ERICH BÄCKER

Having switched to the Jeti DC-16 transmitter, Erich Bäcker went on a hunt for new receivers, a gyroscope and a power supply for his CARF J-10. So, the Mercury SRS from PowerBox Systems, a redundant system with integrated gyro and serial receiver inputs, came at the exact right moment. One could say, that the Mercury is a bridge between the high-end Royal SRS and the smaller Cockpit/Competition.

The small POWER MANAGER

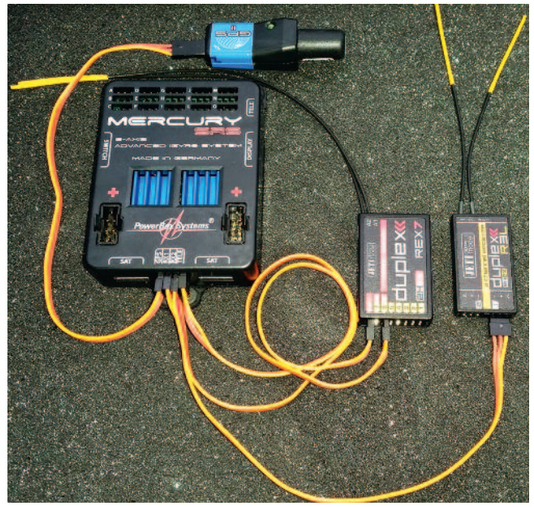
PowerBox Systems **Mercury SRS**

The Mercury has a lot of functions: 15 servo outputs, an iGyro with GPS regulation, two serial receiver inputs, two battery inputs with two redundant regulation systems and each with 20 A peak current, the output voltage can be set to stabilised 5,9 or 7,4 V, extensive telemetry functions, door sequencer, servo matching and a lot more. Furthermore, the Mercury works with almost all current RC systems and can decode 18 channels serially. The proven iGyro unites the experiences of all the versions iGyro 3e, iGyro SRS and Royal SRS. The external OLED display has a similar size to those of the integrated Cockpit/Competition series.

The Mercury fits into all jets with 15 servo outputs and the currents passing through the receiver. Prime example for the successful application of the Mercury is the CARF J-10: too many channels for a standard receiver, fast and strong servos with large deflexions for the thrust vector control and the 3D flight needs Gyro support. Of course, the J-10 can fly with only one battery and one receiver. But, due to bad experience, I fly my jets only with receiver and battery redundancy.

The delivery scope of the Mercury SRS from PowerBox Systems with GPS II sensor.

The start screen of the Mercury.



In order to learn about the functioning of the Mercury, it was equipped with two serial receivers and a GPS sensor.

The integrated GPS telemetry functions such as height, speed, distance, flown route, coordinates, etc., are very interesting. As in the Royal SRS, all data is passed through, so the GPS sensor is available for the speed-dependant adjustment of the sensitivity (Gain) of the iGyro and telemetry. It reduces the amount of servos and cables, making the installation easier.

Before installing and launching the Mercury SRS, it's worth taking a look into the very compact manual, which can be also downloaded from the PowerBox website. If you have questions, a visit of the PowerBox expert forum at forum.powerbox-systems.com might help. Here, you will find many tips and tricks regarding all PowerBox products and your questions will be answered quickly. It's recommended to test-install the components and test servos, in order to learn about their functions. Before installing into the jet, you should reset the Mercury, which makes the configuration much faster. To ensure a trouble-free function of the Mercury, it should be screwed right-angled to the main axis on a firm surface in the model. The position will be recognised automatically.

The handling of the Mercury SRS follows the proven tradition. The supplied sensor switch serves as on and off switch for both batteries. The box can be configured with the three buttons in combination with the external display. In order to activate the Mercury, the switch, the display, two serial receivers (four satellites in the Spektrum) and the GPS II sensor are installed. Two batteries with Multiplex plug are needed for the power supply. The correct battery polarity is absolutely necessary, a wrong polarity would destroy the voltage regulators!

The start display shows the battery voltage, the receiver status, the GPS antenna, the position of the flight mode switch, the operating time and the output voltage for receiver and servos. All infos, except for the timer, can be shown on telemetry displays of almost all common RC systems. The Mercury displays are in English, special terms in the manual are written in German.

To ensure, that the Mercury SRS can work with the RC system, you have to choose the RC system in the menu item "General Settings". The receivers have to be set to serial transmission, in order to communicate with the Mercury. If two receivers are plugged in, the Mercury will choose one during the switch-on and will switch onto the other within seconds, if having receiving problems. In order to improve the receiving situation, I keep my receivers wide apart from each other. In jets I place one receiver in the cockpit area, one antenna in flight direction, another one across. The second receiver is placed in the mostly hollow vertical stabiliser, one antenna vertical, the other one horizontal. That's how I cover all receiving directions.

In dependence of the applied servos and batteries, the next steps are setting up the frame rate, the battery type and the desired output voltage.

The Mercury can be set up to LiIon, LiPo, LiFePo or NiMh. If the wrong battery is set up, the switch will still work, only the graphic bar display won't be accurate.

The assistants

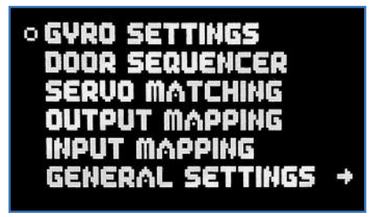
The already known assistants have been developed consequently, in order to make the set-up as easy as possible, assuming, there is a prepared RC transmitter, meaning, all functions and encoders are configured and verified with

JP TECHNICAL DATA

Measures	93 x 67 x 19 mm
Weight	85 g
Weight sensor switch	15g
Weight Display	15 g
Operating voltage	4,0 – 9,0 V
Power supply	2s LiPo / LiIon / LiFePo, 5s NiCd / NiMH
Power consumption operation	99 mA (mit OLED)
Power consumption standby	3 µA
Current carrying capacity	peak 2 x 20 A
Dropout current	0,3 V
Output voltage	5,9 or 7,4 V stabilised
Signal input	serial
Supported RS systems	Jeti, Futaba, Spektrum, HoTT, M-Link, JR Propo
Receiver redundancy	SRS
Channels	15 (18)
Servo outputs	15
Resolution servo impulse	0,5 µs
Impulse repetition rate	12, 15, 18, 21 ms
Gyroscope system	iGyro
Gyro controlling	Heading and normal mode
Gyro-sensor type	MEMS
Number sensor axis	6
Supported telemetry	Jeti, Futaba, Spektrum, HoTT, M-Link, JR Propo
Price	499,- €
Manufacturer	PowerBox Systems

www.powerbox-systems.com

The menu screen is clear and uncluttered.



Zuordnung der Ausgänge bei Aircraft Type Delta +VT									
A	Delta Right	D	Delta Left	G	Rudder A	J	---	M	---
B	Throttle	E	Flap	H	---	K	Flap	N	---
C	DS1	F	DS2	I	DS3	L	VT-Elevator	O	VT-Rudder

Assignment example Delta VT.

15 assigned servo outputs of the Mercury SRS.

the servo monitor. If all aspects are matching, the basic programming is done within minutes. The Mercury can be equipped and assigned with standard functions like flaps and gas during the set up. In order to determine the transmitter channel, you have to move the corresponding sensor in the menu and the channel will be recognised and accepted. It can't be any simpler. And that's how the basic configuration is set up and now you can proceed to setting up the additional functions and exact servo set-up via the servo match function.

Another simplification is the default setting of the servo outputs, you just plug in the servos into the designated slots, according to the plane type, and save yourself the manual assignment. Of course, all settings and presets can be done or changed subsequently, without using the assistant. The installation position of the Mercury is determined via lifting and lowering of the tail unit, for this purpose, the Mercury uses the six-axis Gyro sensor. As soon as the movement is recognised, the plane type has to be chosen from the following settings: Normal, V-tailplane (V-Tail), Delta, Normal VT (Vector Thrust), Delta VT and Acro. The plane types differ from each other in kind and assignment of the servo outputs and functions. For the J-10 Delta VT is perfect. For a correct function of the iGyro the mix is done in the Mercury, there is no mixer necessary in the transmitter. In the transmitter only ailerons, elevators and rudders, as well as the remaining functions, are configured, the details for Delta, V-tail and thrust vector are done by the Mercury.

Assignment example Delta VT

In the next step of the Setup Assistant a three-step switch is set up as a flight mode switch for the iGyro and a rotary or slide control for the gyro sensitivity. With the switch, the iGyro can switch between the three modes FM1 to FM3 during the flight. With the Gain switch the gyro sensitivity is determined during the set up, it deactivates automatically via the Test Fly Assistant. In order to determine the functioning of the two sensors, they have to be prepared in the transmitter and set up to a servo channel. Now, all positions have to be shifted or the switch moved all around - and everything is recognised, saved, ready.

The Heading mode of the iGyro is only active in the neutral position of the stick. As soon as the pilot uses the control, the iGyro works in the Rate Mode (Normal Mode). So, for this function, no switch is needed and the pilots don't have to fight against the Gyro, the iGyro tries to maintain the flight attitude in the Attitude Assist Mode. In order to exclude any confusions with the "Heading Lock Mode", which is well-known in the heli scene, PowerBox has named the Heading Mode "Attitude Assist Mode" in the iGyro, for the control behaviour of the iGyro is different from that in the Heading Lock Mode in helis.

With Attitude Assist the jet loses its fidgety behaviour, for example, the independent roll back from a curve, an independent interception from the downswing or the submerging in inward flight. As long as the pilot doesn't steer, the model flies virtually on rails, the "behaviour" is basically neutralised. Especially in jets, a more exact steering is possible, that's why many pilots call the Attitude Assist Mode the "Gyro Deluxe Mode". The jet can be landed easily with the Attitude Assist Mode and the pilot can concentrate on planning the landing circuit and a clean approach. Potential stalls will be compensated by the iGyro, a slow plane will not dip over, but rather sag, and can be saved using a spirited throttle.

For the iGyro to develop its full performance, it's provided with the possibility of a speed-dependent sensitivity adjustment via GPS II sensor. The influence of speed on the control behaviour of the gyro should not be underestimated. If it's flown in average speed, the iGyro corrects with the needed sensitivity and accordingly adjusted rudder settings. In slow flight larger settings are necessary, in fast flight only minimal corrections. The GPS II can also be used as a standalone telemetry sensor with almost all telemetry-adjusted 2,4 GHz systems. In jets with extremely wide speed spectrum, a correction with the Airspeed Factor is possible. If the machine swings up in higher speeds, not in lower speeds, the factor can be gradually increased. The higher the factor, the more the gyro will fade out in increasing speed.

In order to set up default flight modes FM1 to FM 4, you have to choose the corresponding flight mode via FM switch and change it with the sensor buttons.

Following settings are available: *GYRO OFF (default FM1) The iGyro is deactivated, the signals pass through. * RATE MODE The iGyro works in Normal Mode and can be activated in all flight modes. * ATTITUDE ASSIST STD (default FM2) This setting affects only the ailerons and elevators, the rudders work in Rate Mode. Otherwise, in an aileron-controlled curve in normal flight, the rudder servo would work against it. * ATTITUDE ASSIST ALL The positioning attitude for ailerons, elevators and rudders is activated, allowing to fly slow rolls, the rudder holds the correct position. * VECTOR THRUST 3 D The thrust vector control is activated automatically, so no rudder and elevator mixes have to be set up. All gyro outputs including vector are set to 100 % gain, ATTITUDE ASSIST is deactivated, very important for vector jets. * TORQUE ROLL (no default setting, is chosen during the set up, preferably FM3) This option sounds interesting, but can't be used in vector-controlled jets, a crash would be predestined. All three gyro axis are set up to 100%, ATTITUDE ASSIST is activated for all rudders. In order to activate, the jet has to be almost still, and using the aileron, you can even turn it around itself.

Due to the preset options, almost all i Gyro configurations, including the otherwise time-intensive set up of the vector control, can be done within a very short time.

> "To enable the iGyro to show its full performance, it has the option of speed-sensitive sensitivity adjustment via GPS-II sensor.

Set up of the standard functions

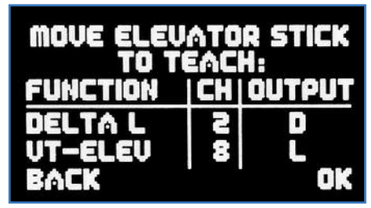
Now, the standard functions are applied and the servo plug-ins are assigned to aileron, elevator, rudder, flaps and throttle. You move the corresponding stick or sensor up to the desired function, which is then recognised by the Mercury and an output is assigned. The Mercury will recognise, if one function has two channels in the transmitter. Free functions or channels can be assigned to free servo outputs in the Output Mapping. In case of a failsafe of both receivers, every available function can be set up individually to Hold (HD) or to preset positions (Failsafe FS). The correctly set and checked effective directions of the iGyro are very important, the gyro has to compensate the indirected movements in the right direction. The effective direction should not be confused with the servo's running direction in the transmitter menu. The simple rule is: The rudders have to deflect in the direction of the movement. If you move the tail unit up, the elevators will move up, too (in the J-10 in FM3 the altitude vector will move, too), etc. The effective direction can be reversed easily via the menu.

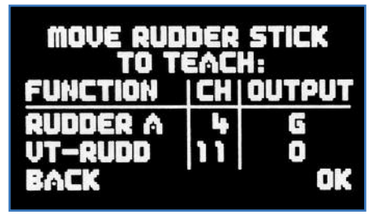
The Test Fly Assistant

The Test Fly Assistant has the purpose of adjusting the basic setting of the iGyro during the flight. In only one flight, the needed sensitivities for all gyro axis can be set. The iGyro is shortly initialised and reset, while the model should stand still. In order to set up the transmitter channels, all gyro channels aileron, elevator, rudder are set up to the limit. In order to set the iGyro correctly, the model has to be flown-in and trimmed. The linkages should be free of play and fixed in right angle to the servo lever and rudders. The jet is flown parallel to the runway at medium speed and, as soon, as the plane starts to rock on one of the three gyro axis, the sensitivity is increased slowly via the corresponding controller in Flightmode 2. Fast stick movements or a knife flight can provoke a build up of rocking movements. If there are no apparent rocking movements, the flown gain values are automatically transferred into the set up via FM1 (Gyro OFF) and saved. The corresponding controller will be deactivated, so there's no danger for the setup to be shifted by mistake. After that, the iGyro can be activated via Flightmode button to FM2 and the first landing will be supported by the Gyro.

If the Expo values for the aileron, elevator and rudder are high, the flight behaviour might be perceived as spongy, after the iGyro set-up. Correcting the iGyro around the neutral position has the same effect as higher expo values, as the gyro effect fades out only at higher deflections. In this case, a reduction of the expo settings by 10 - 20% might suffice.

Some models might need more than the normal 100% gyro sensitivity. Here, the Gain can be increased by the factor 4 (Gyro Sense x 4). Normally, this is only necessary in large and slow models, not in jets.





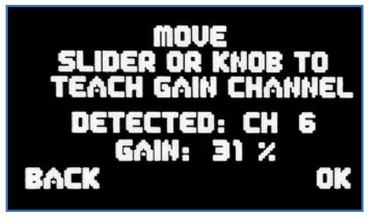
Classifying of the controlling functions - here Elevator and Vector, Rudder and Vector Thrust - is done quickly.

Servo matching and door sequencer

If two or more servos have to be matched with each other, for example, two flap or elevator servos or servos on an aileron, it can be done easily with the Matching function. The Matching function can limit the servo travel or change the direction of rotation. At first, one of the servos is set up via the transmitter as a reference. In Servo Matching, the neutral and both end positions are classified and the second (or third) servo is adjusted most accurately with the servo control.

The landing gear flaps can be controlled in a similarly simple way. The flaps are normally opened and closed via servos, pneumatic cylinders or electric actuators and have to be adjusted to the timing of the landing gear. The door sequencer is a mighty tool and can successively work through different steps. The start is done

Identification of the Flightmode switch and the Gain controller via the Set-up Assistant.



The default Flightmode configurations of the iGyro for different plane types. In the above picture, the standard set-up, below Vector Thrust.

The standard setting for thrust vector models in Flightmode 3: in the iGyro menu the vector Altitude is named Elevator-B and the vector Rudder is called Rudder-B.

The Mercury is located in a CFRP sandwich carrier, behind the Canard frame of a J-10. The cardboard holder can be used as a stencil.

via the landing gear switch, the chronology can be adjusted to the original. Another function of the door sequencer: it can switch-off the nose wheel servo after retracting and park it in a defined position. That's how you can save the setting-up of mixers in the transmitter.

In the Setup Assistant of the door sequencer, the landing gear switch and the servos/actuators/valves are defined separately and assigned to the outputs of the Mercury. There is a total of 24 single procedures, called tasks (12 ON and 12 OFF) and they define almost all procedures of a landing gear. Apart from that, there are three pre-defined modes (Motion Sequence).

Mode 1: The landing gear flaps open before extending and close after retracting of the landing gear.

Mode 2: After extending of the landing gear, the main landing gear flaps close again.

Mode 3: In addition to the main landing gear flaps, also the nose landing gear flaps close while the landing gear is extended.

Flight recorder and telemetry

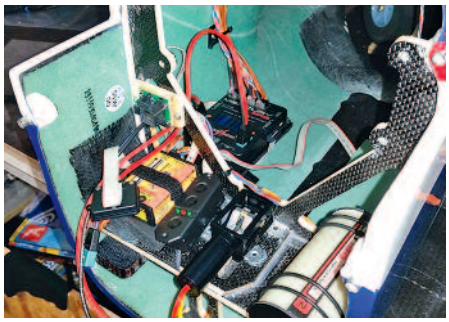
The flight recorder monitors and records the reception quality. It documents Antenna Fades, Lost Frames and Holds or rather Failsafes. If there are any abnormalities, the installation position of the antennae or receivers have to be changed. I have explained the possibilities of the PowerBox switch, inter alia the Mercury SRS, in connection with jet telemetry and the transmitter DC-16, in the JETPOWER 3/2016. The Mercury is, of course, updatable and can be kept up to date via a PC and a free terminal program and an optional USB adapter. A more elegant solution is the BlueCom adapter and a smartphone or tablet, which will make an update possible even at the airfield.

The installation

The Mercury is located in a CFRP sandwich carrier, behind the Canard frame of my CARF J-10. When installing, you can use the cardboard holder from the package as a stencil. Depending on the version, the J-10 needs between 9 and 14 servos/channels, the configuration is done quickly with the set-up assistant and Aircraft Type DELTA VT. I didn't need a single mixer for the installation in the transmitter. The Canards of the J-10 don't have to be necessarily gyro-ed, you can tag them along, for example via the direct connection in the Output Mapping of the Mercury. According to a hint of Enrico Thäter, the Canards in my J-10 are fixed in neutral by now. Originally, they were responsible for a clean straight flight via a separate Heading gyro, this task has now been taken over by the altitude function of the Delta rudders.

Conclusion

The new PowerBox Mercury SRS is a small box with many important and modern functions. It's space-saving, designed for medium-sized machines and quickly installed. Due to the redundancy and the integrated iGyro, it makes the handling of model jets safer and more comfortable. The gyro support helps not only for the pilots to relax, but also creates more safety during the landing. The set up is done quickly, using the assistant, and, even though I love setting up everything myself, I have to admit, that I came to appreciate Mercury's assistant.



Thanks to the support of the integrated gyro, the handling of my Eurosport has changed significantly. The flight image is rounder and softer, simply more jet-like. The landings in wind are as uncomplicated as in calm weather. In the J-10, the Mercury SRS simplifies the cable handling and the set up, especially of the vector thrust system. With the help of the set up assistant you will set everything up within minutes and won't have to deal with mixers or additional flight conditions in the transmitter. Flying with iGyro support is a pleasure, especially in 3 D mode. You still have to fly, though, this is the one thing the Mercury can't do for you.

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