

PowerBox Systems®

World Leaders in RC
Power Supply Systems

PowerBox

Professional



Dear customer,

We are delighted that you have decided to purchase the **PowerBox Professional** power supply system from our range.

We hope you have many hours of pleasure and success with your **PowerBox Professional!**

1. Product description

The **PowerBox Professional** is a modern power supply system which contains all the electronic components required for today's receivers, servos and models. Every component needed for a totally secure airborne power supply, including ICs, micro-controller and electronic circuits, is **duplicated!** This High-End power supply system features an outstanding range of the latest innovations, including a high-resolution graphic OLED screen, four match-channels catering for eight servos, and the facility to bind to the downlink channels of various manufacturers.

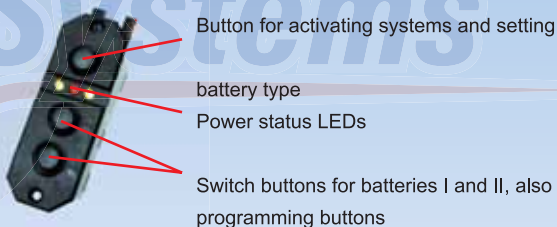
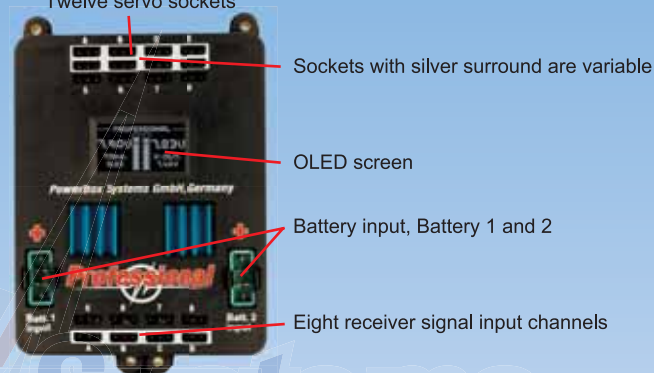
Features:

- High-resolution graphic **OLED screen** with 128 x 64 pixels
- Ultra-simple menu-based programming system using the **SensorSwitch Signal amplification** for a total of eight channels and twelve servos
- **Synchronised servo output:** all servos operate totally synchronously
- 16-bit processor for high-speed, high-resolution signal processing
- **Four match-channels**, each for two servos; all servos separately variable
- **Double** regulated output voltage
- Sockets for Multiplex MSB and Spektrum downlink bus systems, **update capability** with **USB Interface Adapter** for other systems
- Direct transmission of both battery voltage values to the transmitter
- Voltage display for each battery separately
- Servo voltages can be set to **5.9 V or 7.4 V**
- Minimum value memory displays any voltage collapses
- Combined heat-sinks permit high regulator power
- Voltage regulator monitor
- Supports four battery types: **LiPo, LiFePo, NiMH, NiCd**
- Suppression of any servo feedback currents which may occur
- Can also be switched on and off using the MagSensor
- Update-capable using the **PowerBox USB Interface Adapter**

2. Connections, controls

The following illustrations show the essential sockets and controls:

Twelve servo sockets



Left: socket for Spektrum telemetry
Right: **SensorSwitch** socket



Socket for Multiplex telemetry MSB
Also for Futaba and Hott when available
This socket is also used for software updates

3. First steps before using the unit

3.1. Connections

- Connect all the servos to the channel outputs you wish to use. The channel assignment is left up to you, bearing in mind that, for example, input 4 corresponds to output 4.
- **CAUTION:** connect all the servos, but for safety's sake please disconnect the mechanical linkages to the unmatched servos: Please read the set-up notes under Point 4.1 !!
- Connect the receiver to the unit using the eight patch-leads supplied. If you only need six channels, use only six patch-leads. Power is fed to the receiver via all of these leads.
- Now connect the **SensorSwitch** to the appropriate socket on the unit, ensuring that the ribbon cable faces up. In models subject to severe vibration we recommend that you secure the ribbon cable by at least one additional point to avoid the connector working loose. If the connector were to fall out, it would have no effect on the switched state of the backer, but it would prevent you switching the system off.
- Connect the batteries to the backer's connectors, taking great care to **maintain correct polarity** (note red + on the case !). We recommend the use of **PowerBox Batteries** of 1500 mAh, 2800 mAh, 3200 mAh or 4000 mAh capacity. If you prefer to use other makes of battery, or wish to make up your own packs, it is absolutely essential to maintain correct polarity. If you connect a battery with reversed polarity, the immediate result will be to ruin the corresponding regulator in the backer. In order to minimise power losses, the unit does not feature reverse polarity protection.

3.2. The procedure for switching on and off

The method of switching the unit on and off is very simple, and effectively eliminates the possibility of changing the backer's status accidentally. This is the procedure:

Locate the **SET** button on the **SensorSwitch** and hold it pressed in until the central LED glows red. Now press buttons **I** and **II** in turn to switch the backer on. Both the backer's switches are now turned on. Of course, you can also switch the power circuits on individually for checking purposes.

Repeat the procedure to switch off: hold the **SET** button pressed in, wait until the central LED glows red, then confirm by pressing buttons **I** and **II** in turn.

Your **PowerBox** stores the last switched state (on or off). That means: if the backer is switched on using the **SensorSwitch**, it always stays switched on; once switched off, it remains switched off. Intermittent contacts or inter-ruptions in the power supply cannot cause the backer to be switched off.

We can also supply an optional method of turning the **PowerBox Professional** on and off using a concealed switch; this requires the **MagSensor** (Order Number: 9040). The switching process is carried out using a ring magnet and requires no physical contact, i.e. it can operate through the fuselage side.

3.3. After charging the batteries

The **PowerBox operating time** can be reset after each charge process, so that the unit is able to display reliable values for energy consumption and operating times. This is the reset procedure:

With the system switched on, locate both buttons I and II on the **SensorSwitch** and press them simultaneously; hold them pressed in until the following screen display appears:



Now release both buttons: the operating time starts recording again at 0, so that you can monitor and keep to the calculated operating and flight times for the battery type you are using.

3.4. Main screen display

When switched on, the unit's integral screen shows this display:



Key to the individual points:

- Digital voltage display:

This highly accurate display allows you to read off the voltage of the two batteries directly, i.e. the voltage present at the **input** of the **PowerBox**.

- Graphic voltage display:

A brief glance into the model provides you with information about the batteries' state of charge. This display is always correct for the type of battery you have selected. This means that the bar will extend right to the top of the box if the connected battery is fully charged. If the bar only fills the bottom third of the box, then the corresponding battery is almost flat.

- Operating time:

This figure shows the elapsed time since the last "RESET". It is important always to carry out a RESET after each battery charge process.

- Output voltage:

This value displays the backer's exact regulated output voltage, i.e. the voltage fed to the servos and receiver.

Note:

The voltage of the two batteries is likely to drift apart slightly as the packs are discharged. This by no means indicates a fault in the **PowerBox**; on the contrary: it proves that this is a dual system featuring genuine redundancy. Here at **PowerBox Systems** we compensate manually for manufacturing tolerances between the two regulators, but

it is never possible to produce paired components which are absolutely identical. All **PowerBox** battery backers actually contain **two independently operating regulators**, and they are designed deliberately to maintain a reserve in one of the batteries.

The slight difference in discharge rates has a positive effect in terms of security: If one of the batteries is already flat due to excessive flying, the other still maintains a residual current of 200 - 300 mA, thereby preventing the situation where both packs suddenly become flat at the same moment.

3.5. Basic settings

The **PowerBox Professional** features a modern, clearly legible OLED screen, intended to do away with old-fashioned programming methods based on flashing LED codes, morse code beeps or jumpers. The screen is the basis for a convenient, user-friendly, menu-based system which is controlled using the **SensorSwitch**. Wherever possible the screen provides full information in English; few abbreviations are used. Programming is simple and self-explanatory, and you will rarely need to consult the operating instructions.

This is the basic rule: use buttons **I** and **II** to move the cursor (small circle) or change values, and the **SET** button to select or confirm your inputs.

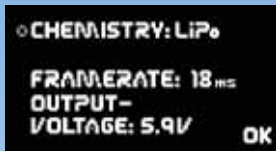
The basic settings cover the battery type in use, the regulated output voltage for the servos, the servo frame rate, the initialisation of the match-channels and the servo settings.

These settings should always be entered immediately after you first use the device. The next screen-shot shows the default settings for the **PowerBox Professional**. **If you wish to change them, this is the procedure:**

- Switch both batteries on.
- Hold the SET button pressed in until the following display appears:



- Press button II until the cursor is alongside “**Power Manager**”, then press the SET button. The following display now appears:



- If you wish to change one of the settings, use buttons I or II to move the cursor (small circle at the left margin) to the appropriate menu point, and press the **SET** button to confirm this.
- Now alter the value using buttons I and II. Once you have selected the desired value, confirm your choice with the **SET** button again: this saves (stores) the value. You can return to the main menu by repeatedly pressing the **SET** button, until the cursor reaches the **OK** menu point.

NOTE: the presence of a solid disc (instead of a circle) indicates that you are at a menu point.

It is possible to alter a value more quickly by holding one of the two buttons I or II pressed in; the value then starts to change slowly in the corresponding direction, the rate of change accelerating with time.

Key to the individual menu points:

Chemistry: this is where you set the battery type. Three different types of battery are available:

- LiPo
- NiMH (incl. NC)
- LiFePo

Frame rate:

Caution: the default frame rate value is 18 ms, and you should only change it if you are certain that your servos are suitable for a lower frame rate, e.g. 12 ms. This value indicates the time interval at which the servo signal is refreshed. Modern digital servos are unlikely to give problems with a 12 ms setting, but older analogue servos may require an increase in the frame rate to 21 ms. For more information please contact the servo manufacturer. A faster refresh speed (lower frame

rate, e.g. 9 ms) causes the servos to respond more quickly, and they will offer greater torque.

The frame rate can only be adjusted on the four match-channels. The remaining four channels operate with the frame rate of the receiver you are using.

Servo output voltage:

The default setting for output voltage is 5.9 Volt.

If you intend to raise the servo voltage to 7.4 Volt, please ensure that all the consumer units connected to the backer, i.e. all servos, receivers and gyros, are compatible with a 7.4 V supply.

Note: even though a servo manufacturer has approved his servos for the higher voltage, you may well observe that they jitter constantly, and are imprecise in operation. If this should happen, you risk massive servo problems, and we recommend that you revert to a voltage of 5.9 Volt.

Note: compared with a direct, unregulated power supply, the advantage of a stabilised 7.4 V supply is that the voltage is always constant. This means that the servos in your model always run at the same speed and generate the same torque. For example, if you were to operate the servos on the unregulated voltage of LiPo batteries, their transit speed and torque would decline steadily as the batteries became increasingly dis-charged. A further major advantage of a regulated 7.4 V voltage is substantially extended useful life of the servos. All our top pilots, from every part of the world, consider this regulated voltage an important factor, as it is the key to a constant, predictable flying style.

4. Servo matching

4.1. Initialising the transmitter

If the servo-matching function is to operate effectively, it is essential to ‘teach’ the backer the centre point of your transmitter’s sticks; this only has to be carried out **once**.

Move to the main menu and call up the “**TX SETTINGS**” point. This takes you to the following menu:



Your transmitter must be initialised in the **PowerBox Professional** to ensure accurate servo matching. This simply means “teaching” the backer the centre positions of your transmitter stick channels.

Move the cursor to “CHANNEL”, and select the desired channel.

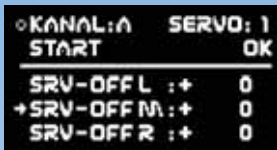
Now use the cursor to select “POS”. The stick for this channel must be at centre. Confirm the value with the SET button. Repeat this procedure with each of the match-channels in turn.

You can now start matching the servos, starting from this stick position. Subsequent changes to the trim values have no effect on servo matching.

Press “**OK**” to return to the main menu.

4.2. Adjusting the match-channels

Select the “Servo Matching” point in the main menu, and you will arrive at this screen display:



◦ KANAL: A	SERVO: 1
START	OK
SRV-OFF L : +	0
+SRV-OFF M : +	0
SRV-OFF R : +	0

As already mentioned, please note that the channels to be matched must be initialised beforehand.

We recommend that you start by adjusting the mechanical linkage for servo 1 of the channel in question, so that the control surface is exactly at neutral when the servo is at centre. We also advise you to set up the maximum travel correctly before matching the servos. The method of programming is once again ex-tremely simple; a step-by-step account follows:

- **Disconnect** the control surface linkages from the servos to avoid high forces acting upon the as yet unmatched servos.
- Select the channel you wish to match in the “**CHANNEL**” menu point.
- Now select the servo you wish to adjust; both servos can be adjusted or reversed independently of each other.
- Move the cursor to “**START**”, but **do not** press the **SET** button at this point.
- If you now move the corresponding transmitter stick, the arrow at the bottom of the screen indicates which “**OFFSET**” you are adjusting. This does not affect the adjustment process, but does inform you whether you are altering the end-point or the centre position.
- Move the stick in the direction you wish to adjust, then press the **SET** button.
- You can now release the stick, as the **PowerBox** retains the position. This means that you have both hands free, enabling you to use one hand to adjust the position accurately using buttons **I** and **II**, and the other to check that the disconnected ball-link lines up correctly with the linkage point.
- Press the **SET** button again to conclude the set-up process.
- Don't re-connect the linkage until you have adjusted the centre position and both end-points perfectly.

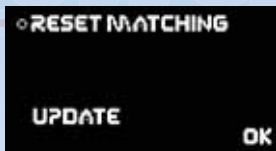
- If you wish to adjust further settings at a different end-point or centre position, move your stick in the appropriate direction once more, and press the **SET** button again to start the process.
- If you wish to reverse the direction of rotation of a servo, move the control surface to one end-point and select the “**START**” menu point. Now press button **I** or **II** constantly until the control surface moves in the opposite direction. Repeat the procedure for the other end-point of travel.

TIP:

In the case of large ailerons in particular, it can be advantageous **not** to match the servos with 100% accuracy. If the servos are precisely matched, gearbox play may allow aileron flutter to develop. You can eliminate this risk as follows: first match the servos exactly to each other, and then reduce the play in the servo gears by pressing the **I** or **II** buttons two or three times.

4.2. Resetting the match-channels

Select the “**RESET**” point in the main menu to move to the following screen display:



This menu point is used to reset the values for the match-channels to the factory default settings.

Caution: once you have confirmed your choice by answering “**YES**” to the security query, the values are reset, and the previous settings are permanently lost.

5. Connections for radio control systems with downlink facilities

The **PowerBox Professional** includes one entirely new feature: you can connect various radio control systems to it in order to transmit all

data for both batteries directly to the screen of your radio control transmitter. The system currently supports the Multiplex “MSB” system and Spektrum telemetry. Updates for Futaba and HoTT will be available as soon as these radio control systems offer this feature. You will be able to install the update yourself.

All you have to do is connect the receiver or the downlink transmitter to the appropriate port of the **PowerBox Professional** backer **before switching the system on**. There is nothing to configure, and the system automatically adopts the correct settings and calibration values. However, if you are using an MSB connection it is essential to check that other sensors connected to the “bus” do not share the addresses used by the **PowerBox**. The table below contains a summary of the addresses used. The voltage of both batteries is available, and alarms are triggered at the transmitter if the values fall below a specific threshold, according to battery type.

Addresses of the **PowerBox Professional** for the MSB system (Multiplex):

Address	Function
3	Battery voltage 1
4	Battery voltage 2

6. Error message

The **PowerBox Professional** constantly checks both voltage regulators in-dependently of each other. If a fault should occur in one of these regulators, this warning will appear on the screen:



There are three possible causes for this warning:

a) One or both regulators is generating insufficient output voltage or none at all. This could mean that you are flying with only one regulator functioning, and for reasons of safety this is not advisable.

b) One or both regulators is not functioning, and is passing through the full battery voltage. This means that the servos and receiver are being operated on an excessive voltage, which could lead to failures in the longer term. This malfunction usually occurs after a **reversed polarity** situation when the batteries were connected to the **PowerBox Professional**.

c) One battery is plugged in, but not switched on; the second battery is plugged in, and switched on. In this case there is **no error!** This message is just a warning, and is intended to remind you to switch both regulator circuits on.

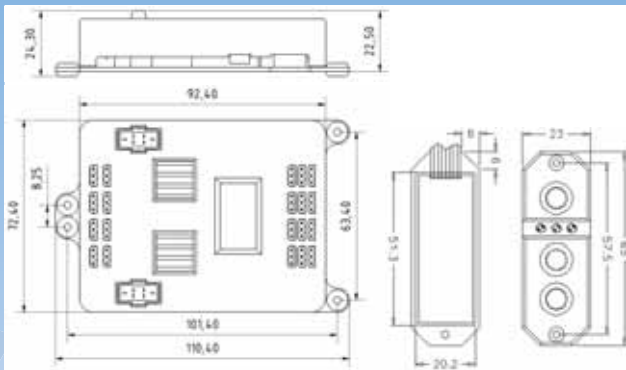
If either of the first two faults should occur, please send the device to the Service address stated below, accompanied by the repair form which is available for downloading from our website.

7. Specification

Operating voltage:	4.0 V - 9.0 V
Power supply:	2 x 5S NiMH / NiCd, 2S LiPo, 2S LiFePo
Current drain:	approx. 130 mA
Idle current:	approx. 15 μ A
Output voltage:	5.9 V or 7.4 V, stabilised
Max. load current:	Peak 2 x 20 A
Dropout voltage:	0.3 V
Receiver:	1, via parallel inputs
Supported telemetry systems:	DSM2 / DSMX, M-Link
Channels:	8, 4 of them programmable
Servo outputs:	12, 8 of them programmable
Servo signal resolution:	0.5 μ s
Selectable signal frame rates:	9 ms, 12 ms, 15 ms, 18 ms, 21 ms
Integral screen:	OLED graphic panel, 128 x 64 pixels
Dimensions:	110 x 72 x 24
Weight incl. switch:	130 g
Temperature range:	-30°C to +75°C
EMV approval:	EN 55014-1:2006
CE approval:	2004/108/EG

The unit must not be connected to a mains PSU!

8. Dimensions



9. Set contents

- **PowerBox Professional**
- Eight patch-leads, Uni-connectors
- **SensorSwitch**
- Four rubber grommets and brass spacer sleeves, pre-fitted
- Four retaining screws
- Operating instructions in German and English

10. Optional accessories

- **MagSensor**
- **SensorSwitch** with 0.8 m, 1.5 m and 2 m connecting lead
- **USB Interface Adapter** for future software updates

Guarantee conditions:

At PowerBox Systems we insist on the highest possible quality standards in the development and manufacture of our products. They are guaranteed “Made in Germany”!

That is why we are able to grant a **36 month guarantee** from the initial date of purchase on our **PowerBox Professional**. The guarantee covers proven material faults, which will be corrected by us at no charge to you. As a precautionary measure, we are obliged to point out that we reserve the right to replace the unit if we deem the repair to be economically unviable.

Repairs which our Service department carries out for you do not extend the original guarantee period.

The guarantee does not cover damage caused by incorrect usage, e.g. **reverse polarity**, excessive vibration, excessive voltage, damp, adhesives and short-circuits. The same applies to defects due to severe wear.

We deny any further liability, e.g. for consequent damage.

We also deny liability for damage caused by the device or the use of the device.

We accept no liability for transit damage or loss of your shipment. If you wish to make a claim under guarantee, please send the device to the following address, together with proof of purchase and a **description of the defect**:

Service Address:

**PowerBox-Systems GmbH
Ludwig-Auer-Straße 5**

**D-86609 Donauwörth
Germany**

Liability exclusion:

We are not in a position to ensure that you observe our instructions regarding installation of the **PowerBox Professional**, fulfil the recommended conditions when using the backer, or maintain the entire radio control system competently.

For this reason we deny liability for loss, damage or costs which arise due to the use or operation of the **PowerBox Professional**, or which are connected with such use in any way. Regardless of the legal arguments employed, our obligation to pay damages is limited to the total invoice value of our products which were involved in the event, insofar as this is deemed legally permissible.

We wish you every success using your new **PowerBox Professional**!

A handwritten signature in dark ink, appearing to read 'E. Alentah', is written over a large, semi-transparent watermark of the word 'Systems'.

Donauwörth, March 2012



PowerBox Systems®

*World Leaders in RC
Power Supply Systems*

PowerBox-Systems GmbH
certificated according to DIN EN ISO 9001:2008

Ludwig-Auer-Straße 5
D-86609 Donauwörth
Germany

Tel: +49-906-22 55 9
Fax: +49-906-22 45 9
info@PowerBox-Systems.com

www.PowerBox-Systems.com