RC Electronic by EMCOTEC
embedded controller technologies

DPSI® RV

Dual Power Servo Interface
- Regulated Voltage -

Mini 5 / Mini 6 2008 Magic

English

Operating Instructions

Contents

1. Preface

With a **DPSI RV Mini** dual current supply from EMCOTEC you purchased a high grade, modern and secure product for your remotely controlled model. We appreciate your trust and assure you that you made the right choice!

Long lasting experience for years in development and manufacturing of electronically systems as well as the knowledge of the world's best model airplane pilots has influenced the development. All products are developed by experienced engineers and manufactured at EMCOTEC GmbH in Germany on our own production line. Extensive optically and electronically end tests for every system, which leaves our house, assure that you, our customer acquire an absolute reliable product, which considerably increases the reliability of your valuable RC-Model.

Of course, the products not only have been tested extensively in the laboratory, but also went through intensive flight-testing. Extensive series of tests with especially in house developed data loggers have been accomplished to measure the real current consumption in model airplanes. Like done in the automobile industry FMEA (**F**ailure **M**ode and **E**ffect **A**nalysis) reduces the possibility of damage and malfunction on operating errors to a minimum.

Hint:
We kindly ask you to read these operating instructions carefully and to observe the installation hints. Thus, errors can be avoided in advance.

We are all ears for your wishes and questions. Challenge us!

Bobingen, October 2008

The Staff of EMCOTEC GmbH

2. History

For all times, EMCOTEC was and is the leader in "safe current supplies" around RC-Models. Novelties and developments were initiated by EMCOTEC:

- First dual current supply with servo current distribution and electronically switches (DPSI 2001)
- First and only "genuine" fail-proof switch actuator for current supplies; no mechanical influences or microcontroller errors can lead to malfunctions (DPSI pin switch actuator)
- First LiPo capable dual current supply with regulated output voltage (DPSI RV Mini, DPSI RV)
- First provider of LiPo-Batteries for supplying receivers (LongGo und LongGo „S")
- First and only provider who's products output error information acoustically (e.g. low voltage)
- First dual current supply with integrated receiver-switches worldwide (DPSI TWIN)
- First remote control system which transmits in two different frequencies (HF TWIN)
- First LiPo capable dual current supply with LC-Display for indicating all relevant data (DPSI BIC)
- First electronically fuse with current monitor which shuts off defective servos causing an overload (DPSI OCP)
- First electronically switches which are actuated contact free using a magnet instead of any mechanically switching elements (e.g. push buttons or switches)
- Smallest and most light weight LiPo capable dual current supply of its class (DPSI Micro – DPSI RV)
- First receiver switch with 16 channels (DPSI TWIN Mini)
- First dual current supply with integrated receiver switch, 16 channels and LC-Display (DPSI TWIN Maxi)
- First dual current supply with separate supply voltage for receiver, servos and pulse amplifiers and integrated servo-matching (DPSI RV Mini 5/6 Magic)

Innovation and Quality – Made in Germany by EMCOTEC!

3. DPSI RV Mini at a glance

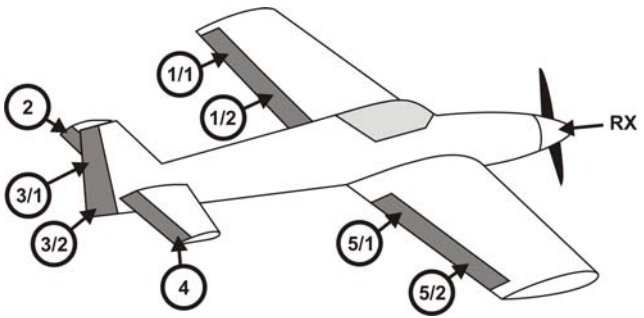
The **DPSI RV Mini** – family consists of four different dual current supply systems with servo current distribution for models of medium size which fit all applications:

DPSI Version	Receiver-channels	Servo-connections	Specifics
DPSI RV Mini 5	5	8	3 built in V-cable
DPSI RV Mini 6	6	7	1 built in V-cable
DPSI RV Mini 5 ***Magic***	5	8	3 built in V-cable with servo-matching
DPSI RV Mini 6 ***Magic***	6	7	1 built in V-cable with servo-matching

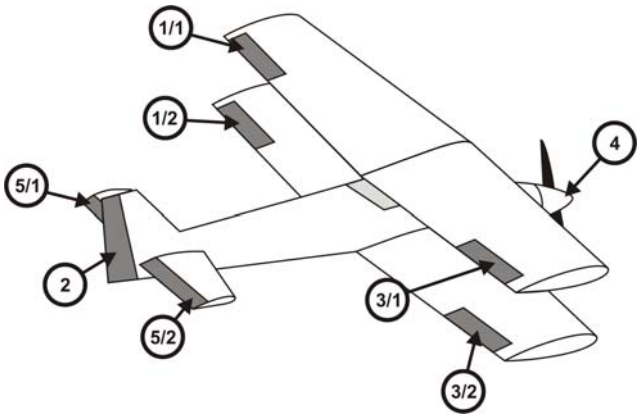
The **DPSI RV Mini 5** corresponds to pilots of the 2m to 2.7m air acrobatic class who need up to 10 servos and where up to 2 servos actuate one rudder. Therefore, only heavy loaded rudders are supplied by the DPSI (aileron, elevator and yaw rudder). Servos for additional functions (e.g. engine, retractable landing gear, etc.) are connected directly to the receiver.

The **DPSI RV Mini 6** is mainly used by jet- and glider-pilots (as well as engine driven planes and helicopters) were more channels are necessary but only one powerful servo actuates one rudder. Here too, additional (less powered) servos can be directly supplied by the receiver.

Examples for the **DPSI RV Mini 5** (Magic)

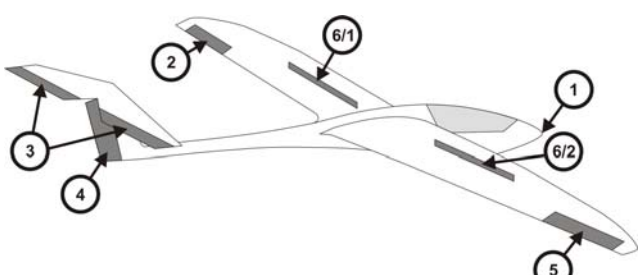


An acrobatic airplane with 2 servos per aileron and 2 servos for the yaw rudder. The throttle servo is directly connected to the receiver.

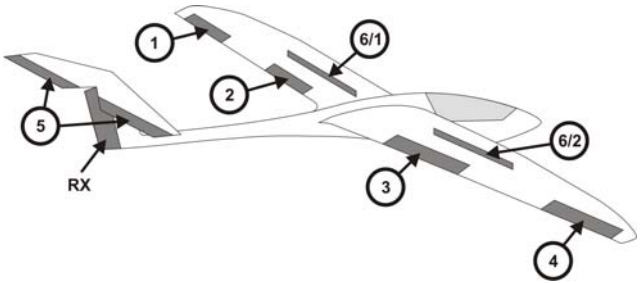


A biplane with 4 aileron servos, split elevator- and one yaw-rudder servo. The throttle servo may be directly connected to the receiver as an option.

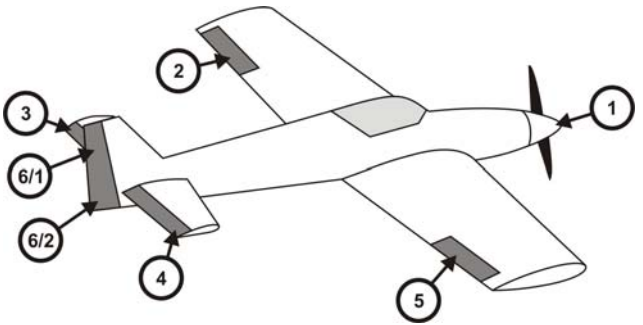
Examples for the **DPS RV Mini 6** (Magic)



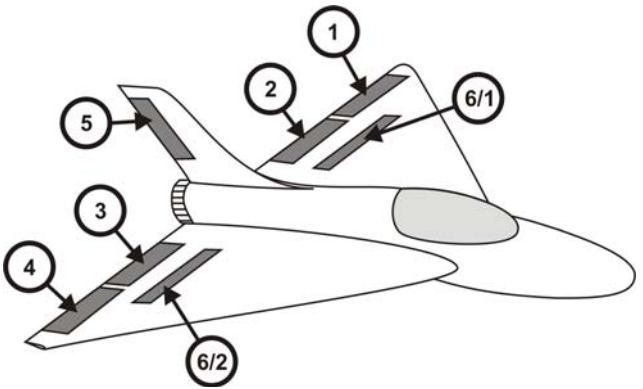
A glider with spoilers and tow release.



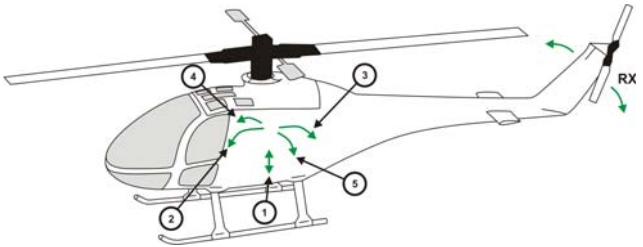
A glider with flaps and spoilers. The yaw rudder (and if so one tow release) are directly connected to the receiver.



An acrobatic airplane with one servo per rudder, the yaw rudder is actuated by 2 servos.



A jet with flaps and spoilers. The turbine-ECU is directly connected to the receiver, as well as landing gear doors or other electronically systems.



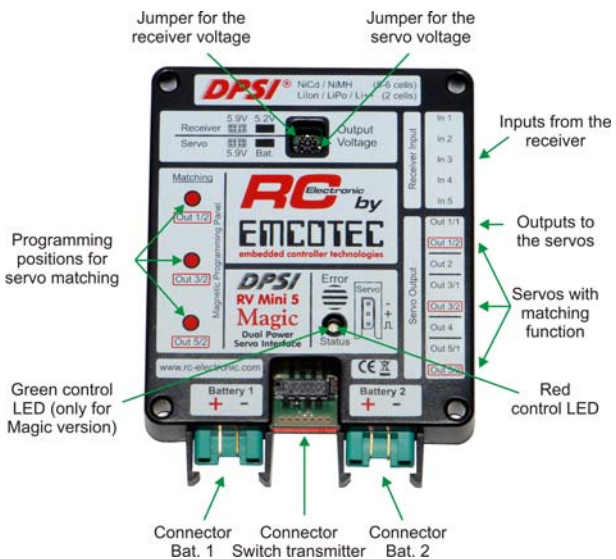
A helicopter with 4-point-control of swash plate (2 roll- und 2 pitch-servos). 1 = throttle. The gyro (tail rotor) is supplied directly by the receiver (5.2V) or via channel 6/1 of the DPSI (5.9V).

In these examples, the outputs of the **DPSI RV Mini** are assigned to the corresponding rudders. Outputs at the DPSI are labeled "Out 1/1", "Out2", and so on.

Additional servos and auxiliaries can be directly connected to the receiver.

Hint:
Assignment of the receiver channels to the DPSI is totally arbitrary and therefore not stringent. Mapping according to the manufacturer (e.g. channel 1 = throttle, etc.) is not necessary. Receiver channel 3 can be connected to DPSI input 1 just as well. Any combination is allowed and possible.

4. Overall layout



5. Characteristics

With the **DPSI RV Mini** - systems a new dimension is reached as far as safety and comfort about current supplies for RC receiver equipment is concerned:

- Dual current supply (battery switch)
- Separate electronically high power switches for both batteries
- Up to 50A peak current load
- Switching without microcontroller and therefore failsafe (**CSHC**= Controller-less Self Holding Circuitry)
- Possibility to connect an external LED voltage indicators onto switch actuator
- Due to voltage regulators usage of all battery types available
- Selectable output voltage for receiver
- Selectable output voltage for servos
- Usage of 7.4V servos unlimited
- Compliant to all RC receiver-equipment's manufacturers specifications
- Continuously constant servo power due to constant voltage supply
- Servo current distribution for heavy loaded servos in system
- Optimal recognition and conditioning of servo signals from 2.7V receivers
- Short-circuit proof servo pulse amplifier in current-saving **APP**-Technology (Advanced Push Pull) for each individual servo
- **HFIB** (High Frequency Interference Blocking) suppression of induced HF interference caused by long servo cables (for each individual servo)
- Built-In "V-cable“ for connecting two servos per channel
- Servo-matching for built-in "V-cable“ (in Magic versions)
- Failsafe function of programmable servos (in Magic versions)
- Optically and acoustically warnings on malfunctions, e.g. battery low voltage or total battery loss
- **IVM** (Intelligent Voltage Monitoring) – intelligent voltage monitoring with acoustically and optically state indication for six different battery types (programmable)
- Protection of receiver against the so-called "Dynamo Effect“ (feedback of servo counter electromotive force)
- Cable free system, i.e. all lines are pluggable and therefore replaceable at any time
- Special grounding concept for flawless operation and highest safety

- High grade plastic housing with integrated latches for battery connectors
- Large area heat sink for heat dissipation
- Each system 100% tested and provided with individual serial number
- Delivery inclusive all accessories
- Developed and manufactured by market leader (Made in Germany)

5.1. Dual Current Supply

First of all the **DPSI RV Mini** is a dual current supply with regulated output voltage which allows for usage of all commercially available batteries as a receiver power supply (NiCd, NiMH, LiIon, LiPo, LiFePo, etc.).

It's a dual current supply because two batteries can be connected to the system. If one battery fails, secure operation is guaranteed by the second battery. Normally, both batteries are discharged equally at the same time. Additionally, current drawn from each battery is cut in half due to the two batteries connected in "parallel" which allows for batteries with lower current load capabilities.

5.2. Electronically Switches

The batteries are switched using fail-proof electronically switches. The external switch actuator only generates the On/Off signal. Power is switched by highly loadable semiconductors. Thanks to the electronically switches there is no power loss, contacting problems or transition resistance. All **DPSI RV Mini** systems are built with separate electronically switches, i.e. all electronics are dual. The switches are fail-proof and are controlled by a self holding circuitry (not by means of a microcontroller!).

An operating **DPSI RV Mini** stays turned on even if the On/Off switch actuator is removed or broken or should the microcontroller malfunction.

5.3. Detached Voltage Regulators

Until now, the receiver set was supplied directly by the connected battery (or corresponding battery switch). The output voltage of batteries depends heavily on the actual discharging state. Because 5-cell NiCd or NiMH batteries are utilized more often for optimal servo power, a fully charged battery reaches voltages up to 7.5V after turning the charger off. Although this peak voltage usually drops quickly it can shorten the life cycle of servos in adverse cases because servos usually are approved only for 6V by the manufacturer. Due to increased usage of light weight Lithium Polymer batteries voltage regulation is mandatory because these batteries carry a nominal voltage of 7.4V.

The electronics in the **DPSI RV Mini** make sure that the voltage is reduced to a permissible value, independent of the higher input voltage of the battery. Jumper (small pluggable bridges) allow for selection of the desired output voltage. This way, the power requirements can be adapted to the pilot needs and technical data of the servos.

As a specialty, two separate voltage regulators are built into the **DPSI RV Mini** each having its own selectable output voltage. Servos directly connected to the DPSI are supplied by their own voltage regulator. Its output voltage is either 5.9V or battery voltage. This means: the servos are supplied either with a regulated 5.9V (regular permissible voltage) or directly with the (unregulated) battery voltage. Later is about 7.4V for 2-cell LiPo batteries. Some servos can be supplied with this higher voltage already.

A receiver connected to the **DPSI RV Mini** is supplied by its own voltage regulator. This is very advantageous and gains safety significantly.

The output voltage of the receiver can be set between 5.2V and 5.9V. Besides direct connections of high power servos the concept of the **DPSI RV Mini** allows for connection of additional low power servos to the receiver (e.g. a throttle servo), where 5.2V normally suffice.

Even fast tail rotor servos or gyro systems which only "allow for" small voltages can be supplied by the receiver with 5.2V. Additionally, the receiver supply is protected against voltage peaks. This means: all disturbing pulses induced into the supply voltage are limited to safe values.

5.4. Servo Current Distribution

Furthermore, a **DPSI RV Mini** provides current distribution for high power servos, in order not to connect these to the sensitive receiver. All servos directly connected to the **DPSI RV Mini** are supplied with full power and each individual servo gets its maximum possible current. This can be recognized by a significantly better servo actuating force.

5.5. APP (Advanced Push Pull Servo Pulse Amplification)

In order to provide each servo optimally conditioned control signals from the receiver, these signals are electronically amplified. This is especially important if receivers operate on low voltage (e.g. 2.7V); their pulse amplitude is too low for some servos.

Each individual servo output of the **DPSI RV Mini** has its own pulse amplifier and specific HF suppression. The amplifiers recognize even very weak servo signals from the receiver and elevate the level up to an exactly defined value. They are short-circuiting proof and are supplied with their own voltage regulator for safety reasons (i.e. not with the regular servo voltage). Therefore, the signals always carry a defined and constant level over the total operating range.

An additional advantage is the current-saving **APP-Technology**. The amplifiers consist of special output stages which actively control the low- as well as the high-phase of the servo signal. In connection with highly effective filters which practically eliminate induced disturbances caused by long servo cables completely, best pulse quality and highest possible safety is guarantied.

5.6. HFIB (High Frequency Interference Blocking)

In order to even increase safety, a highly effective filter is looped in into each servo's signal path. Disturbances, "caught" by long servo cables are almost completely eliminated directly at the servo connector and therefore do not reach the receiver. Ferrite cores, as often utilized, can be omitted, which saves weight and cost. The filters in the **DPSI RV Mini** are tremendously more effective than cheap ferrite cores; their effectiveness is controversial anyway.

5.7. Built-in V-Cable

Depending on the system (Mini 5 or Mini 6) V-cables are built in to the DPSI. This means, two servos can be connected to one receiver output. This is especially handy, if two servos actuate one rudder (e.g. the aileron of a larger acrobatic plane). The **DPSI RV Mini 5** has three, the **Mini 6** one built-in V-cable (e.g. for the yaw rudder and nose gear).

5.8. Servo-Matching ("Magic" option only)

DPSI RV Mini with "MAGIC" option allow for setting the servos which are connected to V-cables arbitrarily, i.e. direction, center- and end-limit positions.

This means: one receiver channel serves actually two servos; their direction, center position and end positions can be aligned. A split elevator rudder can be controlled by one servo on each side with one single receiver channel. Therefore one receiver channel and one mixer in the transmitter get freed up.

The same holds true for controlling the yaw rudder with coupled nose gear. Here too, "matching" helps to adapt both servos and saves one channel.

There is no external programming device (e.g. a PC) necessary for programming or adapting the servos. A delivered magnet initiates programming.

Each matching system has its own microcontroller (there are three in the **DPSI RV Mini 5 Magic**, one in the **DPSI RV Mini 6 Magic**). Resolution (precision) is more than 3000 steps and the delay of the servo signals is only 1500 micro-seconds!

6. Error Detection and Indication

6.1. IVM (Intelligent Voltage Monitoring)

An internal microcontroller monitors all voltages using an intelligent algorithm and indicates different errors (overload, low voltage, voltage errors, battery malfunctions) acoustically by means of a built-in piezo-buzzer. Furthermore, errors are visualized by blink codes by a LED in the switch actuator.

Additionally, the **DPSI RV Mini** allows for connection of external LED-Displays (battery monitors) directly at the switch actuator.

In order for the **DPSI RV Mini** to detect low voltages correctly the battery type must be programmed once. Simple programming allows for selection of 6 different battery types.

Hint:
At delivery, low voltage recognition of the **DPSI RV Mini** systems is programmed for 2-cell LiPo batteries. If other battery types are to be used, the corresponding battery type must be programmed in first place (see chapter 9.10.)!

Output voltages for receiver and servos are both set to 5.9 volts at delivery.

7. Safety Features of DPSI RV Systems

Because of the results of FMEA and an elaborate design **DPSI RV Mini** is especially safe:

Short-circuits at contacts of the male multi point connector where the switch actuators cable is connected to, do not damage the **DPSI RV Mini**. Therefore even not a defective (squeezed) switch actuator cable.

Shorts on servo pulse lines, no matter whether to ground or positive, do not any damage, too. All other servos of that channel, where there is a short-circuit pending, remain fully functional. Even reverse polarity of a servo does not harm to the **DPSI RV Mini**.

Mistakenly shorted servo cables usually burn up or melt without damaging the **DPSI RV Mini.** The heat sink naturally gets very hot at events like this!

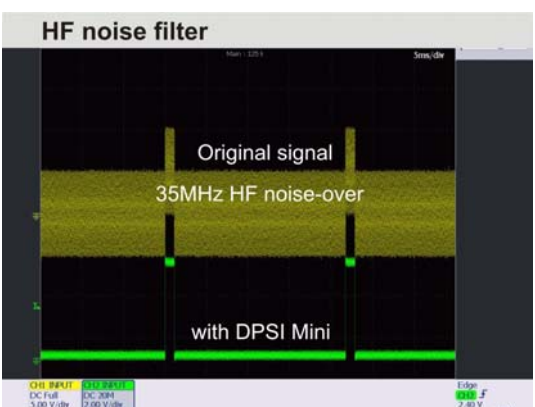
Both batteries are totally decoupled and also the electronically switches (inclusive peripheral electronics) are doubled. There are no dual diodes (two diodes in one housing) built in. Therefore, no malfunctioning part can cause total fail of the system. This circuitry has been proven outstandingly several thousand times.

A **DPSI RV Mini** must not be disconnected from its batteries during long breaks (e.g. in winter time) because the self discharge of the batteries is much higher than the quiescent current consumption which practically is not measurable.

In order to allow for optical power-on control, an ultra bright LED has been built into the switch actuator of the **DPSI RV Mini**. It signals power-on and low voltage or other errors of the battery / batteries by blinking even over large distances.

All commercially available remote control systems (JR, Futaba, Multiplex, Spektrum) with all available modulations (PCM, SPCM, PCM1024, PPM, IPD), 2.4GHz as well, were tested in connection with **DPSI RV Mini** systems. Therefore all systems can be utilized with no problems.

Receivers which are supplied with 2.7 volts internally (e.g. Futaba 6014), can be used without hesitation, because the servo pulses in the **DPSI RV Mini** are already recognized at 1.6 volts reliably. Servo amplifiers in the **DPSI RV Mini** are supplied by their own voltage which is totally independent from the regular servo and receiver voltage. Therefore, voltage peaks and voltage drops do not have any influence to the pulse quality. Due to its sophisticated safety features in connection with elaborate testing, operating errors and outside influences usually do not lead to damage of the **DPSI RV Mini**.



8. Contents of Delivery

Delivery of DPSI RV Mini 5 (6):

- "DPSI RV Mini 5 (6)“ Base Device
- On/Off switch actuator with pin and mounting material
- 5 (6) pieces receiver connection cables (with servo connectors on both ends => patch cable)
- 2 pieces MPX high-current sockets for the batteries
- 4 pieces of shrink tubing for MPX high-current sockets
- 2 pieces of voltage selection jumpers
- Operating instructions, EMCOTEC 3D sticker

Delivery of DPSI RV Mini 5 (6) Magic:

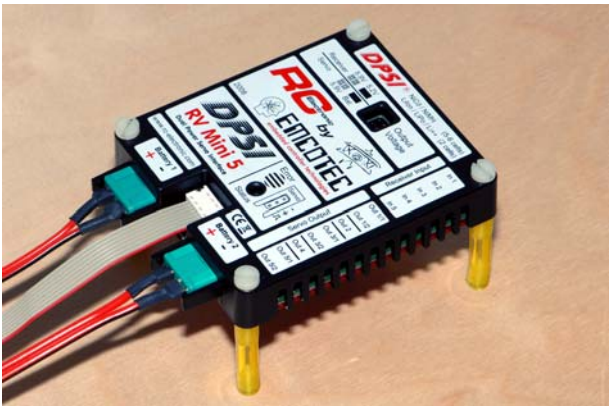
- "DPSI RV Mini 5 (6) Magic" Base Device
- On/Off switch actuator with pin and mounting material
- 5 (6) pieces receiver connection cables (with servo connectors on both ends => patch cable)
- Switching-magnet for programming of the matching-functions
- 2 pieces MPX high-current sockets for the batteries
- 4 pieces of shrink hoses for MPX high-current sockets
- 2 pieces of voltage selection jumpers
- Operating instructions, EMCOTEC 3D sticker

Each individual **DPSI RV Mini** system carries its own serial number and is tested several times prior to delivery!

9. Mounting Hints and Programming

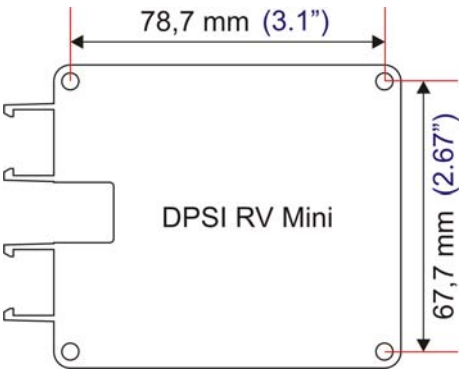
9.1. Mounting the DPSI RV Mini

The **DPSI RV Mini** is simply mounted onto 4 pieces of silicon hoses (gasoline hose). Just mount the package vibration damped onto 4 "stilts", as shown in the picture.



In general, always observe vibration free mounting including good air circulation. Vibration damping is especially important for the receiver because it is much more sensitive to mechanical stress than the **DPSI RV Mini**.

9.2. Hole-Spacing for Mounting



9.3. Mounting the Receiver

The receiver can be directly glued onto the **DPSI RV Mini** by means of dual sided adhesive foam rubber (approx. 5-10 mm thick). The programming marks must remain free for Magic versions.

Separate mounting of the receiver is also possible and even recommended for 2.4GHz receivers. At high current loads and under combat conditions, the upper surface of the **DPSI RV Mini** should remain uncovered in order to allow for unrestricted heat dissipation.

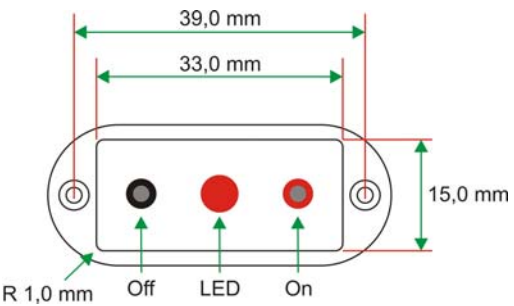
Hint:
The lower side of the **DPSI RV Mini** where the heat sink resides, must not be covered or pasted up with something at all and should have at least a distance of 30mm to the next area (fuselage's bottom or similar)! Good air ventilation (eventually with air hoods or guided cooling air) is especially reasonable when operating many servos.

9.4. Connecting the Switch Actuator

Mechanical switches risk malfunctions. There are vibrations at a fuselage's side wall especially with large models. In order to avoid any mechanically influence in **DPSI RV** systems electronically switches with self-holding circuitry are utilized.

The electronically switches are only controlled by a pulse from the external switch actuator. The receiving set therefore is turned on or off by means of a pin or magnet (Magic version). The corresponding switch actuator just delivers the on/off signal.

Dimensions of the switch transmitters:



Rear side of the switch transmitter with connected battery controllers (optionally)

Pin-Switch-Actuator in DPSI RV Mini:
The pin, put into the "ON" socket (red) turns the **DPSI RV Mini** on. Putting it into the "OFF" (black) socket turns the **DPSI RV Mini** off. Even if the pin gets lost a powered system remains on.

A **DPSI RV Mini** only can be turned off if the pin is put into the OFF socket (in other words swapped from red to black)!

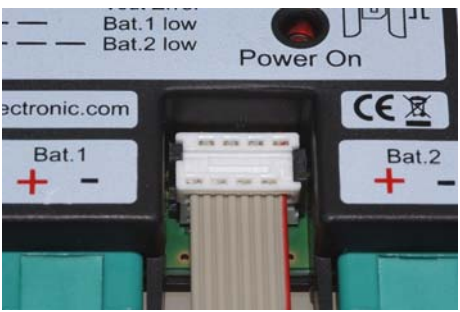
DPSI RV pin-switch-actuator:

Of course, two pins must not be put into each of the sockets at the same time although this does not damage the **DPSI RV Mini**. In this case, the set would be turned off and the batteries would be discharged slowly with approx. 12mA. In the powered state the pin should always remain in the ON socket!

Hint:
Should the pin get lost, a 2mm wire or 2mm screw suffices by putting it into the corresponding socket.

The On/Off switch can be arbitrarily positioned (e.g. at the fuselage's side wall). Put the connection cable with its plug into the multi point connector of the **DPSI RV Mini** until it locks (see picture). If eventually a swap or disconnect is in order, carefully remove by moving upwards out of the multi point connector (grapple the cable directly at the plug).

Correctly mounted switch actuator at DPSI RV:



Switch Actuator in Magic versions:
Magic versions of the **DPSI RV Mini** (with servo-matching) are not delivered with the pin switch actuator but rather with a magnetically switch actuator. Because a magnet is necessary for programming the servo-matching functions it can be used as switching element for the switch actuator as well.

The magnet is positioned close to the on-position of the switch actuator (green marking on housing) for about 1 second.

For turning off, hold the magnet close to the opposite marking of the switch actuator for about 2 seconds.

Hinweis:
For regular **DPSI RV Mini** versions, a magnetically switch actuator is available as optional accessory.

DPSI RV magnetically switch-actuator:

The central ultra bright LED in the switch actuator housing is lit when the **DPSI RV Mini** is powered. In case of errors (e.g. low voltage) or during programming, the LED indicates the states by different blink codes.

Two commercially available battery controllers with JR-Uni connectors can be connected directly at the rear of the switch actuator. The prints "B1" and "B2" indicate battery 1 and battery 2 respectively. Herewith, additional voltage monitoring is possible. When using such voltage controllers, observe required cell numbers and/or correct battery type.

A turned off **DPSI RV Mini** system also turns off eventually connected battery controllers, too.

9.5. Connecting the Receiver

Connect the receiver to the **DPSI RV Mini** using the delivered patch cables (see print on housing). When connecting the receiver not all inputs of the **DPSI RV Mini** must be used. Just connect as many cables as needed. Each of the cables provides the receiver with voltage.

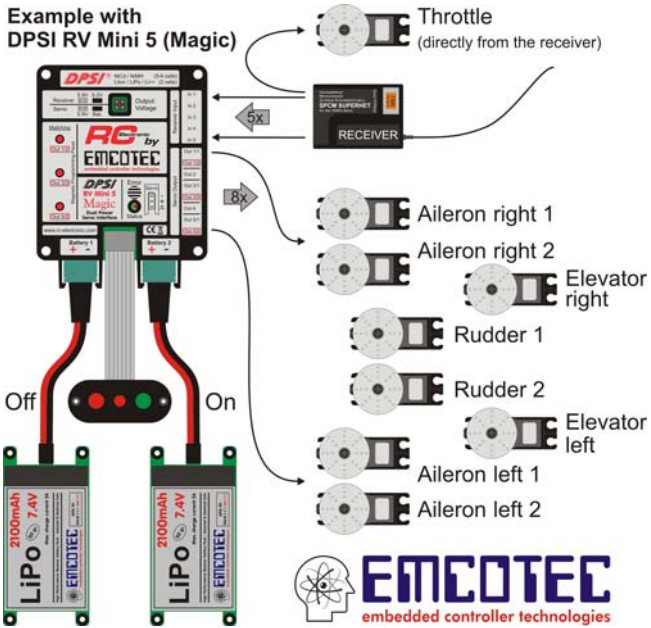
Hint:
All receiver connection cables supply the receiver with regulated output voltage! Therefore it is not relevant which cable (channel) is connected.

Hint:
At all **DPSI RV Mini** systems the negative wire (brown) points to top i.e. towards the print. The pulse wire (orange) points towards the heat sink.

Hint:
If the equipment does not work please make sure that all cables are correctly connected and that the modulation mode of the transmitter corresponds to that of the receiver (e.g. PPM, PCM, SPCM, IPD and so on).

Hint:
Assignment of the receiver channels on the DPSI housing's print is only a suggestion! Assignment is arbitrary in any case. This means: receiver channel 1 must not necessarily be connected to channel 1 of the DPSI. It is only important that servo outputs correspond to the receiver inputs of the DPSI (e.g. receiver input 2 to servo output 2). Therefore, receiver channel 1 can be connected to DPSI input 2. In this case servos at output 2 are controlled by receiver channel 1.

Hint:
Under no circumstances connect a patch-cable between receiver and a servo output of the **DPSI RV Mini**. Both, the **DPSI RV Mini** or the receiver could become damaged!



9.6. Selecting Batteries

All commercially available batteries are selectable (NiCd and NiMH) as well as Lithium-Ion (LiIon), Lithium-Polymer (LiPo) or LiFePo (A123). Independent of the selected output voltage these batteries are usable with no restrictions.

6-cell NiCd batteries are also connectable. This only makes sense if the output voltage for the servos is set to "Bat." and servos with a corresponding higher supply voltage are connected (e.g. 7.4V servos). Usually 5-cell NiCd/NiMH or 2-cell LiPo batteries are used.

Battery capacities

In general observe current load and capacities of the utilized batteries. Battery packs of 2 times 450mAh are far too small for a model carrying 10 servos. There should be at least two "2000th" which can be discharged with 5C (peak current). (C is nominal capacity in Ah => a battery with 2Ah can be loaded with 5 * 2A = 10A at 5C). Especially when using digital servos higher current consumption must be observed.

Our elaborated measurements with a 3m model using 15 digital servos resulted in a current consumption of about 0.6 – 0.8Ah at 10 minutes flight time. Dimension your batteries very carefully! If in doubt, ask your model manufacturer.

Furthermore, make sure, that the connection cables of the battery are thick enough when selecting the batteries. If a battery with 0.25 mm^2 cable area is being used, the advantage of using the DPSI is lost because of losses in such thin cables. Therefore, battery wires for large models should have an area of 1.0 – 1.5mm^2.

Solder the battery connection cables to the delivered Multiplex high current connectors to make them compatible to the **DPSI RV Mini** (if no readily conditioned batteries are utilized). Shrink tubes for isolating the solder connections are delivered as well.

If the batteries must be placed far away from the **DPSI RV Mini** due to COG (Center of Gravity) purposes (long connection cables) it is desirable to twist the wires. We recommend using our EMCOTEC Lithium Polymer batteries. These are delivered completely wired and can be connected to the **DPSI RV Mini** right away. An additional charging connector at the battery allows for charging without removing the battery from the **DPSI**. Charging devices for all battery types are available from EMCOTEC, too.

Selecting the output voltage

Meanwhile almost all servos are suitable for a 5.9V supply voltage. Therefore, the default setting for servos directly connected to the **DPSI RV Mini** is 5.9V. If 7.4V servos are to be used, the output voltage can be set to battery level ("Bat.") by jumper. In case LiPo batteries are used servos are supplied with 7.4V.

Some servos are restricted to 4.8V according to manufacturer's specifications (e.g. fast tail rotor servos for helicopters). Connect these servos directly to the receiver. Its supply voltage then is set to 5.2V by jumper at the **DPSI RV Mini**. 5.2V correspond to the voltage of 4-cell NiCd batteries which are the reference for 4.8V servos.

As of today, all commercially available receivers can be operated with 5.9V with no limitation. Therefore, the receiver voltage at the **DPSI RV Mini** is set to 5.9V by default.

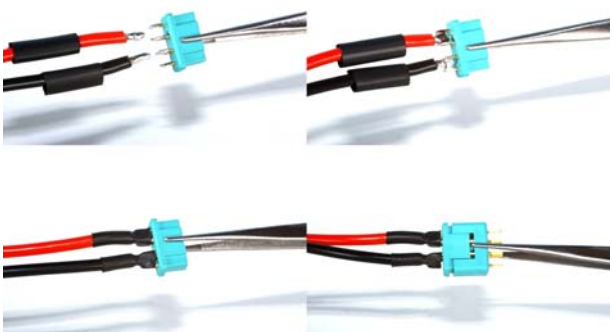
Hint:
The higher the difference between input and output voltage, the higher is the power dissipation which must be converted to heat. If using many servos it is advisable to select a higher output voltage at the **DPSI RV Mini**.

Hint:
Using a 4-cell battery pack (NiCd/NiMH) on a **DPSI RV Mini** is not permissible!

9.7. Soldering Battery Sockets

Delivered Multiplex high current sockets are marked + and – on their soldering side. **Observing this marking is mandatory!** Dismantle the cable about 5mm, and then tin it. Before soldering, push the delivered shrink hose over the corresponding cable. Solder the cable to all 3 pins on one side of the socket; it must contact all 3 pins from the inside (see picture). If the cables are thin, bend the pins of the socket a little to their common center. Use plenty of tin to assure good contact to all 3 pins. Shrink the hose using a heat gun.

Soldering Multiplex connectors:



Hint:
DPSI RV Mini systems are not inverse polarity protected by design! Please observe correct connection of the batteries, i.e. connect red wire to positive and black wire to negative. Better control once too many than too little!

9.8. Charging the Batteries

All **DPSI RV Mini** systems switch battery-positive, i.e. both batteries are interconnected with their negative pole (ground) if connected to a **DPSI**. Simultaneously charging therefore is not always possible because most chargers with more than one charging output measure the current in their negative line while interconnecting the positive lines. **Separate charging of the batteries is possible at any time when connected to a DPSI RV Mini!**

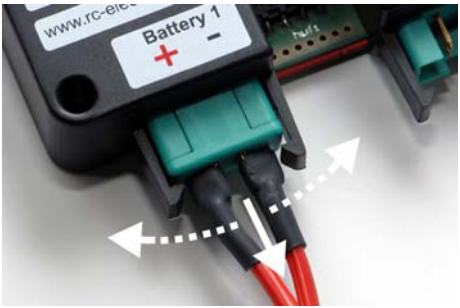
If one wishes to charge the batteries while connected to a **DPSI RV Mini** a second cable must be soldered to the battery which serves as a charging cable. This cable then is in parallel to the connection cable of the **DPSI RV Mini**.

Simultaneous charging of both connected batteries while connected to a **DPSI RV Mini** is only possible with Lithium Polymer batteries. LiPo batteries may be charged in parallel because the DPSI discharges these batteries absolutely identically and therefore having identically discharge states. This means: both batteries are interconnected in parallel for charging by means of a V-cable (positive to positive, negative to negative). This makes it a "2S2P"-battery. Cell number (voltage) stays the same, charging current may be doubled. Corresponding charging cables are available from EMCOTEC.

If in doubt it is reasonable and safer to disconnect the batteries from the **DPSI RV Mini** for charging. Just tilt the plug a little (to the side) and pull it from its **DPSI RV Mini** latches with slight zigzag moves.

Hint:
It is possible to charge the battery when still connected to the **DPSI RV Mini** (e.g. via an additional soldered charging cable). Only charge one battery at a time (exception: LiPo batteries). Please observe correct polarity!

Removing the battery plugs from the DPSI RV Mini:



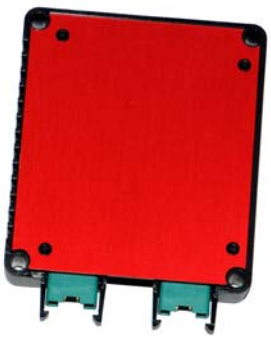
9.9. Setting the Voltages

The output voltage of the **DPSI RV Mini** can be set in 2 steps for the receiver as well as the servos. This is done using delivered jumpers which are plugged to the multi-pin connectors of the **DPSI RV Mini** depending on the desired output voltage. Best use a tweezers or small pliers.

Setting the voltage of the receiver and the servos to 5.9 Volt:

Selecting full battery voltage for the servos (receiver stays at 5.9V):

The positions of the jumpers on their multi-pin connectors and their corresponding output voltage are printed onto the housing of the **DPSI RV Mini**. Because a **DPSI RV Mini** should be mounted vibration-less the jumpers can not fall out.



9.10. Programming the Batteries

Because **DPSI RV Mini** systems monitor the battery voltage intelligently, they need to know the utilized battery type (e.g. 5-cell or 6-cell batteries or LiPo batteries). Therefore the battery type must be programmed once – the programmed state is memorized in the microcontroller of the **DPSI RV Mini** until programmed again.

Programming starts when only one battery (no matter which type and at which connector) is connected to the **DPSI RV Mini** and when the system is turned on.

After power on, the internal buzzer (signaling device) of the **DPSI RV Mini** turns on for 3 seconds and pauses for another 3 seconds. This indicates operating mode "programming".

Now one beep follows which indicates "battery type no. 1". If the missing battery is now connected to the **DPSI RV Mini** within 3 seconds, "battery type no. 1" is selected and programmed.

If the missing battery is not connected within 3 seconds, two beeps follow for indicating "battery type no. 2". Again, the user has 3 seconds to connect the missing battery if he/she wishes to select (program) this battery type.

This principal is repeated until the buzzer beeps seven times (deactivate all tests). If no battery is connected within 3 seconds there is no programming at all and the system changes to normal operation.

Battery types are defined as follows:

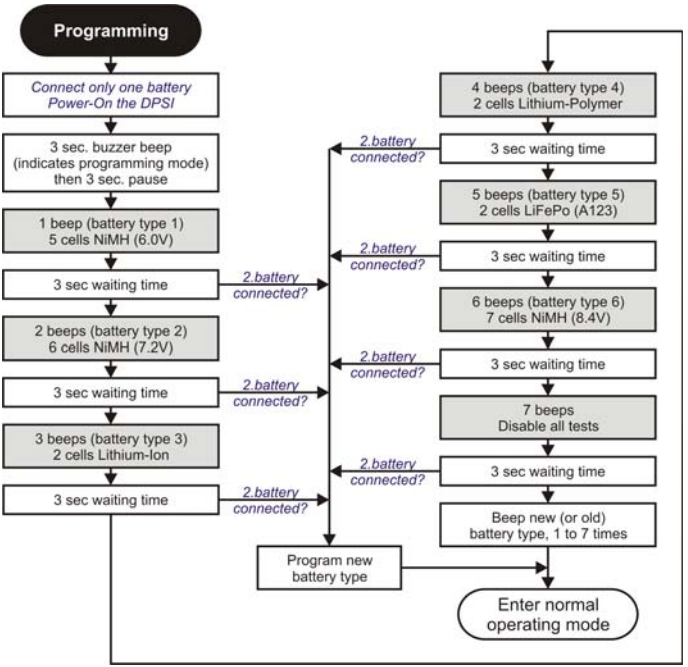
Type no.	Buzzer Code	Battery Type / Programming
1	1x beep	5 cells NiCd / NiMH
2	2x beeps	6 cells NiCd / NiMH
3	3x beeps	2 cells Lithium-Ion
4	4x beeps	2 cells Lithium-Polymer
5	5x beeps	2 cells LiFePo (e.g. A123)
6	6x beeps	7 cells NiCd / NiMH (res.)
7	7x beeps	All tests deactivated

By default "battery type 4" (LiPo battery) is programmed at delivery. Selection "7 beeps" (all tests deactivated) causes the **DPSI RV Mini** not to conduct any voltage tests. No empty batteries or other errors are indicated anymore.

Hint:
Always use two identical batteries (i.e. same battery type: NiCd, NiMH or LiPo and same number of cells). Battery capacity may be different - although it makes no sense.

Hint:
The battery type is output after powering the **DPSI RV Mini** on by means of buzzer codes. Multiple beeps after turning the system on therefore do not indicate an error!

Programming the battery type at a glance:



9.11. Connecting Servos

- The **DPSI RV Mini 5** (Magic) distributes 5 receiver channels to 8 servos in total (with 3 "built-in“ V-cables).
- The **DPSI RV Mini 6** (Magic) distributes 6 receiver channels to 7 servos in total (with 1 "built-in“ V-cable).

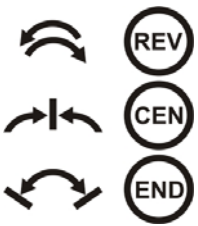
In the example at page 28, 8 servos are connected to the **DPSI RV Mini 5** in total, the throttle servo however directly at the receiver. For all servos connected to the **DPSI RV Mini** the pulse wire points downwards (as pretended by chamfered noses in housing). We do not recommend connecting more than 10 servos in a receiver system powered with a **DPSI RV Mini** in total because current limits can be reached or thermal load could get too high.

Observe sufficient cooling when using digital servos, in any case.

Hint:
Dependent on number and force of servos total current consumption varies in the system. The higher the total current consumption, the higher is the energy which is converted to heat. The heat sink of the **DPSI RV Mini** can get very hot. This is not an error, but rather represents normal function. Therefore, observe for sufficient cooling (distance to neighboring walls like fuselage's side walls or similar – eventually arrange for cooling air supply). On request, an additional heat sink can be mounted.

Hint:
Printed assignment connections on top of the DPSI RV systems are only a suggestion! Receiver channels may be connected to any DPSI inputs. Receiver channel "1" might be connected to DPSI input "3". Servo outputs "3" of the DPSI are then controlled by receiver channel "1". Assignment therefore is arbitrary!

10. Servo-Matching



There are built-in V-cables in a **DPSI RV Mini** allowing two servos to connect to one receiver channel (Mini 5 has three V-cables; Mini 6 has one V-cable). As a specialty, ***MAGIC*** versions allow to program the direction, center- and end positions for one of both servos ("slave" servo). This servo therefore can be "matched" to the main servo (MSTR).

This is especially helpful if e.g. two servos actuate one rudder and synchronized movement is not possible by mechanically adjustments (e.g. two servos for one aileron). Often it suffices to change one servo's direction. This is also simply possible with the **MAGIC** version.

Failsafe-Function:
Additionally a failsafe function has been integrated. An erroneous or missing receiver signal stops both servos (master and slave) at their current position (hold) until a valid receiver signal is recognized again. This state is indicated by a flashing green LED on the upper side of the housing ("status") which stays active until power is turned off. After the flight the flashing LED indicates a failsafe situation.

High Precision:
Due to the intelligent software design and a highly accurate crystal oscillator resolution is more than 3000 steps. Therefore, the system is suitable even for modern remote controls with high servo positioning accuracy (number of steps).

10.1. Programming

No external operating unit is necessary for programming the slave-servos such as a PC or a programming box. Only the delivered magnet serves to activate the corresponding programming function. Everything else is done with the transmitter (the remote control system).

During programming settings of the original servo (master) do not change! Programming always refers to the slave servo. The slave servo connects to the red encircled output. This is the servo at output "Out 6/2" for the **DPSI RV Mini 6 Magic**; for the **DPSI RV Mini 5 Magic** these are outputs "Out 1/2“, "Out 3/2“ and "Out 5/2“.

Hint:
Setting and programming of the slave servo is only possible within the first 10 seconds after powering the DPSI on. Afterwards programming is inhibited for safety reasons!

Hint:
Prior to EACH programming the corresponding transmitter stick (or switch actuator) must be positioned in the center!

Hint:
If both servos, MSTR and SLAVE share one rudder at least one link must be released in order to avoid mechanically blocking of the servos.

Hint:
Whenever the servo center is changed, end-limits should be reprogrammed as well!

Hint:
Implemented basic settings correspond to servo values of Graupner/JR sets. Center position is 1.50ms; end-positions are set to 100% each. Of course, all remote control sets can be utilized.

Hint:
Whenever programming is activated the green LED blinks for controlling purposes in the **DPSI RV Mini Magic** at a rate of 0.5Hz (1s on, 1s off). A fast blinking of this green LED indicates a failure (=> missing receiver signal).

10.2. Changing Servo Direction

If the direction of a servo is to be changed, all other settings remain! For changing the direction of the servo, the magnet is to be put close to the corresponding position (red dot in the "magnetic programming panel" field) within the first 10 seconds after power on. Distance of the magnet may be up to 8mm. It is easiest to set the magnet onto the housings upper surface.

2.5 seconds after placing the magnet the slave servo makes a short move back and forth (approx. 10% deflection). If the magnet is then removed within 5 seconds, the direction of the servo changes and is permanently stored.

10.3. Setting Servo Center

Programming also starts by positioning the magnet close to the red dot. The servo turns shortly (just as when changing direction). Do not remove the magnet now but keep it on the current position (on the red dot). The transmitter's stick or switch actuator must not be moved anymore, i.e. it must remain on its center position. After another 5 seconds the servo turns again. Now programming of the servo's center position is activated.

The master servo now remains in its current center position and does not move even if the transmitter's stick is moved. Each move of the stick out of its center position increases or decreases the servo position (servo center) of the slave servo for one step.

Holding the stick in its end position the steps increase or decrease automatically after 2.5 seconds. This serves for quicker settings.

Hint:
Due to the high resolution it is possible that the change in servo positions is only visible after several single steps.

As soon as the slave servo reaches its final center position remove the magnet from the red dot. Programming of servo center is finished.

Hint:
If the servo center position is newly programmed, the end-positions should be re-programmed as well in order to gain linear curves.

10.4. Setting End-Limits

Programming of end limits starts identically to programming servo center. Here, the stick (or switch actuator) is put into its maximum end position within 5 seconds after the servo makes its short move. After these 5 seconds the servo moves again and both servos remain in their maximum-position. The stick is now moved to its center position – servo positions do not change!

Here too, deflection of the slave servo is accomplished by moving the stick out of its center position in order to increase or decrease the steps.

If the desired end position is reached, remove the magnet.

Hint:
Whenever changes of servo deflections are programmed, all values should be reprogrammed, i.e. center position and end-positions! Sequence of programming (center, end-positions) is actually unimportant.

Caution:
Programmable values for end positions of the servos can be higher than the mechanically resolution of the servo. The servo therefore could be damaged or function incorrectly if the full range is being used. Therefore approach limits carefully. An additionally connected servo tester (e.g. EMCOTEC Mini Servo Tester – part number A71050) which indicates the corresponding servo position digitally can be helpful if in doubt.

10.5. Deletion of all Programming

Total reset of all programmed settings is also possible. Just position the magnet close to the red dot after powering the **DPSI RV Mini** on and keep it there for about 30 seconds. After 2.5 and additional 5 seconds, the servo makes its short move (just like when programming center / end values). The stick must not be moved at all during this time and the magnet must remain at its position close to the red dot. After 30 seconds have elapsed all settings are deleted.

Hint:
Whenever programming is activated the green LED on the DPSIs top side blinks for controlling purposes in the **DPSI RV Mini Magic** at a rate of 0.5Hz (1s on, 1s off).

10.6 Supplemental Hints for MAGIC-Version

These additional hints are valuable for the ambitious user who likes to know more about the functions of servo-matching by explaining its behavior under certain circumstances.

10.7. Changing the Model

If an already programmed **DPSI RV Mini** is to be used in another application (e.g. changing the model) all settings should be generally deleted (see "Deleting of all Programming"). This holds true if even a servo with different direction is built in.

10.8. Sequence of Programming

When programming the slave servo, set direction first (if necessary). Then center position and end-positions follow, while the sequence is not important.

Hint:
Whenever a change of e.g. then servo center position is reprogrammed, end-positions should be reprogrammed as well!

10.9. Limitation of Range Settings

The **DPSI RV Mini** only allows for certain values during programming of the slave servo. Because the slave servo is to be adapted to the master servo both servos should have a similar basic setting e.g. a similar center position.

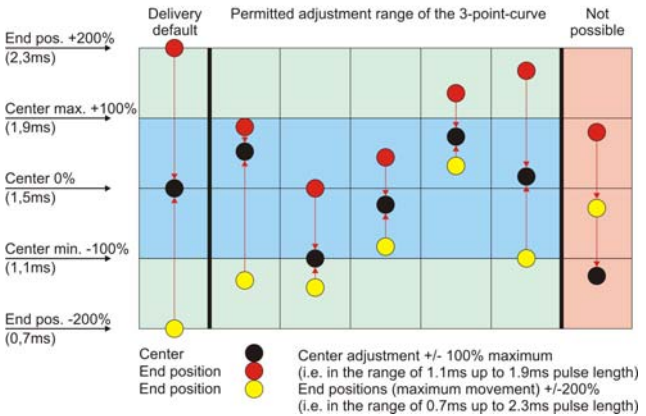
If the servo center of the master servo already exceeds 100% of the servo deflection it does not make much sense to offset the slave servo even further. Therefore only a setting of a servo center for a maximum of +/-100% is possible.

Setting of the slave servo is generally accomplished by a so called 3-point curve (i.e. center position, maximum value left / upper, maximum value right / lower).

"Distance" of maximum value to the center position is 20% minimum otherwise the value is not programmable.

A range check takes place at every programming attempt. It is therefore not possible to position the servo center position outside of the maximum value. This inhibits malfunctions (e.g. V-curve of servos).

Example for the different adjustment possibilities of the DPSI V-Match



10.10. Technical Data of Servo-Matching

Servo Signal Level Input:	
Low-Level	0V ... 0.8V
High-Level	2.0V ... 8.4V
Servo Signal Level Output	approx. 5.0V
Permissible Center Position	+/-100% (1.10ms .... 1.90ms)
Permissible End-Limits*	+/-200% (0.70ms .... 2.30ms)
Permissible Signal Period	min. 6.9ms, max. 34.868ms
Resolution (steps)	3200

**** Caution:***
Programmable values for end positions of the servos can be higher than the mechanically resolution of the servo. The servo therefore could be damaged or function incorrectly (e.g. wheel spinning) if the full range is being used. Therefore approach limits carefully.

11. Connecting Optional Products

Operating the DPSI RV Mini with Gyros
It is possible without any difficulty to operate the **DPSI RV Mini** in connection with a gyro. The gyro and its connected servos can be supplied by the receiver without problems.

Varios, Smoke-Pumps, Retractable Gears and other Consumers
All other types of consumers can be connected to the **DPSI RV Mini** just like a normal servo. Using a **DPSI RV Mini** also allows for connecting additional auxiliary functions directly at the receiver if the available slots (channels) of the **DPSI RV Mini** are not sufficient. Just observe maximum current (see also technical data).

Ignitions
Even if it appears appealing to supply the ignition system for gasoline engines by a DPSI we strongly recommend not doing so! Ignitions induce considerable disturbances which influence the range of the remote control if integrated into the receiving set. Always supply the ignition system with a separate battery!

12. Operating

After powering the **DPSI RV Mini** on, the red ultra bright LED in the switch actuator and the LED in the **DPSI RV Mini** illuminate. This signals operation. Immediately after power on, the signaling device (buzzer) indicates the programmed battery type (once, twice, three-, four-, five-, six- or seven times). Afterwards, the algorithm for error recognition starts.

In case one battery is not connected, the **DPSI RV Mini** starts in programming mode. This programming mode automatically ends after approx. 30 seconds. Within these 30 seconds, the second battery must not be connected if reprogramming is not desired.

Hint:
If the buzzer beeps 3 seconds after turning the **DPSI RV Mini** on, only one battery is connected and the DPSI starts in programming mode. If no reprogramming is desired, either turn the **DPSI RV Mini** off or wait approx. 30 seconds before connecting the second battery.

Hint:
If the **DPSI RV Mini** indicates errors for low voltage after a short period of time although the batteries are fully charged, probably the wrong battery type is programmed.
It is also possible, that a battery with a too high internal resistance is used which breaks down when loaded (e.g. NiMH batteries in AA size). Only utilize batteries for high current load!

13. Error Indication

There is a microcontroller integrated into the **DPSI RV Mini** which constantly monitors all voltages and the function of the voltage regulator. An intelligent algorithm makes sure that low voltage of a connected battery not only is detected during shortly dropping voltages (e.g. in case all servos move at once). The algorism is especially designed for operating RC-models (this is cyclic load of the batteries) i.e. not constant load of the batteries. Now, reliable recognition of low voltages is possible.

Despite this, don't trust blindly low voltage recognition. A good and responsible model pilot knows how long he/she can fly with fully charged batteries and recharges them in time (not just when low voltage is indicated).

Different error types are indicated by the internal piezo-buzzer and the red LED in the switch actuator.

1. Overload (short circuit): ————————————————————

Error signal: constant beep

If current consumption of the **DPSI RV Mini** gets too high a constant beep is output. In this case, an external short-circuit is detected which can lead to total damage of the **DPSI RV Mini** (depending on the duration of the short). Immediately turn the system off or disconnect the batteries. This error type has highest priority. If the short (during operation) gets away, the buzzer stops beeping after a "de-qualification" time of approx. 4 seconds.

2. Battery empty: ——— ——— ——— ———

Error signal: endless 0.5 seconds beeps / 0.5 seconds pause

If the voltage at the receiver (not at batteries!) drops below 4.5V, error type 2 is output. The batteries (no matter which type) are totally discharged and safe operation not possible any more. This error is extremely critical because the whole RC-system can drop out of operation at any time (due to low voltage).

Error type 2 has second highest priority and is active until the **DPSI RV Mini** is turned off. If using LiPo-cells, a state is reached where the batteries are irrevocable destroyed if not turned off immediately and the batteries being recharged.

3. Voltage Regulator defective: ——— — ——— —

Error signal: endless 0.5 seconds beep / 0.1 seconds pause, 0.1 seconds beep

This error signal is output if the voltage regulator for supplying the receiver malfunctions. Send in the DPSI for repair in this case. Error type 3 has third highest priority and stays active until turning the **DPSI RV Mini** off.

4. Battery Malfunction:

Error signal: endless 0.1 seconds beeps / 0.1 seconds pause

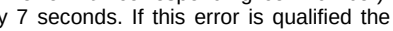
If a battery fails of a **DPSI RV Mini** (e.g. broken cable, loose contact or battery defective) a fast buzzer signal is output (5Hz). This error type has forth highest priority. If the disconnection stops during operation, the error stays active (until power off)!

5. Low Voltage battery 1:

Error signal: 3 times 0.1 seconds beeps with 0.1 seconds pause each, then 1 second beep

If the voltage of battery 1 drops a certain level this buzzer code is output. Usually capacity suffices for one more flight before recharge is in order. It is better to recharge right away if this error code is indicated. A correctly programmed battery type of course is prerequisite (NiCd/NiMH, LiIon, LiPo or LiFePo with corresponding cell number). This error code repeats every 7 seconds. If this error is qualified the first time, it stays active until the **DPSI RV Mini** is turned off.

6. Low Voltage battery 2:



Error signal: 3 times 0.1 seconds beeps with 0.1 seconds pause each, then 2 times 0.65 seconds beeps with 0.1 seconds pause

If the voltage of battery 2 drops a certain level this buzzer code is output. Usually capacity suffices for one more flight before recharge is in order. It is better to recharge right away if this error code is indicated. A correctly programmed battery type of course is prerequisite (NiCd/NiMH, LiIon, LiPo or LiFePo with corresponding cell number). This error code repeats every 7 seconds. If this error is qualified the first time, it stays active until the **DPSI RV Mini** is turned off.

If battery 1 as well as battery 2 indicates low voltage, both error codes are output alternatively. Low voltage errors 5 and 6 have lower priority (importance) than errors 1-4. In case of an error of type 1.-4., output of low voltage errors is interrupted.

Hint:
Limits for recognizing low voltage are especially set up for operating RC models. When utilizing the **DPSI RV Mini** for other purposes erroneous information could eventually be output. If this is the case the error indication (if disturbing) can be completely inhibited (see also "Programming the Battery Type").

Hint:
Low voltage recognition is only pointing to batteries getting weak and do not absolve the user from his/her care of only to fly with fully charged batteries! Due to different characteristics of batteries from different manufacturers low voltage recognition does not feature 100% safety.

14. Safety Directions

- In general, all connecting lines should be run so that they do not come into contact with moving or hot parts of the model (such as servos, gears or mufflers).
- The **DPSI RV Mini** must be protected from humidity and moisture.
- The **DPSI RV Mini** must be located at a sufficient distance from neighboring surfaces to enable good heat dissipation of the cooling element.
- Improper handling of the **DPSI RV Mini** can result in serious damage/injury to property or persons!
- Carry out a general inspection of all connections in your model before each use! All plugs must be correctly polarized and have clean contacts (i.e. fit tightly). Loose cables present a potential hazard!
- Under no circumstances may power sources that do not meet the specified voltages be used.
- The current-conducting contacts of the connector plugs may not be short-circuited. If you fail to observe this warning, the short-circuited cables may overheat and even melt.
- The **DPSI RV Mini** may not be taken apart or technically altered under any circumstances.

- Never use the **DPSI RV Mini** for purposes other than for RC model making as a hobby. Above all, their use in passenger-carrying equipment is strictly prohibited.
- Operate the **DPSI RV Mini** only with the remote control components provided for model making.
- Always ensure that you have fully charged batteries when operating your model. Empty batteries inevitably lead to failure of the RC components, which cause the model to crash.
- Do not expose the **DPSI RV Mini** to any extremely hot or extremely cold temperatures, moisture or humidity. This would lead to danger of malfunction, damage or decreased efficiency.
- Only use EMCOTEC approved accessories in connection with the **DPSI RV Mini** (e.g. switch actuator, external voltage monitors, etc.)

We recommend the usage of EMCOTEC Lithium-Polymer batteries for the **DPSI RV Mini** systems. There are several capacities available as well as chargers, balancers and other accessories.

15. Technical Data of DPSI RV Mini-Systems

Current sources	5, 6, (7)-cell NiCd / NiMH Cells, 2-cell Lithium-Ion batteries, Lithium-Polymer batteries, LiFePo batteries
Operating voltage range	5.0V 13V
Nominal input voltage	6.0V 8.4V
Output voltage receiver	5.2V or 5.9V settable by jumper
Output voltage servos	5.9V or full battery voltage settable by jumper
Quiescent current (turned off)	approx. 1µA per battery
Quiescent current (turned on)	approx. 55mA totally (MAGIC versions approx. 70mA)
Max. continuous current @ 5.9V (15 minutes with LiPo batteries)	5 Ampère
Max. peak current @ 5.9V (10 seconds with LiPo batteries)	50 Ampère
Drop-out losses @ 4A	0.4V
Maximum power dissipation	8W
Number of servos	Up to 10 servos in the complete system
CE approvals	according to 2004/108/EC
Environmental conditions	-10°C .... +50°C
Permissible temperature range	-25°C .... +85°C
LCL filtering (EMI)	For each individual servo output
Interference Suppression at 35MHz	-20dB @ 35MHz, -34dB @ 100MHz
Dimensions incl. latches for battery connections	77mm x 99mm x 15.8mm
Screw diameter for mounting	4 x 4.2mm
Hole spacing for mounting	78.7mm x 67.7mm
Weight	approx. 105 grams
Warranty	24 month

Technical modifications and errors excepted!

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16. Warranty

EMCOTEC GmbH shall issue a 24-month warranty on the **DPSI RV Mini**. The guarantee period shall begin with delivery of the equipment by the retailer and shall be not extended by any guarantee repair or guarantee replacement.

During the period of guarantee, the warranty shall cover the repair or replacement of any proven manufacturing or material defects at no charge. There shall be no specific entitlement to repair work. In case of a guarantee claim, the manufacturer shall reserve the right to exchange the equipment for a product of equal value if repair of the item is not feasible for economic reasons. There shall be no assumption of liability for consequential damages that are brought about by a proven defect during operation of the **DPSI RV Mini**. There shall be no extended claims for damages.

- All transportation, packaging and travel expenses shall be borne by the purchaser.
- No liability shall be assumed for any damages during transport.
- If repair is needed, the equipment must be sent to the appropriate service center of the respective country or directly to EMCOTEC GmbH.
- The guarantee shall only be valid when the following conditions are met:

  The guarantee document (original invoice) must include the delivery date, the company stamp, the serial number and signature of the retailer.

  No intervention in the equipment may have been undertaken.

  It must have been operated in accordance with our operating instructions.

  Only the power sources and other accessory devices and components that were recommended by us may have been used.
- The guarantee document, the original invoice and other pertinent information regarding the malfunction (a short description of the defect) must be included with the transmittal.
- The equipment must still be the property of the initial purchaser.
- If equipment is sent in that later proves to be functional following an initial inspection, we shall impose a flat processing fee of € 15.
- In all other respects, the general business terms and conditions of EMCOTEC embedded controller technologies GmbH shall apply for any items not listed.

Legal information:

Trademarks:
The following names are registered trademarks:

- EMCOTEC
- DPSI - Dual Power Servo Interface
- DPSI RV

Other product names mentioned in this manual may also be trademarks or registered trademarks of their respective owners.

Manual Note:
EMCOTEC GmbH reserves the right make changes to this manual and to equipment described herein without notice. Considerable effort has been made to ensure that this manual is free of errors and omissions. We shall not assume responsibility or liability for any errors that may be contained in this manual nor for any incidental, concrete or consequential damage that may arise from the provision of this manual, or the use of this manual in operating the equipment, or in connection with the performance of the equipment when so operated.

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