, and the unusual positioning of the digital trims wasn't the problem which I anticipated (although I am not a great fan of digital trims).

I like flying with this Tx a lot and would use it more except (a) I already have a 4000 and (b) the shared mixers issue discussed above. When going flying with several models, I know the 4000 will handle all of them, so I just take that.

Comparison with Profis

3030

Existing 3030 users will no doubt be wondering whether to switch to the Evo. However the two systems have overlapping features, so a direct comparison is not really possible. I would advise prospective purchasers to evaluate their requirements carefully before taking the plunge, particularly if they are using switched model memories on the 3030.

4000

As regards the 4000, the Evo is not as flexible (no 3-state switches, multimix or servo side curves), and was never intended to be. However, I did discover that with fast digital servos, the processing speed of the Evo is visibly faster than the 4000 – unlike on the 4000, there is no detectable delay between moving the stick and a servo starting to move.[6]

Servo Centre Adjustment

Now for something I like a lot, but which is not properly documented: you can set the true servo center position (i.e. 1.5 mS center) on your servos. This allows you to very

[6] Explained by the 4000 needing more than one frame interval to do its calculations, perhaps?

easily compensate for temperature drift on your servos, without fear of losing your trim settings.

This feature is also provided on the 4000 and 3030, but not all other radios. As a user of older Volz servos which drift a lot with temperature, I find it extremely useful.

For a description see

http://www.rc-soar.com/mpxevo/progtips/servocent.htm

Summary

The Evo is a groundbreaking set which will appeal to a wide range of modellers from beginner to advanced sports flyer. The unique selling points are the synthesiser, integrated scanner, and mixer architecture, all of which makes most other sets feel like museum pieces.

My only really major gripe is that the mixers and layouts are shared between models. Advanced users with more than five moderately complex models will feel limited by this feature.

Nevertheless, the Evo should sell like hotcakes, and deservedly so.

Good points

- Synthesiser
- Good ergonomics
- Multiplex architecture
- Quick programming
- Excellent user interface

Bad points

- Mixers are 'global'
- Build quality on early sets (much improved on later units).
- Manual could be better

Feedback

I would very much welcome any feedback from existing Evo owners. My email address is ***evoreview at rc-soar dot com***.

> *Dear Mike,*
> *Just read your review having purchased an RE9 a month or so ago. I can say that on mine the build quality appears to be very good in all the areas you identified as being suspect* [on an early production model – MS]. *It's not a Profi case and I agree that the side switches look very vulnerable but the construction is well executed on mine.*
> *Regards,*
> *Matt.*