

POWERBOX IGYRO 3E

FLYING AS IF ON RAILS

BY DIPL. ING. KARL-HEINZ KEUFNER

The number of model flyers turning to electronic gyro support is constantly growing. These stabilizing systems can be a great help in adverse weather conditions, and in such circumstances gyro assistance makes flying much

less stressful. The performance of these little electronic aids is constantly improving, while their size steadily decreases.

The iGyro™ 3e is a recent introduction by the innovative German company PowerBox Systems,

and constitutes a small, low-cost gyro, which complements the other gyro systems in the firm's range. The purpose of this article is to provide a description of the unit.

For PowerBox it is standard practice to announce and advertise a product when the design is finalized, and is ready for the consumers. Thus a review sample was ready for me to examine immediately after it first appeared on the company's website.

COMPONENTS

The iGyro™ 3e is housed in a solid, two-part aluminum case, with the two halves held together by machine screws. All electrical connections are accessible from above: on the left are the sockets for connecting the gyro to the receiver, while the servo sockets are on the right. The socket marked MISC is not currently assigned, but may be used for future expansion. A USB port is provided for connecting the iGyro to a PC. If adjustments other than basic setup are necessary, the iGyro is straightforward to configure using the free Terminal program running on a PC, if the USB PowerBox Interface Adapter is used; the port can also be used for installing software updates. A wiring diagram for the inputs and outputs is printed on the

underside of the gyro.

Two inputs and outputs are present for each of the aileron and elevator functions. This feature is intended for use in model aircraft whose individual control surfaces are actuated by separate servos. The small number of settings that have to be defined are entered using a dialogue controlled by a button and the integral red and green LEDs, which are assigned to each control surface function and mounted on the top face of the gyro. In addition to the iGyro, the set includes six patch-leads for connecting the unit to the receiver, and two self-adhesive pads that are used as a secure mounting for the gyro.

HIGH-PERFORMANCE MEMS SENSOR

Opening the iGyro™ 3e reveals a neatly manufactured circuit board populated with the very latest micro-electronics. A sixteen-bit processor ensures extremely fast signal processing and very high servo signal resolution. The heart of the circuit is a modern MEMS sensor (Micro-Electro-Mechanical System); the chip detects every movement of the model simultaneously in three dimensions and around the three flight axes. Compared with conventional piezo

sensors, the temperature drift of a MEMS sensor is virtually zero; aging effects are negligible, and the sensor is less susceptible to vibration. The position of the MEMS sensor determines the installed position of the gyro in the model.

The three edges of the MEMS sensor must be aligned exactly parallel with the model's primary axes, to ensure that its movements can be interpreted accurately. The edges of the gyro's case are exactly in line with those of the sensor. The iGyro™ 3e can be installed either in the fore-and-aft orientation, transversely, or even standing on end, but in every case it must be positioned exactly parallel with the primary flight axes. The default setting is for a horizontal mounting, with the sockets facing forward and aft. If you wish to install it in a different position, there is a very simple method of selecting this in the parameter setting procedure.

3E: TRIPLY SIMPLE

If we are to believe the advertising produced by PowerBox Systems, the new gyro is simple to install and simple to program, and the model is much easier to fly when the iGyro™ 3e is employed. To make a long story short, I can confirm these claims. The new gyro from PowerBox Systems

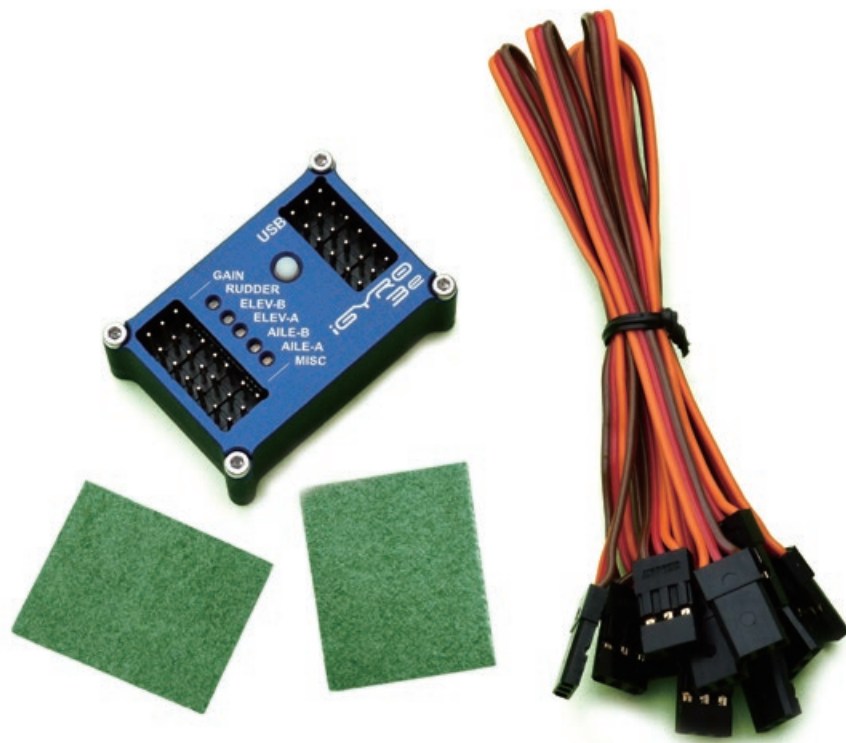
is a genuine plug-and-play device: once you have checked the direction of its corrective effect, and carried out any minor changes required at configuration, the gyro can be used immediately, because its default settings have been carefully selected to make it usable without further adjustment. If your model allows the installation of the iGyro™ 3e in accordance with the default settings mentioned above, all you need do is check the direction of gyro response, and make any changes required. This is a very simple matter: you observe the LEDs assigned to the individual inputs, and make your selections using the white button fitted to the top surface.

If the process of checking the direction of gyro effect reveals that a change must be made, the following procedure is required. The gyro is first installed in its default orientation using the self-adhesive pads supplied in the set, then the receiver and servos are connected. It is essential to select a rotary knob or slider at the transmitter and assign it to operating mode selection and gyro gain adjustment. The selected control must provide adjustment of that channel over the range -100 to +100 percent. Switch the transmitter on, followed by the receiving system, then set the



The sockets are situated on the top surface of the rugged aluminium case, which is screwed together.

The wiring diagram for connecting the servos and receiver is printed on the underside of the iGyro™ 3e.



The set includes six patch-leads and two self-adhesive pads in addition to the gyro itself.

>> transmitter control for gyro gain to the +100% position: this activates full gain in NORMAL operating mode. The gyro's effect direction can then be checked around all three primary axes by tilting the model in each direction in turn: the control surface deflections generated by the gyro must be in the direction which counteracts the model's tilting motion around that axis.

ULTRA-SIMPLE PROGRAMMING

If one direction of gyro effect is incorrect, it must be changed. This is accomplished by holding the button pressed in for a period of five seconds, until all the LEDs go out. When you release the button, the LED assigned to the first aileron servo (AILE A) glows dimly. Pressing the button at this point reverses the direction of effect for that servo function; the corresponding LED now lights a bright red. Pressing the button a second time restores the previous state. Any changes you make are immediately and permanently stored. If you need to reverse another servo function, you must keep the button pressed until the associated LED lights up dimly, after which the direction of effect can be reversed as already described. Once all the directions of corrective effect are set correctly, the iGyro™ 3e is ready for use — provided the model features a normal wing and tail configuration. For initial test-flights the gyro gain slider should be set to its center position in order to switch the gyro function off completely. Thanks to the sensible default settings, everything can be carried out very easily and rapidly, without requiring a PC for programming.

POWERBOX TERMINAL PROGRAM

If it proves necessary to make further alterations to the gyro's configuration, perhaps because your model has a V-tail, then the procedure can be carried out with the help of the USB Interface Adapter and a PC; the Terminal program required for this can be downloaded from the PowerBox website free of charge. The program includes integral instructions; if you call up the "Quick Tip" menu point, you will find a detailed explanation of all the functions. The frame rate can

be adjusted to suit the servos installed in the model, a different wing or tail type can be defined, and much more. It is also possible to set up the gyro's operating modes to suit individual requirements. Gyro effect and the "Heading" option are freely variable for each of the five outputs, relating to the three primary axes of a model. It is even possible to configure a "delta limiter" to ensure the cumulative travel of the aileron and elevator servos do not result in excessive movements, which could cause mechanical damage. When the program is started, it reads out the current configuration and displays the information on the PC's screen. If you wish to alter the configuration in terms of the installed orientation — perhaps because you need to install the iGyro™ 3e standing on edge in a slim glider fuselage — then you simply activate the corresponding orientation with a mouse-click; the active orientation is displayed on-screen in a frame.

ALL CHECKS PASSED

The iGyro™ 3e processes standard PWM signals at the input and output, and this means it can be integrated into an existing model quickly and easily: the device is simply looped in between the receiver and the servos.

In my case I decided to use a Katana 50 E as testbed; this is an electric-powered model from SebArt. The first step was to install the unit as described in the instructions, followed by a thorough check of the gyro's functions. No problems of any kind were encountered during the test procedure on the ground. I did need to make changes to the direction of gyro effect, and this again was accomplished without difficulty. The checking procedure showed that even the tiniest movement of the model generated the corresponding servo response without any delay, and this was true of both the Normal and Heading modes. If you have activated normal damping mode, tilting the model results in a brief compensating servo deflection which affects the corresponding model axis. If Heading mode is active, the corrective servo deflection remains in force until the model is returned to its exact original position. When



Test-flights were carried out with a 50-class electric-powered model.

switching operating modes I was pleased to see that the LEDs, whose primary purpose is to guide you when setting up the configuration, have an additional function: they glow red or green to indicate whether Normal mode (green) or Heading mode (red) is active for the corresponding control surface function. The Heading mode of the iGyro™ 3e has been developed specifically for fixed-wing model airplanes, and is based on a special regulatory algorithm that ensures that the model's flying characteristics are natural. I found that gyro gain adjustment also worked straightforward every time. So, there was nothing to stop me carrying out an actual test flight.

TEST FLYING

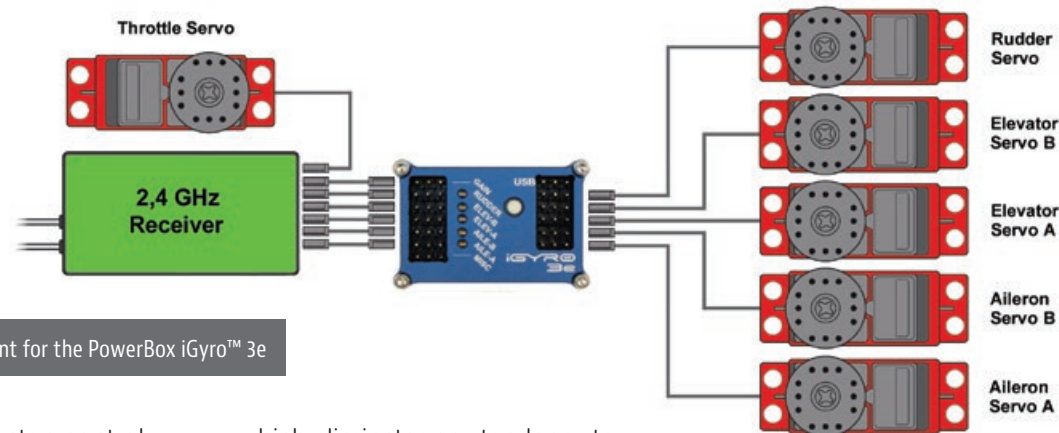
The first flight took place in extremely windy weather, initially without gyro support; i.e., the transmitter control for gyro gain adjustment was set to the Neutral position. Once the model had reached a safe altitude, I moved the gyro gain to a medium value in Normal mode, and was instantly aware of the positive influence of the new PowerBox gyro: the model flew more smoothly, and the effect of the wind was much less pronounced. After a few circuits I increased the gain value further, but this was a

little too much, and the model started oscillating gently around the transverse and longitudinal axes. Turning the rotary knob back a little cured the problem, and from this point on, the Katana 50 E flew with an unexpected level of smoothness in spite of the powerful wind; the aircraft's formerly unpredictable response to gusts of wind was almost completely eliminated. It even proved straightforward to carry out landing approaches in a strong cross-wind. Another self-evident advantage of the iGyro became clear during a ground-roll on an un-mown grass strip. Models with tail-dragger undercarriages always tend to tip onto their nose at takeoff or landing, but the gyro nips the movement in the bud — long before the pilot could possibly perceive it. The new gyro from PowerBox Systems is simply a great help in model flying.

I also tried Heading mode, and discovered that, in my opinion, the optimum gain value is slightly lower than for Normal mode. The gyro's special regulatory algorithm, which was developed specifically for fixed-wing models, produces impressively confident flying characteristics. In this mode the iGyro™ 3e keeps the airplane in the attitude to which it was brought by the pilot's deliberate control commands. Each stick



The iGyro™ 3e's parameter setting procedure is carried out using a menu system and the free Terminal program available from PowerBox Systems.



Typical wiring arrangement for the PowerBox iGyro™ 3e

>> movement which affects a control surface results in a permanent change to the model's flight attitude — even after the pilot returns the sticks to the zero position. A model placed in a nose-up or nose-down attitude no longer tends to recover by itself when the elevator stick is returned to the neutral position; instead the pilot must give an appropriate elevator command. This feels strange at first, but I found I became accustomed to this behavior relatively rapidly.

When Heading mode is selected on the iGyro, it only affects all three flight axes for as long as the corresponding transmitter stick is at the neutral position. Any movement of the stick disables Heading mode, causing the gyro to revert to normal Damping mode. This unusual characteristic produces a very smooth, completely harmonious behavior in flight, and the pilot soon learns to appreciate this feature, especially when flying aerobatics. The first indication of this is in inverted flight: roll the model inverted, and the gyro's Heading mode maintains the model in a stable attitude even though the sticks are not touched. Down-elevator correction is generally necessary when the model is inverted, but the iGyro™ 3e relieves the pilot of the task; i.e., it applies the required down-elevator automatically. And it does so very accurately, applying just the right amount of deflection. Four-point rolls show the gyro's positive effect extremely clearly. The usual elevator and rudder corrections are carried out by the iGyro, so all the pilot has to do is roll the model to the four points in turn using the aileron stick. The model's heading is maintained accurately by the gyro,

which eliminates any tendency to veer off course. The model aircraft is easy to control when the iGyro is in Heading mode, and the pilot very soon starts to feel pleasantly relaxed on the sticks.

Once I had established the optimum gain for the gyro's two operating modes, I set up a three-position switch for selecting the modes: in the switch's centre position the gyro is disabled, while the forward and back positions activate Normal mode and Heading mode respectively. The travel adjustment option is used to enter the values established during the test-flying procedure, and in practice this works extremely well. In overall terms the model airplane is much more stable in the air, and the PowerBox gyro effectively stabilizes the aircraft in adverse conditions and very windy weather. It was not long before I found I no longer wanted to fly without the iGyro™ 3e. However, it is important to understand that even this superbly effective device is unable to perform miracles: the pilot still needs to master their model and learn how

to fly the individual moves. If you cannot manage a particular maneuver without gyro support, don't expect to be able to manage it just by switching on the gyro.

SUMMARY

The new PowerBox iGyro™ 3e for fixed-wing model aircraft has such a marked stabilizing effect on the weather that outside influences become insignificant. It also makes the pilot's task substantially easier when flying aerobatics. The PowerBox gyro is ready for use virtually out of the box; in most cases there is no need for wide-ranging programming work since the default settings are so well considered. The gyro has proved excellent all round, and has never failed to work properly. Thanks to the unique regulatory algorithm, these attributes apply equally to Heading mode. In my opinion the iGyro™ 3e constitutes a really sensible buy for any fixed-wing model flyer. **RC SF**

SPECIFICATIONS	
	Operating voltage: 4.0 – 9.0 V
	Current drain: 40 mA
	Signal input: PWM
	Number of sensor axes: 3
	Servo outputs, total: 5
	Servo signal resolution: 0.5 µs
	Gyro regulation: Heading and Normal modes
	Gyro sensor type: MEMS
	Current capacity: max. 20 A
	Temperature range: -30°C – 75°C
	Dimensions: 43 x 30 x 15 mm
	Weight: 36 g (incl. six patch-leads)

iGYRO 3e

Quality manufacturing to DIN EN ISO 9001:2008

PowerBox Systems GmbH

World Leaders in RC Power Supply Systems



3 x easy:
 ✓ easy installation
 ✓ easy setup
 ✓ easy flyin'

Please contact our main dealers Chief Aircraft INC., Dreamworks model products, Aircraft International or Duralite Flight Systems - They have our products on stock

www.powerbox-systems.com

POWER EXPANDER SRS

Quality manufacturing to DIN EN ISO 9001:2008

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World Leaders in RC Power Supply Systems



- + The unique channel expansion unit from PowerBox Systems
- + Sockets for direct connection of eighteen servos, like a receiver
- + Integral SRS for use of two receivers: full receiver redundancy
- + Compatible with: Futaba, Spektrum, Graupner, Jeti, Multiplex and JR
- + Integral heavy-duty socket: optional MPX high-current connector or original Ultra Deans

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