

PowerBox Systems®

World Leaders in RC
Power Supply Systems

Instruction Manual

POWERBUS



Dear customer,

We are delighted that you have decided to purchase this **PowerBox** accessory from our range.

We hope you have many hours of pleasure and great success with your **PowerBUS** devices.

The **PowerBUS** is the basis of a completely new method of wiring servos. The **PowerBUS** consists of a three-core cable which supplies current and signal to the servos connected to it. At first glance this is nothing unusual, but the big difference lies in the signal wire. When conventional servo signals are transferred, the signal wire always carries the information for one individual servo only - this is a PWM (Pulse Width Modulated) signal. In a servo bus system the signal wire carries positional information for multiple servos in digital form. The information for individual servos includes address data, and since each servo is assigned its own individual address, it can read out "its" information from the data stream, and convert it into a movement of the control surface. **PowerBus to PWM** adapters can also be employed to enable the use of servos without their own decoder; in this case the adapter carries out the decoding.

The advantage of this arrangement is obvious: all you need is one three-core lead in order to supply the essential information to several servos. The wiring is much simpler, and there is also a significant weight saving.

However, until now there has always been one disadvantage to bus systems: a short-circuit in one servo causes the bus lead to be blocked, and all the servos connected to it stop working. Here at **PowerBox Systems** we have completely eliminated this former drawback:

The servo distributors which we have developed are protected against short-circuits in the power supply lines and the signal line! This means that, if one output is shorted out at a servo distributor, within a few micro-seconds that output is switched off, and the bus lead remains active.

This supplementary feature is very important to flight safety, since a servo bus without it can never be suitable for use in valuable model aircraft!

The following section introduces and describes the individual components of the **PowerBUS**:

1. Overview of PowerBUS components

Three different types of distributor are available:



Order No. 9200 - PowerBUS to PWM Adapter
Quadruple distributor with integral BUS/PWM converter



Order No. 9210 - PowerBUS to BUS Adapter
Quadruple distributor for bus-enabled servos



Order No. 9220 - PowerBUS Splitter
Splitter, for converting one **PowerBUS** lead into two

The following standard cable lengths are available:

Order No. 9126/30

PowerBUS connecting lead, MPX plug / MPX socket, length 30 cm

Order No. 9126/60

PowerBUS connecting lead, MPX plug / MPX socket, length 60 cm

Order No. 9126/90

PowerBUS connecting lead, MPX plug / MPX socket, length 90 cm

Order No. 9126/120

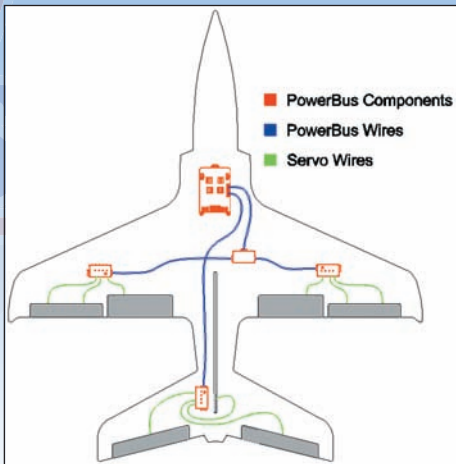
PowerBUS connecting lead, MPX plug / MPX socket, length 120 cm

We can also make up **PowerBUS** connecting leads to the exact lengths you require. Please refer to our webshop, where you will find a configuring tool for this purpose.

2. Description of PowerBUS components

a) PowerBUS Splitter

The **PowerBUS Splitter** is required if the **PowerBox** does not feature a sufficient number of outputs. For example, if you wish to use the bus technology for both wings as well as elevator and rudder, you will need a total of three bus leads. The following diagram shows a typical **PowerBUS** installation:



b) PowerBUS to BUS Adapter

The **PowerBox to BUS Adapter** is designed for use with servos which are fitted with an integral bus decoder. At present these are Futaba S-Bus servos. When these servos are used, the channel assignment is programmed directly at the servo. The **PowerBox to BUS Adapter** does not feature a decoder, but nevertheless all the outputs are protected against short-circuits both in the signal wire and the power supply wires, as you would expect. The adapter includes integral signal amplifiers for all servo outputs as well as the adapter's **PowerBUS** output. This means that as many bus adapters as required can be connected in series, i.e. cascaded.

c) PowerBUS to PWM Adapter

The **PowerBox to PWM Adapter** is used for servos which are not fitted with a bus decoder. In this case the channel assignment is defined at the **PowerBUS to BUS Adapter**. The bus signal is decoded in the adapter, which then generates conventional PWM signals for the servos. This unit allows all known makes of servo to be operated with the **PowerBUS** system. As with the other adapters, all the outputs are protected against short-circuits both in the signal wire and the power supply wires. The adapter includes integral signal amplifiers for all servo outputs as well as the adapter's **PowerBUS** output. This means that as many bus adapters as required can be connected in series, i.e. cascaded.

3. The PowerBUS - basic information

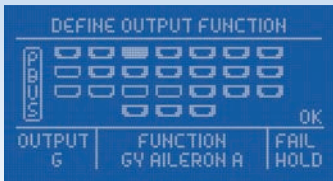
The **PowerBUS** can carry 16 channels + 2 switched channels. It is possible to assign any functions you wish to the bus, thanks to the unrestricted channel assignment facilities of the **Champion SRS** and **Royal SRS**. This is important: for example, if you wish to assign the aileron signal - as it comes from the transmitter - to the **PowerBUS**, and also wish to include the gyro gain and servo match settings. The door sequencer function can also be assigned to the **PowerBUS**.

a) Procedure for setting up the PowerBox

Requirement for subsequent steps:

The type of radio control system must be entered correctly at the **PowerBox**. If you are using a gyro (with the **Royal SRS**), you must first complete the **iGyro Assistant** procedure to complete the channel assignment on the input side.

The first step in assigning particular outputs to the bus is to assign the function in the Output Mapping menu of the **PowerBox**:



You will find this standard display in the **OUTPUT MAPPING** menu of the **Royal SRS**. Functions can only be assigned to the **PowerBUS** if they have already been defined under **OUTPUT MAPPING**.

These instructions include an example which shows the step-by-step procedure for assigning the bus; it also shows how to use the ServoMatch function in conjunction with the **PowerBUS**.

The function of output **G** is **GYRO AILERON A**, and the function of output **H** is also **GYRO AILERON A**. At first sight the function of both outputs is the same. However, these two functions are to be assigned to an aileron actuated by two servos. The ServoMatch function is used for fine-tuning, to ensure that the travel of both servos is identical.

Note: in the case of the **Champion SRS** it is only possible to select the **DIRECT 1 – 16** and **DS1 - 6** outputs instead of the gyro channels.

Once the function assignment process is complete, move the cursor to the left to **P-BUS** and confirm your choice by pressing the **SET** button. You will see this display:

P-BUS	OUTPUT	FUNCTION
CH 1	X	DIRECT 1
◆ CH 2	G	GY AILERON A
CH 3	H	GY AILERON A
CH 4	K	GY ELEVATOR A
CH 5	S	GY ELEVATOR B
CH 6	U	GY AILERON B
CH 7	W	GY AILERON B

The column under **P-BUS** indicates the **PowerBUS** channel number. **CH1 - CH16** are proportional channels, while **CH17** and **CH18** are switched channels. At a later stage these numbers are crucial when we move on to programming the servo or the **PowerBUS** adapter.

The **OUTPUT** is user-variable; here you determine which **PowerBox** output (**A - X**) is assigned to the selected **BUS** channel (**1 - 18**).

The **FUNCTION** column shows which function is assigned to the output you have selected. This provides a clear overview of the functions which are already assigned to the bus.

In our example the gyro function **GY AILERON A** has been assigned to outputs **G** and **H**, so that these two functions can be fine-tuned later using the ServoMatch function. At the **PowerBUS** they have been assigned to channel numbers **2** and **3**.

b) Procedure for setting up the PWM Adapter

Our function **GY AILERON A** is now assigned to bus channels 2 and 3. The next stage must be to inform the **PowerBUS to PWM Adapter** (description under 2c) which bus channel is to be generated at which of the four sockets (servo 1 - 4).



This is the procedure:

- b1) Do not connect the adapter to the **PowerBUS** lead at this stage.
- b2) Connect the **PowerBUS** lead to the **PowerBox**.
- b3) Press the **SET** button on the adapter while you plug in the PowerBus lead.
- b4) The red LED lights up at servo 1, then moves step-by-step to servo 4 while you hold the button pressed in.
- b5) Release the button when the red light is aligned with the servo output which you want to set up. The red LED now shines less strongly.
- b6) To program the output: Briefly press the button the same number of times as the channel which you wish to set up. For example, press the button five times in sequence for channel 5.
- b7) When you have finished programming one output, save the setting simply by disconnecting the adapter from the **PowerBUS** lead. Resume at Point b2) to assign a further output.

Back to our example with two ailerons:

Hold the **SET** button pressed in while you connect the bus adapter, then immediately release it again. Servo output 1 at the adapter is required to generate **PowerBox** output **G**: press the **SET** button twice in order to assign bus channel 2 to servo output 1. Now disconnect the bus adapter again.

Hold the **SET** button pressed in once more while you connect the bus adapter, but this time wait until the LED moves on to servo output 2. Servo output 2 at the adapter is required to generate **PowerBox** output **H**: press the **SET** button three times in order to assign bus channel 3 to servo output 2. Disconnect the bus adapter again.

Now connect the bus adapter and the two servos (outputs 1 and 2), and move the aileron stick at the transmitter: the two servos should operate in parallel.

At this point you should call up the ServoMatch function at the **PowerBox** to ensure that the two aileron servos do not work against each other mechanically.



First select output **H**, and fine-tune the servo which is connected to servo output 2 at the **PowerBUS** adapter to match the movement of the first servo. Refer to the instructions supplied with the **Royal / Champion SRS** for a detailed description of this procedure.

4. PowerBUS cable

PowerBUS cable is manufactured specially for **PowerBox Systems**. The **PowerBUS** cable is extremely flexible, and is made up using very thin individual strands in order to pass the maximum current through the given cross-sectional area of 1.5 mm^2 . The insulation is made of a special material which is also employed in full-size aviation. It is virtually indestructible, and offers excellent protection even when reduced to just a thin film around the copper conductor. This insulation produces a weight reduction of about 30% compared with the much cheaper PVC. The insulation is not inflammable, and its heat resistance is much higher than the usual PVC.

To save more weight, the conductors are of different thickness: power is carried by two thick wires (1.5 mm^2), while a thin wire of 0.25 mm^2 is used for the signal. This produces a further weight saving of 27%.

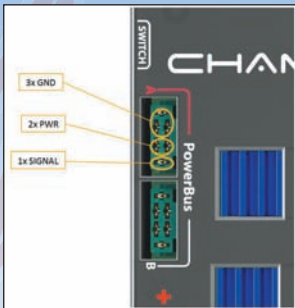


The picture clearly shows the thin insulation, the fine individual strands, and the difference in cross-sectional area between the power and signal wires.

5. Pin assignment

One great advantage of the **PowerBUS** is that it employs standard commercial MPX connectors. We supply **PowerBUS** leads in standard lengths, but can also make them up to the lengths you need. Please note that some installations present problems, with the result that the connectors can only be attached once the lead has been installed.

The following photos show the correct pin assignments:



PowerBUS socket



PowerBUS plug

Caution!

PowerBUS adapters are protected from reverse polarity, but if you plug servos into an incorrectly wired **PowerBUS**, they will instantly be ruined! For this reason it is essential to observe correct polarity, and compare your soldered connectors with the photos shown above!

6. Service note

We are anxious to offer good service to our customers, and to this end we have set up a **Support Forum** which deals with all queries concerning our products. This relieves us of a great deal of work, as it eliminates the need to answer frequently asked questions time and again. At the same it gives you the opportunity to obtain help quickly all round the clock - even at weekends. All the answers are provided by the **PowerBox Team**, guaranteeing that the information is correct.

Please use the Support Forum **before** you telephone us.

You can find the forum at the following address:

www.forum.powerbox-systems.com

7. 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** on our **PowerBUS accessory** from the initial date of purchase. 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, fuel, and short-circuits. The same applies to defects due to severe wear.

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**

8. Liability exclusion

We are not in a position to ensure that you observe our instructions regarding installation of the **PowerBUS accessory**, fulfil the recommended conditions when using the unit, 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 **PowerBUS accessory**, or which are connected with such use in any way. Regardless of the legal arguments employed, our obligation to pay compensation is limited to the invoice total of our products which were involved in the event, insofar as this is deemed legally permissible.

We wish you every success with your new **PowerBUS!**



Donauwörth, June 2013



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