Weatronics Pt 2

David reviews the first flight tests of the Weatronics receiver

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The Weatronic Dual Receiver unit is rather larger than conventional receivers but has a vastly greater capability. The case is a substantial moulded unit. The right hand of the unit incorporates a slot for the recording SD or MMC card which vastly increases the internal storage memory

Introduction

In the last edition we described the operational concept and hardware of the German Weatronic Dual Receiver (DR) unit which is now in full production and being delivered to customers on 35, 36 and 72 MHz frequencies.

The review receiver has now been received on 36 MHz (the Australian frequency). It has been installed in a Skymaster Hawk for ground evaluation and flight test prior to installation in the AirWorld Hawk. Although my departure from Australia for the northern hemisphere summer prevented flight test in the SM Hawk, my UK flying colleague, Mick Burrell, has been flying his unit in a SkyMaster MB339. He has all flight data recorded on a SD card from the test flying. The DR records numerous parameters which can be examined in great detail after the flight. At a stroke, Weatronic have removed all guesswork about what is going on in our aircraft radio system. This aspect of the unit alone, has convinced me that a Weatronic DR will be installed in all of my large jets, will be discussed in detail at the end of this article.

Description

The review receiver was received by air-freight from Germany extremely well packed in a very professional looking box. The unit was accompanied by a CD on which is a full manual and operating software, a ribbon cable for the switch unit and USB connector for connecting the unit to a laptop or PC. Also included are a mounting plate for the switch connector and two flagged plugs, one a switch activator and the other an auto-tune activator also included in the outfit.

The first noticeable aspect of the DR is that, in comparison with normal receivers it is quite a large unit measuring 110 mm x 77 mm x 25 mm (4.5" x 3" x 1") and weighing 182 g (7 oz). These dimensions are for the test unit which is a full 10-channel format with GPS and gyro facilities. The case of the receiver is a substantial moulded plastic unit which incorporates mounting lugs although no mounting grommets are supplied but purpose made units are available as an accessory from Weatronic.

The orientation of the receiver is vital if one is using the built in gyro function; if aileron damping is proposed then the DR is installed longitudinally. If the gyro use will be for pitch, damping the elevators it is installed transversally. The unit can, of course, be used for yaw damping on the rudder channel but that would involve mounting the DR, vertically on its end. My personal preference would be to see the gyro orientation changed so that flat mounting of the receiver would be the correct position for yaw damping commonly used on jets for rudder and nose wheel steering. That, however, may not suit the 3-D and IMAC flyers!

Mounting the Unit

Mounting the receiver should be done with care as some vibration damping is essential. Even on jets the plane can get quite a shaking during the take-off and landing rolls. If using the gyro function, mounting the DR too softly could compromise the accuracy and sensitivity of the gyro operation. Clearly the unit will need a fairly large fuselage to accommodate it so installation in smaller models is going to be very tight, if at all possible. The test unit was an easy fit into a SkyMaster Hawk. The production unit has two Multiplex sockets on fly leads for connecting the batteries, one main and one standby (a little different from earlier units on which the sockets were built into the case) and two 1 metre long aerials of a more substantial gauge than normally found on receivers. There is a socket for the ribbon cable plug and a slot for the SD/MMC cards and 24 servo sockets (20 actually for servos, three for gyro connections and one unused.)

My first action was to connect the unit to a battery and plug in a few servos and have a basic look at the system before installing it in the model. Servos are simply plugged into the unit in the conventional way but I did find some non-JR extension cables did not grip the plugs very tightly, genuine JR and Graupner products were a perfect fit but as a range of after market products are available, care is required here.

Loading the Software

Before installing the unit in the model a basic set up is required and this involves connecting the DR to the computer on which the software is loaded from the supplied CD. Loading the software and USB drivers is very straightforward. If the download does not start automatically it is simply a matter of following some simple instructions.

One of the first Australian customers alerted me to the fact that the unit would not work correctly using his JR synthesized transmitter but worked perfectly with a crystal module installed.

Weatronic addressed this issue in very short time and new firmware has been designed and produced and this update is another illustration of the incredible capabilities of the DR. As well as changes to allow the use of synthesized Tx modules, the new firmware also has other changes including a very fast (1/2,000th of a second!) battery switching time. This is so that failsafe signals are not generated for the engine ECU during battery changeover. It is interesting to note that when viewed on an oscilloscope the wave form of a PPL transmitter looks much 'dirtier' than a crystal unit.

Updating the firmware is very simple. The new firmware is downloaded from the Weatronic website and saved to the SD or MMC card in a card reader (which must be formatted to FAT standard and not FAT32). The SD/MMC card is then inserted into the

DR and one battery connected to it. After about 20 seconds the red LOG LED stops blinking and the DR update is complete, that is all that is required. We can go ahead and continue to configure the unit for the intended model, quite amazing!

Antennae and Batteries

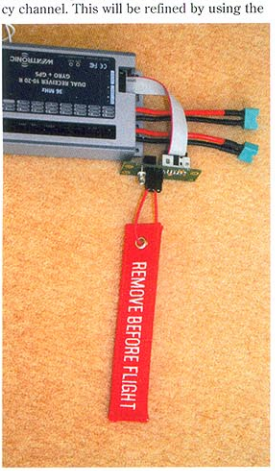
The DR has, of course, two aerials, one for each receiver and Weatronic advises that the orientation of each aerial should be as different as possible. They suggest that one should run to the rear of the model whilst the other should take the form of a vertical whip. Two batteries are required and these are a main and standby battery (unlike the Powerbox unit which uses two batteries sharing the load dependant on pack voltage). That means that the standby, or second battery, needs only to have sufficient capacity for one flight (plus, I would suggest, at least 100% extra capacity!). The batteries can be NiCad, NiMH or LiPo and the discharge characteristics of these packs can be assigned to the DR via the software.

Configuring the Rx

With software loaded and DR connected the PC will automatically display the start-up page and will give a number of details on the actual DR connected. At this point one need not connect the batteries as the DR takes its power from the USB connector. On this page one can also download a picture of the model for which the DR is being configured as well as any notes in plain text.

The next button to press is 'Grundeinstellungen' (basic settings). On this page we configure three basic settings, the first of which is transmitter modulation and the options are Graupner, JR, and Futaba in PCM format or Multiplex in either MPX, UNI or PPM 12 format.

We then select 'Akkutype' (battery type) and the frequency of the transmitter frequency channel. This will be refined by using the auto-tune facility. This data is all stored in the DR by clicking on the 'Speichern' (save) button.



This is the switch and auto-tune initiating socket. To switch on the receiver the plug is removed

Fine-tuning of the DR frequency is achieved by placing the switched-on Tx in close proximity to the DR and plugging the auto-tune plug into the socket on the ribbon cable. After the yellow LED stops blinking the fine-tuning is complete and the frequency shift from nominal, as detected by the DR can be seen on the computer screen. My JR PLL Tx showed a shift of 0.9 kHz.

There are other facilities on the set up page for more advanced programs such as gyro calibration and great care should be taken not to click on the 'Empfanger zurucksetzen' (reset) button as you will lose all settings including your servo configuration! With all of our basic settings made the next step is to configure the servos for the model in question. In part one of the DR article we covered in quite some detail exactly what the DR can do insofar as servo configuration is concerned so we will not repeat it all again here.

Servo Configuration

One must decide whether the servos will be configured in the transmitter or the DR. If one intends to allocate just one servo to each of the ten channels then one it might be reasonable to leave servo configuration (subtrim, travel, direction and exp) to the Tx leaving the DR unchanged but this, however, would not be using the huge potential of the DR. It allows up to 8 servos to be connected to each channel and each of these servos can be configured individually.

A practical example of use here on a jet would be:

1) To drive the rudder servo from the rudder channel and configure it accordingly. The same channel could drive the nose wheel steering servo which might mean reversal and different travel characteristics; the DR takes all of this in its stride.

2) One channel could drive a servo on each aileron and each could be exactly configured to give the correct neutral, travel, differential and response curves. These functions are often done by mixing channels on the transmitter so it is immediately obvious that the DR can reduce channel usage, a huge advantage in itself.

3) It is also possible to designate one servo, 'Haupservo' (lead servo) and slave other servos to it as a group so that two or more servos could drive in unison, say, an all moving one-piece stab. The DR is also capable of synchronising these servos. Adjustment of the 'Haupservo' means that all servos in the group exactly follow the main servo.

It makes sense when adjusting servo response characteristics for a channel within the DR to reset the transmitter channel to default. This is because the DR will follow any settings in the Tx and when changes are made within the DR the results can be very illogical and frustrating (don't ask!).

Failsafe

There are three other items of servo configuration to note and the first of these is failsafe for which three modes can be assigned although only two, Failsafe and Hold are applicable to jets. The third, Learn mode, is really only applicable to slow flying, stable models. As the term failsafe implies, any servo can be commanded by the DR to go to a set position when the DR goes into the failsafe. In hold it will keep the servo at the last valid commanded position before the DR entered failsafe.

Gyros

It is also possible to allocate the gyro function to the appropriate servo and when the sensitivity of the gyro has been determined by flight test. The value selected by the sense channel can be fixed and the channel released to other use. Any other channel can also be assigned to maintain a fixed output without having a Tx signal to define that position; it is maintained by an internal setting within the DR. The unit can also accommodate the addition of an external gyro should this be required and the gyro action allocated to any channel.

Range Checks

Setting up the model accurately and correctly will invariably take some time (the same applies to transmitter adjustments) until the operator becomes familiar with the software. It is an easily learned system which will become even easier when English labelled software, currently being developed, becomes available.

After the set up is complete it is essential that a full range check is completed. Tests to date have indicated that the range of the DR is substantially greater than with conventional receivers. After a successful range check the model with the DR can be flown. You will note absolutely no difference to the models performance, it will respond according to servo configuration. However, the DR offers the greatest degree of integrity of the RF link that is possible using a single frequency.

Data Storage and Analysis

As with the Eagle Tree system the Weatronics Dual Receiver has data logging of certain parameters. Post flight evaluation is available to operators of model aircraft equipped with the DR.

Let's take a look at what it does on an actual flight, in this case Mick Burrell's SkyMaster MB339 which is equipped with a 5-channel unit, including GPS.

The parameters measured are: All 20 servo positions, time, date, speed, position, altitude and course, the last 6 items being derived from the GPS. In terms of monitoring the radio reception aspect the DR records valid and failsafe frames, battery used RSSI (relative signal strength) and antenna used as well as the voltage of both batteries and total current consumption.

Using the software in 2-D format the data can be presented in either tabular or graphical format. In 2-D evaluation in graphical format up to 10 selectable parameters can be presented on one graph, each parameter being shown in a different colour, and up to 16 graphs can be formed!

In 3-D format, the data can be shown superimposed on GPS position and the colour of the selectable parameter varies on the displayed flight path (the viewing point, or camera position, is fully variable) as a function of its value, quite extraordinary and looking at this data is almost as much fun as actually flying the aircraft!

Mick Burrell has been flying his Weatronic Dual Receiver in his SkyMaster MB339 with compete success

On one of the downloaded flights of Mick's MB339, the data in 3-D format showed that Mick flew in a figure of 8 and that during his 8 minutes his 339 achieved a max speed of 260 kph. At one point it reached a max altitude of 240 m and his speed fell to just over 100 kph.

The signal strength was generally 0.55 for Rx 1 and 0.6 for Rx 2 dropping to minimum values of 0.35 and 0.38, and that during the entire flight the system switched to antenna 2 on only one occasion. Signal strength variation seems to be a combination of height and distance out and relative angle of the transmitter antenna. For example, the RSSI fell to a relatively low value when Mick was flying high but close in which suggests his Tx aerial was pointing almost straight up at the model. Most importantly it was revealed that not a single failsafe frame was received, a testament to the efficiency of the receiving system. It was interesting that the temperature of the unit started the flight at 19°C and finished at 27°C, perhaps due to the greenhouse effect of the Macchi's big canopy.

The battery monitor readings make interesting reading to. For most of the flight the total current draw was around 1.5 A and the DR was operating on battery 2. Late in the flight there was a large increase in current draw accompanying large deflections of two servo flaps? At this point the load was 3.6 A. Battery 2 voltage fell to 6.6 v and the DR switched batteries to battery 1 where it remained for the rest of the flight.

In practical terms Mick and other early customers of the DR have reported a rock solid RF performance of the DR and the unit is delivering, to perfection, all that Weatronics promised it would. I will certainly be using this unit in all of my large jets; it is a highly impressive device offering a large step forward in receiver performance.

Conclusions

There are several things that I and other users would like to see changed on future units.

The first is the switch unit, currently the internal switches are operated by the removal of a plug, we would prefer a current sensing switch and avoid the chance of losing a plug.

Secondly, some of us would prefer to see the unit using two large batteries in parallel.

Finally, the a unit which can switch receivers which operate on totally separate frequencies so that if one frequency suffers interference the Rx can switch to another, hopefully clear, channel.

None the less the current Weatronics Dual Receiver is an exceptionally capable unit and one to which I can give, with every confidence, the strongest recommendation. I am hugely impressed!

In terms of price, the initial cost of the DR may seem rather high, but remember that the DR eliminates the need for a battery management unit, devices such as Matchboxes and a gyro system. Add to that the enormous increase in RF integrity and an invaluable data recording system then my belief is that the unit is actually very cheap indeed for what it delivers and is extraordinarily good value.

The Weatronic Dual Receiver, an Impression by Mick Burrell

I am sure this unit will be even better when we get an English program, but I managed to program it without too much difficulty.

I began by envisaging the model on my PC, standard JR servo configuration throttle channel 1, right aileron channel 2, two elevators channel 3, rudder and steering channel 4, left aileron channel 5 and so on. An immediate plus here as the elevator servos face one another so one had to be reversed, easy, just right click on the servo square (highlighted in green) and just 'invert servo'.

The dual receiver was installed in my MB339 and connected to my laptop, again using the configuration dialog box the servo directions and travel volumes were easily set. All the ATVs were set to 100% in the Tx. Exponential throws are set in the Rx, though dual rates can only be switched from the Tx. Conversely the failsafe is now transferred from the Tx to the Rx.

Prior to the first flight the first thing found was the significantly increased ground range, probably a third as much again! Confidence building or what? The model was flown at North Weald airfield and it felt absolutely solid. After landing the SD card was read using the NavView program, and it was fascinating to study the servo deflections, battery voltages, receiver used and many other interesting stats. The most useful must be the current readout which bears a direct relation to servo load, so if you centre the high current, mine was 2.9 A, to the servo deflection you can see which servo is drawing the most current, brilliant. In the 3-D screen the whole flight trace can be viewed.

There were no failsafe frames registered and it switched to the second receiver once. One antenna was down the side of the fuselage and the other connected to the existing whip. A very interesting and confidence building piece of technology, and if you are lost just log the grid reference into 'Google Earth' and it will tell you where you are!